Housing Supply Elasticity and Rent Extraction by State and Local Governments

Rebecca Diamond*
Stanford GSB

January 17, 2016

Abstract

Governments may extract rent from private citizens by inflating taxes and spending on projects benefiting special interests. Using a spatial equilibrium model, I show that less elastic housing supplies increase governments' abilities to extract rents. Inelastic housing supply, driven by exogenous variation in local topography, raises local governments' tax revenues and causes citizens to combat rent seeking by enacting laws limiting power of elected officials. I find that public sector workers, one of the largest government special interests, capture a share of these rents through increased compensation when collective bargaining is legal or through corruption when collective bargaining is outlawed.

*I am very grateful to my advisors Edward Glaeser, Lawrence Katz, and Ariel Pakes for their guidance and support. I also thank Nikhil Agarwal, Adam Guren, Caroline Hoxby, Enrico Moretti, Kathryn Shaw, Juan Carlos Suarez Serrato, two anonymous referees, and participants at the Conference on Urban and Real Estate Economics, Harvard Labor Workshop, NBER Labor Studies, Stanford Public Economics Seminar, Stanford Institute for Theorectical Economics, and the Wisconsin Labor Seminar.

1 Introduction

The determinants and justification of the size of government has been a topic of heated debate in recent years, as many states and localities face budgetary stress. Many theories of local government depict a benevolent social planner who maximizes social welfare. In contrast, Brennan and Buchanan (1980) present a controversial "Leviathan Hypothesis" of the public sector. Drawing on the theory of the private sector monopolistic, they envision a government that seeks to exploit its citizens by maximizing tax revenue that it extracts from the economy. They stress that "interjurisdictional mobility of persons in pursuit of fiscal gains" can discipline a rent-seeking government. This hypothesis was the subject of much debate in the 1980s, with many empirical studies producing inconclusive and contradictory results (Oates (1985), Nelson (1987), Zax (1989). See **?**) for a review).[1]

In this paper, I present a new approach to testing the Leviathan Hypothesis, and gauging its economic magnitude. This paper develops a spatial equilibrium model where governments must compete for residents to tax, and residents can "vote with their feet" by migrating away from excessively rent extractive governments, in the spirit of Tiebout (1956). The model shows that governments which preside over areas with less elastic housing supplies are more able to raise taxes without providing taxpayers with additional government services. These rents extracted from taxpayers can provide the government with additional funding to increase government workers' pay, hire additional employees, or more generally spend on items which benefit the government, but not the general public. Exogenous variation in housing supply elasticity provides a new identification strategy for measuring the economic importance of the Leviathan Hypothesis. I empirically test the model's predictions by first showing that per capita tax revenue is higher in housing inelastic areas. I then analyze how these extra tax dollars get spent on items such as increased public sector compensation and increased employment levels. I then consider whether governments extract rents not only through formal taxation, but also by increasing informal taxes such as bribes and corruption. Finally, I test whether private citizens partially combat government rent seeking by enacting laws which limit the power of elected officials.

The paper begins by laying out a stylized Rosen (1979) Roback (1982) spatial equilibrium model where state and local governments set taxes and the level of government services to maximize government "profits," which can then be spent on government interests, such as an expanded workforce or higher government compensation. Residents in the model vote with their feet and not at the ballot box to focus on the role of migration as a government disciplining mechanism.

The model shows that if state and local governments are using their market power to spend tax dollars on government interests, their abilities to extract rents from their citizens is determined by the equilibrium migration elasticity of private sector residents with respect to local tax rates.

[1] The Leviathan Hypothesis predicts that, all else equal, if there are many small governments, they will be forced to compete with each other for citizens to tax. This increased competition will discipline government rent seeking and shrink the size of government. Most of the previous empirical literature focused on the correlation between decentralization of government and the size of government.

Governments trade off the benefits of a higher tax with the cost that a higher tax will cause workers to migrate away, leaving the government with a smaller population to tax.

Less elastic housing supplies increase governments' abilities to extract rent from taxpayers and raise revenue. A tax hike by a government in an area with inelastic housing supply leads to a small amount of out-migration. Housing prices sharply fall due to the decrease in housing demand driven by the tax hike. Thus, governments in housing inelastic areas can charge higher taxes without shrinking their tax base since housing price changes limit the migration response. Further, the model shows that governments' market power to raise taxes due to inelastic housing supply remains even when there are a large number of governments competing for residents and every government is small (Epple and Zelenitz (1981)).

When state and local governments exercise more market power in areas with inelastic housing supplies, government spending should be more channelled toward items in the government's interest. In particular, the high unionization rate in the public sector may allow union bargaining to influence the decisions of elected officials (Freeman (1986)). I analyze whether these effects are stronger in states which have legalized public-sector collective bargaining.

I proxy for a metropolitan areas's housing supply elasticity using data from Saiz (2010) on the share of land within 50km of a city's center unavailable for real-estate development due to geographic constraints, such as the presence of swamps, steep grades, or bodies of water.[2]

Using county level data from the Census of Governments, I find that government revenue and taxes levied per county resident are higher in housing inelastic areas, consistent with the Leviathan Hypothesis. Further, I find these additional funds flow to increased government payroll per county resident, the number of full-time equivalent (FTE) government workers per county resident, and average government workers' wages.

Increased rent extraction could lead citizens to push back against these forces and place limits on elected officials' powers. Indeed, I find that less elastic housing supply leads to shorter term limits for elected officials and that citizens are more able to directly legislate at the ballot box through local initiatives and referendums.

In addition, I find substantially different government spending effects across states depending on whether public sector collective bargaining is legal.[3] A one standard deviation increase in land unavailability raises government wages by 4.2% in states which allow public sector bargaining, but has little to no effect on government employment levels. However, in states which outlaw public sector collective bargaining, a one standard deviation increase in land unavailability raises per capita government employment by 1.8%, and has essentially no impact on government wages.

[2] With less available land around to build on, the city must expand farther away from the central business area to accommodate a given amount of population, driving up average housing costs. A full micro-foundation of this mechanism can be derived from the Alonso-Muth-Mills model (Brueckner (1987)) where housing expands around a city's central business district and workers must commute from their house to the city center to work.

[3] Data on public sector collective bargaining laws were collected by Freeman and Valletta (1988). Hoxby (1996) uses these data to identify the effects of teachers unions on many aspects of education production. She uses variation in the timing of states' legalization of public-sector collective bargaining. Frandsen (2011) also uses these law changes to look at their effects on other types of government workers, including firefighters and police.

To further analyze whether government workers are receiving excess compensation in areas with less elastic housing supplies, I quantify how the public-private sector wage gap varies across metropolitan areas using data from the 1995-2011 Current Population Survey Merged Outgoing Rotation Groups (CPS-MORG). Results from the CPS-MORG show a one standard deviation increase in land unavailability raises the local public-private sector wage gap by 3.6% when public sector collective bargaining is legal. Drilling down to specific occupations, I find especially large effects for police and firemen wages, but little effect on teacher wages. This is similar to Frandsen (2011)'s findings that the direct effect of these bargaining laws seems to raise police and fire fighters wages more than teachers wages. Overall, state and local governments appear to excessively spend on workforce compensation when they are able to raise additional tax revenue.

These findings are consistent with previous work by Brueckner and Neumark (2014), which addresses a similar question of how desirable local amenities give state and local governments taxation market power. They analyze how public-private sector wage gaps vary across states with differing levels of desirable amenities, finding amenities increase the public-private sector wage gap more in states permitting public-sector collective bargaining. Work by Feiveson (2011) finds that federal government transfers to state and local governments largely get spent on higher government wages in states where public sector collective bargaining is legal. However, a larger share of this money goes to increased government employment in states outlawing bargaining. I find a similar split of money between wage and employment growth.

Recent work by Bai, Jayachandran, Malesky, and Olken (2013) shows that the threat of out-migration also disciplines government corruption and bribes. They study government bribes in Vietnam and show that when firms are more likely to migrate away from corrupt areas, the level of government bribes is lower. I test this mechanism in the US context by analyzing data from the U.S. Department of Justice on the number of public corruption convictions by the presiding federal district court in each geographic area.[4] I find that a one standard deviation increase in land unavailability increases public sector corruption by 40% within states which outlaw public sector collective bargaining. However, states permitting collective bargaining have no increase in corruption in housing inelastic areas.

It appears collective bargaining may give government workers a formal mechanism to bargain for their share of rents from taxation and receive increased compensation. However without this bargaining mechanism, workers may turn to informal ways of capturing these rents through bribes and corruption. Indeed, corruption convictions are 16% lower in states permitting collective bargaining than those which outlaw it. Collective bargaining could potentially help keep corruption in check by providing formal mechanisms to bargaining for rents.

The magnitudes of these effects are substantial. To put these estimates into context, consider the differences in land unavailability between San Francisco, CA and St. Louis, MO, which both permit public sector collective bargaining. San Francisco is surrounded by water to the north,

[4] Since these are convictions in federal courts, the enforcement rate and funding of these courts cannot be influenced by local revenue generated by inelastic housing supply.

west, and east and contains steep grades. St. Louis is surrounded by open land, but has a river running through the middle of the city. In the context of my measure, San Francisco's land unavailability is 2.9 standard deviations higher than St. Louis'. According to the 2007 census of governments, the average San Francisco city employee earned $84,300 per year and likely received benefits worth $42,150.[5] My estimates imply that if San Francisco had the amount of land available in St. Louis it could save $11,055 per city worker, for a total savings of $309 million per year.[6] This is equivalent to 12.8% of the total tax revenue collected by San Francisco.[7] While there is little hope for changing the topography of San Francisco to that of St. Louis, these numbers show that government policies impacting housing supply can have economically large effects on government spending. In particular, the rise in local land use regulation across US cities since the 1970s likely has led to increased government rent extraction.

The labor literature studying public-sector compensation has also found evidence suggesting government jobs offer rents beyond the compensation of similar private sector jobs. Recent work by Gittleman and Pierce (2012) find that the average public sector employee is more generously compensated than a similarly qualified private sector employee. Although, the magnitude of this difference depends strongly on what covariates, such as occupation, are included as controls. Krueger (1988) finds that there are more job applications for each government job than for each private sector job, suggesting that government jobs are more desirable to workers, on average. Average job quit rates reported from the 2002-2006 Job Openings and Labor Turnover Surveys show that the average annual quit rate is 28% for private sector workers, but only 8% for public sector employees. This paper shows that an increase in governments' abilities to extract rent directly leads to higher government payrolls and benefits expenditures.

The public sector workforce is also highly unionized, enabling government employees to bargain for rents. Gyourko and Tracy (1991) use a spatial equilibrium model to show that if the cost of government taxes to citizens are not completely offset by benefits of government services, they will be capitalized into housing prices. Similarly, if high levels of public sector unionization lead to more government rent extraction, the public sector unionization rate will proxy for government waste and also be capitalized into housing prices. Gyourko and Tracy (1991) find evidence for both of these effects, however they need to assume the variation in taxes and unionization rates across

[5] The census of governments does not report spending on worker benefits, but Gittleman and Pierce (2012)'s analysis of Employer Costs for Employee Compensation Survey shows that the average local government worker receives benefits worth 50% of annual wage compensation. This suggests San Francisco employees receive $42,150 in benefits.

[6] This assumes the local private sector wage does not respond to the increased housing supply elasticity. Increasing the housing supply should lower rents and lead to lower equilibrium private sector wages. Since the rent extraction is a function of the public-private wage gap, this decrease in private sector wages would lead to additional government cost savings not accounted for in this calculation.

[7] I calculate the wage savings as: 84,300-(exp(ln(84,300)-(.0359)*(2.9)))=$8335. The benefits saving are: 42150-(exp(ln(42150)-.023*(2.9)))=$2720, where I assume my estimated effects on health insurance spending can be generalized for all benefits spending. This leads to a total savings of $11,055 per worker. I multiply this by the number of FTE wokers in San Fransicso in 2007 as reported in the Census of Governments (27,981), giving an annual savings of $309 million. Total taxes collected by San Francisco in 2007 as reported by the Census of Governments was $2.41 billion.

localities is exogenous. This paper uses land unavailability as a source of exogenous variation in government market power to show collective bargaining laws allow governments to take advantage of their market power to increase compensation.

As previously mentioned, my analysis builds on recent work by Brueckner and Neumark (2014) (BN) who analyze an alternative mechanism through which state and local governments gain taxation market power: the availability of desirable consumption amenities. They use a similar setup where profit maximizing governments compete for residents by setting local tax rates. They allow local governments to play a game in tax-competition where the number of competing governments is small. I allow each government to be small when deriving the determinants of market power, which I believe accurately captures the nature of competition between the over 89,000 local governments in the US. They show that more desirable amenities are associated with higher public-private wage gaps. When I control for the impacts of amenities used by BN, I continue to find evidence for the role of inelastic housing supply in government rent seeking. Further, I empirically identify these effects on local taxes, government employment levels, benefits, corruption, and voters' reactions through legislation, while BN primarily focuses on public sector wages. These many outcomes together help illustrate the causes of rent extraction, how these rents get distributed, and mechanisms through which the private sector can fight against these forces.

The paper proceeds as follows. Section 2 layouts of the model. Section 3 presents empirical evidence, and Section 4 concludes.

2 Model

The model detailed below uses a Rosen (1979) Roback (1982) spatial equilibrium to analyze how local governments set taxes, employ workers, and compete for residents. In the model, I assume that governments use a head tax to collect revenue, however in reality, most state and local governments use property and income tax instruments. In Appendix A I derive results for the case of a government income or property tax and show the same results. I also abstract away from the political election process in each area. While politics could surely influence the extent of government rent seeking, my goal is to analyze the disciplining effects of migration on government rent seeking.

The nationwide economy is made up of many cities. There are N cities, where N is large. Cities are differentiated by their endowed amenity levels A_j, which impact how desirable workers find the city, and their endowed productivity levels θ_j, which impact how productive firms are in the city. Workers are free to migrate to any city within the country. Each city has a local labor and housing market, which determine local wages and rents. The local government provides government services by employing workers and collects taxes.

2.1 Government

The local government of city j charges a head tax τ_j to workers who choose to reside within the city. The local government also produces government services, Y_j^G, under the production function:

$$Y_j^G = \alpha_j G_j,$$

where G_j is the number of government workers and α_j is the exogenous productivity level of government in city j. These government services are equally distributed across all workers in the city, making each worker consume $\frac{\alpha G_j}{Nj}$ units of government services. To simplify exposition, define $s_j = \frac{\alpha G_j}{Nj}$ as the per worker amount of government services in city j. N_j measures the population of city j. Since labor is the sole factor input, the cost of government service production is simply the wage bill. For now, I will assume government workers are not unionized and earn their marginal product of labor. In section 2.7 I will consider the case when workers unionize. In both cases, the government is small relative to the overall labor market, making it a wage taker. The government revenue and cost are:

$$\begin{aligned} \text{Revenue}_j &= \tau_j N_j \\ \text{Cost}_j &= \frac{w_j s_j N_j}{\alpha_j}. \end{aligned}$$

w_j is the rate wage in city j. The local government is not benevolent and maximizes profits. These profits could be spent on inefficient production of s_j (thus, making the government benevolent, but naive). They could also be directly pocketed by government workers, such as through union negotiations. I will return to this case in section 2.7. For now, I assume the profits do not impact government worker wages. The local government maximizes:

$$\max_{\tau_j, s_j} \tau_j N_j - \frac{w_j s_j N_j}{\alpha_j}$$

2.2 Workers

All workers are homogeneous. Workers living in city j inelastically supply one unit of labor, and earn wage w_j, either in the public sector or private sector. Each worker must rent a house to live in the city at rental rate r_j and pay the local tax τ_j. Workers value the local amenities as measured by A_j. The desirability of government services s_j is represented by $g(s_j)$, where $g'(s_j) > 0, g''(s_j) < 0$. Thus, workers' utility from living in city j is:

$$U_j = w_j - r_j + A_j + g(s_j) - \tau_j.$$

Workers maximize their utility by living in the city which they find the most desirable.

2.3 Firms

All firms are homogenous and produce a tradeable output Y. Cities exogenously differ in their productivity as measured by θ_j. Local government services impact firms productivity, as measured by $b(s_j)$, where $b'(s_j) > 0$, $b''(s_j) < 0$. The production function is:[8]

$$Y_j = (\theta_j + b(s_j)) N_j^P.$$

N_j^P is the number of workers in the private sector. The total size of the labor market equals the sum of the public sector and private sector employment: $N_j = N_j^P + G_j$.The labor market is perfectly competitive, so wages equal the marginal product of labor:

$$w_j = \theta_j + b(s_j)$$

2.4 Housing

Housing is produced using construction materials and land. All houses are identical. Houses are sold at the marginal cost of production to absentee landlords, who rents housing to the residents. The asset market is in long-run steady state equilibrium, making housing price equal the present discounted value of rents. Housing supply elasticities differ across cities. Differences in housing supply elasticity are due to topography as well as other unobserved factors, which makes the marginal cost of building an additional house more responsive to population changes (Saiz (2010)). The housing supply curve is:

$$\begin{aligned} r_j &= a_j + \gamma_j \log(N_j), \\ \gamma_j &= \gamma x_j^{\text{house}} \end{aligned}$$

where x_j^{house} is a vector of city characteristics which impact the elasticity of housing supply, including topography.[9]

2.5 Equilibrium in Labor and Housing

Since all workers are identical, all cities with positive population must offer equal utility to workers. In equilibrium, all workers must be indifferent between all cities. Thus:

$$U_j = w_j - r_j + A_j + g(s_j) - \tau_j = \bar{U}.$$

Plugging in labor demand and housing supply gives:

$$\theta_j + b(s_j) - a_j - \gamma_j \log N_j + A_j + g(s_j) - \tau_j = \bar{U}. \quad (1)$$

[8] I assume a perfectly elastic labor demand curve to focus on the role of housing supply elasticity and keep expressions simple. A downward sloping labor demand curve can be added without changing the results.

[9] See Saiz (2010) for a full micro-foundation of this housing supply curve.

Equation (1) determines the equilibrium distribution of workers across cities.

2.6 Government Tax Competition

Local governments set city tax rates and the level of government services to maximize profits, taking into account the endogenous response of workers and firms in equilibrium, equation (1). Each city is assumed to be small, meaning out-migration of workers to other cities does not impact other cities' equilibrium wages and rents. If there were a small number of cities, each city would have even more market power than in this limiting case. The results below can be thought of as a lower bound on the market power of local governments competing for residents. They maximize:

$$\max_{s_j,\tau_j} \tau_j N_j - \frac{w_j s_j N_j}{\alpha_j}.$$

The first order conditions are:

$$\begin{aligned} 0 &= \tau_j \frac{\partial N_j}{\partial s_j} - \frac{w_j N_j}{\alpha_j} - \frac{w_j s_j}{\alpha_j} \frac{\partial N_j}{\partial s_j} \\ 0 &= \tau_j \frac{\partial N_j}{\partial \tau_j} + N_j - \frac{w_j s_j}{\alpha_j} \frac{\partial N_j}{\partial \tau_j}. \end{aligned} \tag{2}$$

Differentiating equation (1) to solve for $\frac{\partial N_j}{\partial s_j}$ and $\frac{\partial N_j}{\partial \tau_j}$gives:

$$\begin{aligned} \frac{\partial N_j}{\partial s_j} &= \frac{b'(s_j) + g'(s_j)}{\left(\frac{\gamma_j}{N_j}\right)} > 0 \\ \frac{\partial N_j}{\partial \tau_j} &= \frac{-1}{\left(\frac{\gamma_j}{N_j}\right)} < 0. \end{aligned} \tag{3}$$

Population increases with government services and decreases in taxes. Plugging these into (2) gives:

$$\begin{aligned} 0 &= \left(\tau_j - \frac{w_j s_j}{\alpha_j}\right) \left(\frac{b'(s_j) + g'(s_j)}{\left(\frac{\gamma_j}{N_j}\right)}\right) - N_j \\ \tau_j &= \gamma_j + \frac{w_j s_j}{\alpha_j}. \end{aligned}$$

Combining the first order conditions shows that government services are provided such that the marginal benefit $(b'(s_j) + g'(s_j))$ per resident equals marginal cost per resident $\left(\frac{w_j}{\alpha_j}\right)$:

$$b'\left(s_j^*\right) + g'\left(s_j^*\right) = \frac{w_j}{\alpha_j}. \tag{4}$$

This is the socially optimal level of government service.

The equilibrium tax rate is:

$$\tau_j^* = \gamma_j + s_j^*. \tag{5}$$

The elasticity of city population with respect to the tax rate $\left(\varepsilon_j^{migrate}\right)$ can be written as:

$$\varepsilon_j^{migrate} = \frac{\partial N_j}{\partial \tau_j} \frac{\tau_j}{N_j}.$$

Plugging in equation (3) for $\frac{\partial N_j}{\partial \tau_j}$ and rearranging gives:

$$\left(\gamma_j\right) = \frac{-\tau_j}{\varepsilon_j^{migrate}}.$$

Substituting this expression into the equation (5) shows that the tax markup can be written as:

$$\frac{\tau_j^* - s_j^*}{\tau_j^*} = \frac{-1}{\varepsilon_j^{migrate}}.$$

The tax markup above cost is equal to the inverse elasticity of city population with respect to the tax rate. While workers are perfectly mobile between cities, worker migration causes shifts along the local housing supply curves. An increase in local taxes would cause workers to migrate to other cities. A decrease in population will cause rents to fall, by moving along the housing supply curve. This decrease in rents will increase the desirability of the city to workers, limiting the migration response to the tax increase. The government takes into account the equilibrium rent response to a tax hike when setting taxes to profit maximize. Thus, if migration leads to large changes in local rent, a tax increase will not lead to large amounts of out-migration, since workers will be compensated for the tax with more desirable rents.

To analyze the effect of housing supply elasticity on governments' ability to extract rent from taxes, I differentiate the tax markup with respect to the slope of the inverse housing supply curve, γ_j.

$$\frac{\partial}{\partial \gamma_j}\left(\tau_j^* - s_j^*\right) = 1 > 0. \tag{6}$$

Equation (6) represents the increased rent response to migration induced by a tax hike in a city with an inelastic housing supply. The equilibrium condition, equation (1) , shows that out-migration will continue until the negative utility impact of the tax hike has been completely offset by changes in the city's wage and rent. In a city with a less elastic housing supply, a smaller amount of migration is needed to push housing rents down to offset the negative utility impact of the tax hike. The government can extract more rent through higher taxes in a city with a less elastic housing supply.

Note that this result assumes there are a large number of cities. Cities can extract rent even in an environment where there are a large number of competitors because household demand for city residence can never be infinite in equilibrium.

Additionally, this model assumes cities charge a head tax, while in reality most cities and states tax their population through income taxes and property taxes. The amount of rent extraction depends on the elasticity of tax revenue with respect to the tax rate. Thus, an income tax will depend both on the wage response to the tax rate, as well as the migration response. Appendix A shows that when using an income tax, governments can still exercise more market power in housing inelastic areas.

In the case of a property tax, government revenue will depend on the local rental rate and the size of the tax base. An increase in the property tax rate can decrease government revenue both by incentivizing workers to migrate away, shrinking the tax base, and decreasing housing rents, lowering tax revenue from each household. However, I show in Appendix A that the housing supply elasticity will not impact the size of the rental rate decrease in response to a given tax hike. Recall the equilibrium condition, equation (1) . For workers to derive utility $\bar{U}$ from a local area, the utility impact of a tax increase must be perfectly offset by a rent decrease. Thus, the equilibrium rental rate response to a given tax increase does not depend on the local housing supply elasticity. Indeed, the housing supply elasticity determines the migration response required to change housing rents in order to offset the utility impact of the tax increase. Thus, a less elastic housing supply decreases the elasticity of government revenue with respect to the tax rate, giving the government more market power when using a property tax instrument. See Appendix A for the full derivation of this result.

Regardless of the tax instrument, governments of cities with less elastic housing supplies are able to extract more rent from their residents.

2.7 Public Sector Unionization

The previous section assumed the government workers had no market power and were wage takers. This lead the public and private sector wages to be identical in equilibrium and for workers to be indifferent between employment in the public and private sectors. If public sector workers are unionized, they could be able to bargain for a share of the rents earned by the government and increase their compensation. Let λ be the share of the rents captured by the public sector union.[10] The total rents extracted by the government is city j are $\gamma_j N_j$. I assume this gets equally split across all public sector workers, in addition to the wage they would receive in the private sector:

$$w_j^{union} = w_j + \frac{\lambda \gamma_j N_j}{G_j}. \tag{7}$$

Re-writing the public sector labor demand, in terms of the optimal amount of per household consumption of government services, s_j^*, :

$$G_j = \frac{s_j^* N_j}{\alpha},$$

[10] I assume that λ is small and does not impact the profit maximization decision of the overall government rent extraction.

I can plug this into the union wage equation (7):

$$w_j^{union} = w_j + \frac{\alpha\lambda\gamma_j}{s_j^*}.$$

It clear to see that union public sector wages are increasing in γ_j, the slope of the inverse housing supply curve.

$$\frac{\partial w_j^{union}}{\partial \gamma_j} = \frac{\alpha\lambda}{s_j^*} > 0.$$

Note that s_j^* does not depend on housing supply elasticity, as shown in equation (4).

The model predicts that the rents due inelastic housing supply only flow to government workers' wages when workers can collectively bargain. In this world, all workers would strictly prefer to work in the public sector than the private sector, leading to job rationing. In the next section, I empirically test these predictions.

3 Empirical Evidence

3.1 Government Revenue Regressions

The model predicts that local governments in areas with less elastic housing supplies will be able to extract more rent from their residents. Saiz (2010) shows that the topological characteristics of land around an MSA's center impact whether the land can used for real-estate development. Cities located next to wetlands, bodies of waters, swamps, or extreme hilliness have limits on how many buildings can be built close to the city center, which impacts the elasticity of housing supply to the area. Saiz (2010) uses satellite data to measure the share of land within 50km of an MSA's center which cannot be developed due to these topological constraints. A rent-seeking government is able to charge higher taxes in areas with less land available for development. I z-score the MSA level data from the land unavailability measure and use it as measures of cities' housing supply elasticities. Table 1 reports summary statistics on these measures. The data cover 47 states (there is no data for Hawaii, Alaska, or Wyoming) and 269 MSAs.[11]

I directly test this prediction by analyzing how local government revenue and taxes vary with characteristics which impact local housing supply elasticities. I measure total revenue and taxes from the 1962-2002 Census of Governments County Area Finance data. These data report every five years on all local governments within a county. This includes the county government, as well as the municipalities, townships, school districts, and special districts within the county.[12] Table 1 Panel A reports summary statistics on average log county area total revenue and taxes collected

[11] I also aggregate these measures to a state-level index for cross-state analysis, where I weight each MSA measure by the state population in each MSA. The state-level housing supply elasticity measure is a noisy measure of the overall housing supply elasticity for the state, since the data is only based off of the MSAs covered by Saiz's sample.

[12] County area finance data for 2007 has not been made available at this time.

per county resident.[13] I include only the counties within the metropolitan statistical areas covered by Saiz's land unavailability data, since these are the counties used in the regression analysis.

To test the model's predictions, I estimate the following regression:

$$\ln Y_{jt} = \alpha_t + \beta^{elast} z_j^{elast} + \varepsilon_{ijt}. \tag{8}$$

Y_{ijt} measures the government revenue outcome of interest in county i in MSA j in year t. z_j^{elast} measures MSA j's level of land availability. As controls, I include year fixed effects, α_t. Standard errors are clustered by MSA since there is MSA-level variation in housing supply elasticity. The model predicts that revenue and taxes should be higher in areas with less elastic housing supplies:

$$\beta^{elast} > 0.$$

Consistent with the model, Panel A of Table 2 shows a one standard deviation increase in land unavailability increases per capita government revenues by 8% and total taxes collected by 8.6%. Local governments are capturing the benefits of inelastic housing supply.

3.2 Government Spending Regressions

While this extra money could be spent in a number of ways, it is possible some of it goes to government payrolls, either by expanding the workforce or raising wages. These effects could be especially strong in states where public sector collective bargaining is legal. These unions may be able to better channel the government's taxation market power into spending that benefits government workers since they have an explicit mandate to represent the interests of government employees.

I measure local government payrolls, employment, and wages using data from the 1972-2007 Census of Governments County Area Employment data. Table 1 Panel A reports summary statistics on average log county area payroll, employment, and number of full-time equivalent government workers per county resident. Average county-area government wages are calculated by dividing total government payrolls by number of full-time equivalent government workers.

Consistent with the model, Panel B of Table 2 shows a one standard deviation increase in an MSA's land unavailability increases government payrolls per county resident by 4.8%, increases government full-time equivalents per county resident by 1.3% and increases average government worker wages by 3.5%.

To assess whether collective bargaining impacts how much extra spending goes to the government workforce, I interact the land unavailability measure with whether the state allows local government workers to collectively bargain. The dataset on public sector collective bargaining laws was originally constructed by Richard Freeman and Robert Valletta in 1985 (Freeman and Valletta (1988)), and codes the relevant laws for every state and every year from 1955 to 1985. This dataset was later extended by Kim Rueben to cover the years through 1996. This paper uses the extended

[13] Tax revenue is a subset of total revenue collected.

Rueben dataset, filling forward the 1996 data through years 1997-2007. These laws have been quite stable during this period, barring the very recent law changes in the last quarter of 2011 in Wisconsin, which is beyond the range of the dataset.

While state laws vary in their exact provisions for public sector collective bargaining, I place the laws into two categories: collective bargaining is prohibited or collective bargaining is either permitted or required. The prohibited category includes statutes which explicitly prohibit state employers from bargaining with worker representatives, but also situations where state law makes no provision for collective bargaining, since courts have typically interpreted this as prohibiting collective bargaining (Freeman and Valletta (1988)). The permitted or required category includes states which authorize the employer to bargain and which give employee organizations the right to present proposals or meet and confer with the employer, as well as those states which either imply or make explicit the duty of the employer to bargain.

The data contain information on bargaining laws explicitly for teachers, police, and firefighters, as well data on laws for other local government workers. I use the law data for "other local government workers" for analyzing the impacts on these aggregate government spending measures. Table 1 Panel C reports summary statistics on these collective bargaining laws. Adding in interactions of land unavailability with the collective bargaining laws gives the estimating equation:

$$\ln Y_{jt} = \alpha_t + \beta^{\text{barg}} z_{jt}^{\text{barg}} + \beta^{elast} z_j^{elast} + \beta^{elast\_\text{barg}} z_j^{elast} * z_{jt}^{\text{barg}} + \varepsilon_{ijt}.$$

z_{jt}^{barg} is a dummy for whether public sector collective bargaining was legal in county j in year t. This analysis of collective bargaining laws uses cross-sectional variation in the legality of collective bargaining to identify its impact on government rent-seeking. Frandsen (2011) shows that cross-sectional estimates of the direct impact on collective bargaining on public sector wages tend to be higher than estimates which use longitudinal changes in state laws overtime. While this suggests there may be omitted variables correlated with collective bargaining laws that impact government worker wages, this paper's analysis looks at how these laws interact with land unavailability. While I cannot rule out the presence of omitted variables, they would have to interact with land unavailability in how they impact government wages, payrolls and employment to cause bias. Further, Frandsen (2011) shows using longitudinal variation in law changes as an alternative identification strategy is also confounded by trends in states' government wages over time. Using variation in law changes also requires getting data going back to the 1960s. Thus, using cross-sectional variation in collective bargaining laws interacted housing supply elasticity can provide strongly suggestive evidence of a causal channel, but surely cannot fully eliminate all potential omitted variable biases.

Table 2 shows that in states which allow public sector collective bargaining, a one standard deviation increase in land unavailability increases government payrolls per county resident by 5.4%, while it only increases payrolls by 1.3% in states which outlaw public sector collective bargaining. Further, this estimate for states which prohibit bargaining is not statistically significant. While these estimates cannot rule out small effects of housing supply elasticity on government payrolls in places which prohibit bargaining, there appears to be quite large, positive effects where bargaining

is legal.

Turning to the effects on employment levels, a one standard deviation increase in land unavailability in states prohibiting public sector collective bargaining raises the number of full-time equivalent workers per county resident by 1.8%, and by 1.2% in states outlawing bargaining. However, the estimates are too noisy to say whether these effects differ based on legality of collective bargaining.

Column 6 of Panel B in Table 2 shows the impact of land unavailability on average government wages in states with and without public sector collective bargaining. Housing supply elasticity has essentially no impact on government wages when bargaining is prohibited. The point estimate shows a one standard deviation increase in land unavailability *lowering* wages by 0.48%, but the effect is not statistically significant. However, in states which allow bargaining, land unavailability raises wages by 4.2%. Thus, collective bargaining appears to take advantage of areas' housing supply elasticity market power and raise government payrolls, with essentially all of this extra spending going to higher government wages. In areas where collective bargaining is prohibited, government employment levels appear to slightly increase and may also slightly raise government payrolls to pay for this increase.

To gain further insight into how these local governments elect different expenditures, I redo these analyses within 19 categories of government spending. The effects do not appear to be driven by specific types of government workers. See Appendix B for more details.

Since the role of housing supply in government spending decisions differ significantly based on collective bargaining, I also check whether government revenues and taxation also differ by collective bargaining laws. Columns 3 and 4 of Panel A of Table 2 shows that the land unavailability effects on revenues and taxes do not statistically differ between states which do and do not allow public sector collective bargaining. However, the point estimates are slightly higher in state permitting bargaining.

Whether governments pass on their additional tax revenue to governments workers appears to depend on whether public sector workers can collectively bargain. However, higher average government wages does not necessarily mean that these government workers are getting "over paid." It is possible that workers in these housing inelastic areas are more skilled and thus deserve a higher wage. In addition, it could be that the market wage for workers is higher in these housing inelastic areas, thus forcing the local governments to spend more on government wages. To test these theories, I turn to data from the Current Population Survey so that I can directly control for workers' demographic and skill differences, as well as use private sector worker wage data to control for MSA differences in market wages.

3.3 Wage Gap Regressions

In this analysis, I focus on public-private sector wage gaps across MSAs as a measure of excess compensation to government employees. By comparing the wages of government workers living in a given MSA to similarly qualified private sector workers living in the same area, I control for

differences in market wages across MSAs, which could have confounded the previous analysis of the Census of Governments wage data. To measure public-private sector wage gaps across MSAs and states, I use data from the Current Population Survey Merged Outing Rotation groups from 1995-2011.[14] The CPS-MORG is a household survey which collects data on a large number of outcomes including workers' weekly earnings, hours worked, public/private sector of employment, union status, and a host of demographics. I restrict the sample to 25 to 55 year old workers with positive labor income, working at least 35 hours per week, to have a standardized measure of weekly earnings. The CPS's usual weekly earnings question does not include self-employment income so all analysis excludes the self-employed. I also restrict analysis to workers whose wages are not imputed to avoid any bias due to the CPS's wage imputation algorithm (Bollinger and Hirsch (2006)). I measure earnings using workers' log usual weekly earnings, deflated by the CPI-U and measured in real 2000 dollars. Top coded weekly earnings are multiplied by 1.5 and weekly earnings below \$128 are dropped from the analysis.[15] All analysis is weighted by the CPS earnings weights.

Table 1 reports summary statistics of workers' log weekly earnings each for workers employed in the private sector, local government, state government, and federal government.[16] Consistent with previous works, such as Gittleman and Pierce (2012), the raw earnings are higher for all three classes of government workers than for private sector workers. However, these raw earnings differences do not account for differences in the characteristics of workers between the public and private sector. To test the model's predictions, I will control for worker characteristics when evaluating differences in the public private sector wage gap. Additionally, the CPS only collects data on workers' earnings, but not compensation paid to workers in the form of benefits. Gittleman and Pierce (2012) show using the BLS' restricted-use Employer Cost of Employee Compensation microdata that government employees receive significantly more generous benefits than similar workers in the private sector. I will return to the question of benefits compensation, but first focus on public-private sector wage gaps.

To test the model's predictions, I estimate the following regression:

$$\ln w_{ijt} = \delta_j + \alpha_t + \beta^{gov} gov_{it} + \beta^{elast} z_j^{elast} * gov_{it} + \beta X_{it} + \varepsilon_{ijt}. \tag{9}$$

As controls, I include location fixed-effects δ_j, year fixed effects, α_t, and a set of worker demographics which include 15 dummies for education categories, gender, race, Hispanic origin, a quartic in age, and a rural dummy. gov_i is a dummy for whether the worker is government worker, z_j^{elast} mea-

[14] Since there was a significant change in the CPS's earnings questions in 1994, I restrict analysis to 1994-2011. I also focus my analysis on workers whose wages are not imputed in the CPS. Since sector, occupation, and union status are not used in the CPS's imputation algorithm, analyzing government wage gaps and union wage gaps using imputed wages can be problematic (Bollinger and Hirsch (2006)). Thus, I focus only on the non-imputed wage sample. The data flagging which wages were imputed are missing in the 1994 data, so I drop this year, leaving me with a 1995-2011 sample.

[15] I follow Autor, Katz, and Kearney (2008)'s top and bottom coding procedures. Autor, Katz, and Kearney (2008) drops all reported hourly wages below \$2.80 in real 2000 dollars. This translates to \$128 per week in real 2011 dollars, assuming a 35 hour work week. They also scale top coded wages by 1.5.

[16] A worker's sector is measured by the CPS variable reporting a worker's class.

sures land unavailability. Standard errors are clustered by state when using state-level measures of housing supply elasticity and clustered by MSA when using MSA variation in housing supply elasticity.

The nationwide average public-private wage gap is measured by β^{gov}. The model predicts that public-private wage gap should be higher in areas with less elastic housing supplies:

$$\beta^{elast} > 0.$$

I test this prediction first using a sample including private sector workers and state government workers. The state-level measure of land unavailability is calculated from a population weighted average of MSA land unavailability within each state. There is likely more measurement error in this state-level measure than in the MSA-level land unavailability measure since it does not include data on the topography of cities and town outside of these MSAs within the state. Assuming this mis-measurement is classical measurement error, the state-level estimates will be biased towards zero.

Column 1 of Table 3 shows that the nationwide average wage gap between state government employees and private sector workers is -0.112 log points. Consistent with Gittleman and Pierce (2012), after controlling for worker demographics, government workers' earnings are lower than similar private sector workers, on average. However, the state worker-private sector wage gap increases by 0.027 log points in states with a 1 standard deviation increase in land unavailability. This effect is significant at the 5% level. Column 2 of Table 3 adds 3-digit occupation codes interacted with a government employee dummy as additional controls. The effects are essentially unchanged, showing that the public-private wage gap is not driven by differing occupation mixes in the public or private sector related to land unavailability.

I now add in interactions with laws on whether state workers are allowed to collectively bargain. While the cross-sectional variation in public sector collective bargaining laws is surely non-random, the variation of interest is the relationship between land unavailability and government wages within each category of state: those which permit public sector collective bargaining and those which do not. The key identifying assumption is that the differential relationship of land unavailability and government wages between states which do/don't allow public sector collective bargaining is driven by the collective bargaining laws. The estimating equation is now:

$$\ln w_{ijt} = \delta_j + \alpha_t + \beta^{gov} gov_{it} + \beta^{elast} z_j^{elast} \cdot gov_{it} + \beta^{elast\_b\,\mathrm{arg}} z_j^{elast} \cdot gov_{it} \cdot z_j^{\mathrm{barg}} + \beta^{b\,\mathrm{arg}} gov_{it} \cdot z_j^{\mathrm{barg}} + \beta X_{it} + \varepsilon_{ijt}. \tag{10}$$

Column 3 of Table 3 shows a one standard deviation increase in land unavailability has essentially no effects on government wages when collective bargaining is illegal, lowering government wages by 0.005 log points. This effect is not statistically significant. However, when collective bargaining is legal, a one standard deviation in land unavailability raises the public-private wage gap by 0.026 log points. Figure 1 visually plots this regression to show where each state falls. Figure 1 shows the state government-private sector wage gaps within states which allow public sector collective

bargaining are higher in states including California, Vermont, Florida, and Connecticut, but much lower in states such as Iowa, South Dakota, Montana, and Nebraska which lines up with these states' land unavailability. In states which prohibit state workers from bargaining such as Georgia, Virginia, Louisiana, and Utah, there is no relationship between land unavailability and wages.

Column 4 of Table 3 adds in controls for 3-digit occupation code by government worker fixed effects. The results are essentially unchanged. Despite the measurement error in the state-level topography data, I find that collective bargaining allows state workers to harness the taxation market power benefits from inelastic housing supply and earn rents in the form of higher wages. Prohibiting collective bargaining breaks the link between housing supply and government wages.

Performing the same analysis on local government employees, I compare the wage gaps between local government workers and private sector workers across MSAs. The controls in this setup now include MSA fixed effects and the land unavailability measure is now at the MSA level. Column 5 of Table 3 shows that the nationwide local government worker-private sector wage gap is -0.071 log points. A one standard deviation increase in land unavailability increases the wage gap by 0.037 log points and is significant at the 1% level. Column 6 of Table 3 adds in controls for 3-digit occupation code by government employee fixed effects, which show very similar estimates.

Column 7 of Table 3 adds the interactions with whether local worker public sector collective bargaining is legal. Consistent with the estimates from the census of governments, a one standard deviation increase in land unavailability increase the local worker-private sector wage gap by 0.036 log points in states with collective bargaining, with essentially no effect in states with outlaw bargaining (point estimate of 0.004). Figure 2 plots this regression to show where different MSAs fall along the regression lines. Within states allowing collective bargaining, the plot shows high local government wages gaps in land unavailable cities including Los Angeles, New York, Cleveland, Chicago, and Portland and low government wage gaps in cities with lots of land to develop including Phoenix, Kansas City, and Minneapolis. Within states outlawing collective bargaining, MSAs with lots of land available such as Dallas, Atlanta, and Houston have similar wages to MSAs with much less land available for development, such as Salt Lake City, New Orleans, and Norfolk.

As further robustness, Column 8 of Table 3 adds in controls for 3-digit occupation by government workers fixed effects, which essentially leaves the results unchanged. To test whether the local housing supply elasticity measures impact local government worker-private sector wage gaps within states, across MSAs, I add controls for state differences in the local government worker-private sector wage gaps. I now estimate:

$$\ln w_{ijt} = \delta_j + \delta_{occ*gov} + \alpha_t + \beta_k^{gov} gov_{it} + \beta^{elast} z_j^{elast} * gov_{it} + \beta^{elast\_barg} z_j^{elast} * gov_{it} * z_{jt}^{\text{barg}} + \beta^{\text{barg}} z_{jt}^{\text{barg}} + \beta X_{it} + \varepsilon_{ijt},$$

where j represents an MSA and k represents a state. Columns 9 of Table 3 show that the impact of land unavailability on the local government-private sector wage gap falls slightly to 0.02 log points, but remains statistically significant. Since states have the ability to redistribute tax revenues across local areas within a state, it is not surprising that the within state effects of housing supply elasticity are smaller than the between state effects, where the tax dollars are relatively more

protected. Overall, land unavailability consistently has a positive impact the public-private sector wage gap both for local and state government workers when these workers can collectively bargain, while wages are unaffected when collective bargaining is prohibited.

3.4 Teachers, Police, and Firefighters

To further gauge how some specific government occupations' wages respond to land unavailability and collective bargaining laws, I zoom in to focusing on teachers, police, and firefighters. The public sector collective bargaining data has data specifically on whether each one of these occupations is allowed to bargain. Table 1 Panel C reports summary statistics on these laws.

I redo the same regression analysis as performed on the local government workers-private sector wage gaps above, as in equation (10) , but use that occupation specific bargaining law and only include government workers employed in the given occupation, comparing their wages to the overall sample of private sector workers. Column 1 of Table 4 shows a one standard deviation increase in land unavailability increase local teacher-private sector wage gap by 0.011 log points in states which prohibit bargaining and by 0.012 in states which allow bargaining. However, neither effect is statistically significant. While I cannot rule out a zero effect for teachers, I also cannot rule out small to medium size effects. Column 2 of Table 4 adds in controls for state specific government wage gaps, allowing the land unavailability parameter to be identified by within-state, cross-MSA variation. The effects still remain statistically insignificant, however I also am not able to reject that the effect is the same as previously found when I included the whole sample of all local government workers. The point estimate is now slightly negative, at 0.005 within states allowing collective bargaining. If land unavailability is, in fact, influencing teacher's wages it must be a small effect.

Columns 3 and 4 of Table 4 repeat this analysis for police. Within states which allow police to collectively bargain, a one standard deviation increase in land unavailability increases the police-private sector wage gap by 0.052 log points. In states which prohibit bargaining, there is a statistically insignificant effect of 0.018 log points. When state by government worker fixed effects are added, the estimates fall substantially within states which allow collective bargaining. The point estimate is now only 0.006, however the standard errors cannot rule out an effect equal to estimate for the overall government worker sample (0.019 log points).

Columns 5 and 6 of Table 4 show similar effects for the fire fighter-private sector wage gap. The point estimate for firefighters in states which allow them to bargain is 0.063 log points, and -0.02 log points in states which outlaw bargaining. Controlling for state specific government work fixed effects lowers the point estimate to 0.0178 within states which allow collective bargaining. While the standard errors are too large to rule out a zero effect, this point estimate is very close to that found in the previous analysis which included all government workers. Public sector collective bargaining appears to allow police and fire fighters to take advantage of inelastic housing supply and receive higher wages, while teachers appear not to benefit as much. This is similar to Frandsen (2011)'s findings that the direct effect of these bargaining laws seems to raise police and fire fighters wages more than teachers wages.

3.5 Benefits

Gittleman and Pierce (2012) show that government workers' benefits are more generous than private sector workers' benefits. If the market power of state and local governments allows government workers to earn more desirable wages than similar private sector workers, this should also be true for public-private differences in the generosity of benefits.

As a measure of benefit levels, I use data from the CPS March Supplement from 1991-2011 on whether workers have employer sponsored health insurance as well as whether the employers pay some or all of the cost of the insurance premiums. Panel E of Table 1 reports summary statistics. For this sample of workers, I include all workers ages 25 to 55 which work at least 35 hours per week and 50 weeks per year. 71% of private sector workers have employer sponsored health insurance, 67% have employers contributing towards premiums and 16% have employers paying the full cost of premiums. 83% of state government workers and 85% of local government workers have employer sponsored health insurance. About 83% of both state and local workers have employers contributing toward insurance premiums.

I repeat the previous regression analysis, now with the lefthand side variable as these measures of health insurance benefits. I use a linear probability model for wether a worker has employer sponsored health insurance:

$$H_{ijt} = \delta_j + \alpha_t + \beta^{gov} gov_{it} + \beta^{elast} z_j^{elast} * gov_{it} + \beta^{elast\_barg} z_j^{elast} * gov_{it} * z_{jt}^{\text{barg}} + \beta^{\text{barg}} z_{jt}^{\text{barg}} + \beta X_{it} + \varepsilon_{ijt},$$

where H_{ijt} is a binary indicator of whether the worker has employer sponsored health insurance. I include the same worker demographic controls as in the wage equations along marital status dummies interacted with sex since health insurance coverage can be extended to spouses. Column 1 of Table 5 shows that a one standard deviation increase in land unavailability increases local government worker-private sector "health insurance gap" by 2.5 percentage points in states permitting collective bargaining, while land unavailability has little to no effect in states which prohibit bargaining (point estimate of 0.2 percentage points).

Turning to effects on the generosity of coverage, Column 2 of Table 5 shows a one standard deviation increase in land unavailability within collective bargaining states increases the probability local government workers receive some employer contribution toward health insurance premiums by 2.2 percentage points, relative to similar private sector workers. There is little to no effect in states without collective bargaining.[17] To put try to put a back of the envelope dollar value on this estimate, I use tabulations of data from the Medical Expenditure Panel Survey. According to the 2010 MEPS, the median employer health insurance premium contribution for state and local government workers with employer sponsored health insurance was $7,663. Since 96.8% of local workers who have employer sponsored health insurance also receive premium contributions, the

[17] These effects are similar when restricting the sample only to government workers, and dropping the private sector "control group." Public sector workers in housing inelastic areas which permit collective bargaining receive more generous health insurance benefits than those in areas without collective bargaining rights or inelastic housing supplies.

average contribution for those receiving one is $7916.[18] A 2.2 percentage point increase in the probability of receiving an employer contribution is worth 0.022*7961=$175. This represents a 175/7663=2.3% increase in health insurance contributions.

Repeating this analysis of state government workers, column 4 of Table 5 shows that there does not seem to be an effect on state government worker-private sector "health insurance coverage gap." State government worker health insurance provision does not seems to respond to land unavailability regardless of collective bargaining laws. I also do not find an effect on employer contributions toward health insurance premiums. One possible reason for this is that employer sponsored health insurance for state government workers is so wide spread, there is not much of a margin for it to vary across space. Additionally, the state-level land unavailability measures have more noise in them than MSA-level measures, since they are imputed from MSA-level measures. This measurement error could lead to a downwardly biased estimate.

I repeat the analysis looking at whether the employer paid the full costs of a workers' health insurance premiums. While I find a positive point estimate for both state and local government workers, the estimates are noisier and I cannot reject a zero effect. However, using whether the employer paid the full health insurance premium as an indicator of insurance generosity is problematic. Employers are less likely to pay the full cost of premiums when the health insurance coverage is for a family plan, instead of an individual plan. If state and local government workers are offered generous insurance, they are more likely to elect the family coverage and share the benefits with their spouses and children. This may make it less likely for their employer to pay the full insurance premium since family coverage usually requires some contribution from the worker. For these reasons, I place more trust in the other measures of employer health insurance generosity.

3.6 Corruption

Bai, Jayachandran, Malesky, and Olken (2013) shows that the threat of out-migration disciplines government corruption and bribes. They study government bribes in Vietnam and show that when firms are more likely to migrate away from corrupt areas, the level of government bribes is lower. I test this mechanism in the US context by analyzing data from the U.S. Department of Justice publication Reports to Congress on the Activities and Operations of the Public Integrity Section. These data report the number of public corruption convictions of federal, state, and local public officials by the presiding federal district court in each geographic area from 1978 through 2012. Since these data measure convictions in federal courts, the enforcement rate and funding of these courts cannot be influenced by local revenue generated by inelastic housing supply. There are 94 federal district courts in the US. Districts can be as large as an entire state, but the more populous states are often divided into as many as four districts within the state. I link the MSA level land unavailability data to the district court presiding over that geographic area. Summary statistics

[18] From Table 1 Panel E, we see 82.2% of local workers receive employer contributions and 84.9% have employer sponsored health insurance. Thus (.822/.849)=96.8% of workers with employer sponsored health insurance receive premium contributions. If $7,663 is the average employer contribution for workers with employer sponsored health insurance, then 7663/0.968=$7916.

in Table 1 Panel G shows that the average MSA is associated with a district court which annually convicted 0.30 public sector workers for corruption per 100,000 residents.

I use the following estimating equation to measure the effect of land unavailability on corruption:

$$C_d = \alpha + \beta^{elast} \frac{\text{Population}_j}{\text{Population}_d} z_j^{elast} + \beta^{pop} \frac{\text{Population}_j}{\text{Population}_d} + \varepsilon_d,$$

where C_d measures the number of corruption convictions per capita within district d which contains MSA j. The magnitude of the effect of land unavailability z_j^{elast} on district wide corruption convictions depends on whether the MSA makes up a large share of the population within the district. I scale the effect of land unavailability by the population share of district d living within MSA j. I also include the direct effect of population share as a control to ensure estimated effects on not directly driven by population size.[19] Table 6 shows that a one standard deviation in land unavailability increases corruption convictions per 100,000 residents by 0.05. Relative to average level of corruption of 0.30, this is a 17% increase, however this effect is not quite statistically significant. Adding state fixed effects to the regression, the point estimate increases to 0.14, and is strongly statistically significant.[20] Scaling this effect by the mean, a one standard deviation increase in land unavailability increases corruption convictions by 47%.

Column 2 of Table 6 compares how these effects differ based on legality of collective bargaining. A one standard deviation increase in land unavailability increase corruption convictions by 40% (0.117/0.296) in states which outlaw collective bargaining. In states which permit collective bargaining the point estimate is much lower at 11% (0.034/0.296) and cannot be statistically distinguished from zero. Adding state fixed effects further enhances these results. Column 4 of Table 6 shows that a one standard deviation increase in land unavailability increases corruption conviction by 86% in states outlawing collective bargaining. In states permitting bargaining the effect is not statistically significant with a point estimate of 9%.

It appears collective bargaining may give government workers a formal mechanism to bargain for their share of rents from taxation and receive increased compensation. However without this bargaining mechanism, workers may turn to informal ways of capturing these rents through bribes and corruption. Indeed, Column 2 of Table 6 shows that corruption convictions are 16% (-0.047/0.296) lower in states permitting collective bargaining than those which outlaw it. Collective bargaining could potentially help keep corruption in check by providing formal mechanisms to bargaining for rents. However, public sector collective bargaining laws are not randomly assigned. These results on the direct impact of collective bargaining on corruption can only be suggestive. Further, these data can only measure corruption convictions and not actual levels of corruption. It is possible that unionized workers also engage in corruption, but the unions are better are not getting caught and convicted. Regardless of collective bargaining, corruption is higher in housing elastic areas,

[19] MSAs which span state lines are dropped from the analysis since they are covered by many district courts. Population data for federal district courts and MSAs come from the 1990 census.

[20] States which only have a single district court for the entire state are dropped from the analysis with state fixed effects.

consistent with the model's predictions that these governments can extract more.

3.7 Voter Reaction

In the context of the formal model, the only way private sector residents can fight rent extraction is to move away, which completely ignores the political system. One possible political way private sector voters could respond is by pushing for laws which place legislative power with the voters and limit power of elected officials. To test this theory, I use data from the International City & County Management Association (ICMA)'s Form of Government Survey. ICMA survey local governments every 5 years. I use data from city governments from 1996 and 2001 and from county governments from 1997 and 2002. The key variables of interest are data on the term limits of elected officials and whether the voter base has power to directly influence legislation through initiatives, referendums, and recalls. To measure term limits, I use data on the maximum number of terms a chief officer can remain in power, as well as a dummy variable for whether the local government has a term limit at all.[21] I define similar measures for city council members. To measure the legislative power of voters, I create an index where 1 point is received each for whether the local governments allows voters to propose local initiatives, referendums, protest referendums, and recalls.[22] Panel F of Table 1 reports summary statistics of these variables.

To combat rent extraction, the local voters in housing inelastic areas might fight for stronger limits of elected official's power. To test this theory, I regress these voter empowerment measures on land unavailability, controlling for year and state fixed effects. Column 1 and 3 of Table 7 show that term limits of both chief officers and city council members are 0.2 terms shorter per standard deviation increase in land unavailability. Columns 2 and 4 show that this effect is not statistically different in states which permit public sector collective bargaining. Looking at the extensive margin of whether these elected officials have a term cap at all, I see similar results in Columns 5 through 8. Finally, Column 9 shows that the voter legislation empowerment index is 0.05 higher per standard deviation increase in land unavailability. This is about a 0.04 standard deviation increase in the index. Column 10 shows that this effect is no different in states which permit public sector collective bargaining.

These results are consistent with the model's prediction that inelastic housing supply leads to more rent extraction regardless of public sector collective bargaining. Private citizens combat rent extraction by limiting the power of elected officials, regardless of collective bargaining laws. The collective bargaining laws only influence to whom the rents flow.

[21] For areas which have no term limits. I code this as a maximum of 15 years. The maximum term limit I observed for areas which do impose a cap is 6.

[22] An initiative allows citizen to place charter, ordiance, or home rule changes on a ballot for approval or disapproval by voters. A referendum allows voters to determine the outcome (binding) or express an opinion (non-binding) on public issues. A protest referendum allows voters to delay enactment of local ordinance of bylaw until a referendum is held. A recall is a vote by citizens to remove an elected official from office before the expiration of that official's term.

3.8 Falsification Tests

3.8.1 Rent Extraction and Amenities

Previous regressions show a strong relationship between land unavailability and government workers' compensation in states permitting collective bargaining. A large body of previous work has used land unavailability as an instrument for housing supply elasticity, including Saiz (2010), Mian and Sufi (2011), Chaney, Sraer, and Thesmar (2012). However, inputs into the land unavailability measures include geographic characteristics which may also be considered amenities, such as bodies of water or mountains. Thus, land unavailability might drive the public sector compensation not through housing supply, but by increasing amenities, the mechanism explored by Brueckner and Neumark (2014)(BN).

To distinguish between the role of amenities and housing supply, I have collected the dataset used by BN on four amenities measured at the MSA level: mild temperatures, dry weather, coastal proximity, and population density.[23] First, I replicate BN's findings in Column 1 of Table 8 that the public/private sector wage gap is larger in high amenity areas.[24] Second, I can add these variables (and their interactions with collective bargaining laws) as controls to see if the land unavailability measure effect still exists. Column 3 of Table 8 shows that even with these many additional amenity controls, I still find a statistically significant effect of land unavailability on the public-private sector wage gap in areas which permit public sector collective bargaining, however the point estimate is smaller than without the controls. This is not surprising because a number of these amenity measures also directly cause or are a consequence of inelastic housing supply. Proximity to a body of water is a key factor causing less land to be available for housing development. Housing inelastic areas are likely to be of higher population density because there is less land available for each person to consume. To better test between the stories of amenities versus housing supply elasticity, I remove the proximity measure and population density controls from the regression. The weather amenities are a better test of distinguishing the theories as they do not directly impact housing supply. Column 4 of Table 8 shows that the land unavailability measure remains statistically significant and has a larger economic magnitude. However, none of the coefficients on the mild weather, dry weather, or their interactions with public sector collective bargaining laws are statically significant now. It seems possible that the estimates found by BN may actually have been picking the effects of housing supply elasticity, instead of amenities.

A second key way to differentiate the amenity channel from the housing supply elasticity channel

[23] These data come from the replication files of Brueckner and Neumark (2014). Mild temperature is the negative of the sum of the absolute values of the differences between monthly average temperature and 20 degrees Celsius, summed over January, April, July, and October. Dry weather is the negative of the average monthly precipitation for those four months, in centimeters. Proximity is the negative of the average distance from the MSA's county centroids, weighted by county population, to the nearest coast, Great Lake, or major river. For each of these variables, a higher (less negative) value is "better," indicating less deviation from mild temperatures, less rain, and a shorter distance to navigable water. Density is the tract-weighted population density (per square mile) in the MSA. I z-score each of these measures to standardize units.

[24] I do not find an statistically significant effect for mild weather, however neither does BN for this specification. See Table 6 of BN.

is through the durable nature of housing. As modeled and analyzed by Glaeser and Gyourko (2005), housing supply elasticity is inherently kinked. Land constraints on new real estate development are only relevant when there is demand to build additional housing. In shrinking cities, housing prices will fall below construction costs. Developers will have no incentive to take undeveloped land to build new housing until the price of housing rises above construction costs. When cities are shrinking, the housing supply is fixed at its current level and completely inelastic, regardless of the amount of land available for new potential new development. See Glaeser and Gyourko (2005) for a full micro-foundation of these mechanisms.

The kinked nature of housing supply provides two empirical tests of the government rent-seeking model. First, variation in land unavailability should have little impact on public-sector compensation in shrinking cities. All shrinking cities will have a very inelastic housing supply and variation in the amount of land available for real estate development has no impact of the current housing supply elasticity. If land unavailability were driving public sector compensation through amenities, there should not be this asymmetry. Even in shrinking cities, amenities will be priced into housing prices to maintain spatial equilibrium. Table 9 re-runs the CPS-MORG public-private sector wage regressions separately for growing and shrinking MSAs. I define a shrinking MSA by whether the MSA experienced a decline in total population over the previous five years. Column 1 of Table 9 shows that the local government-private sector wage gap increases by 3.91 percentage points in growing MSAs where public sector collective bargaining is legal. Column 2 of Table 9 shows that in shrinking MSAs, this coefficient falls to 0.74 percentage points and is not statistically distinguishable from zero. Drilling down to teachers, fire, and police, Columns 3 through 8 of Table 9 show that all three occupations exhibit the largest effects of land unavailability in collective bargaining states when MSAs are growing. When the MSA is shrinking, the point estimates of land unavailability in states permitting collective bargaining is often negative and never statistically different from zero.

A second test of the housing supply elasticity mechanism is that shrinking cities' housing supply elasticities should be significantly less elastic than growing cities. In shrinking cities, the previously built durable housing will only slowly depreciate over time to accommodate the smaller population. Shrinking cities' inelastic housing supply gives the local government more taxation market power, relative to more elastic housing supplies in growing cities. As previous results show, the legality of public sector collective bargaining enables public sector workers to capture some of these rents available from inelastic housing supply. Thus, in the public-private wage regressions, the interaction of the legality of public-sector collective bargaining with whether a city is shrinking should be positive. Column 1 of Table 9 shows that collective bargaining is positively associated with an 8.51 percentage point higher public-private sector wage gap in growing MSAs. Column 2 of Table 9 shows that this coefficient increases to 12.8 percentage points in shrinking cities, as predicted by the inelasticity of housing supply in shrinking cities. Columns 3 through 8 in Table 9 repeat this analysis focusing on teachers, police, and fire. Across all regressions, the direct effect of collective bargaining on public-private wage gaps is substantially larger in shrinking cities than in growing

cites. Overall, these regressions are strongly consistent with housing supply elasticity being the mechanism through which land unavailability leads to larger public-private sector wage gaps.

3.8.2 Effects on federal & state government workers

The public-private sector wage and benefits gaps results presented thus far suggest that collective bargaining enables government workers to harness state and local governments' taxation market power by extracting rents and receiving higher wages and more generous benefits than similar private sector employers. A falsification test of these predictions is to analyze whether the federal government-private sector wage and benefits gaps across cities and states exhibit similar properties.[25] Since federal workers are not paid by the state or local government which presides over their location of residence, housing supply elasticity should have no impact on federal workers' compensation.

Table 10 reports the same state and local wage gap regressions, but uses federal workers instead of state and local workers. The point estimate of the impact of land unavailability of the federal worker-private sector wage gap in states both with and without collective bargaining is statistically insignificant, and economically small. The point estimates within states which permit collective bargaining is even negative. Column 2 of Table 10 shows this result using MSA-level variation in land availability and Column 3 shows this using state-level variation in land unavailability. As predicted by the model, the federal worker-private sector wage gaps are not inflated by the housing supply elasticity of these workers' cities or states of residence.

Performing a similar test on state government workers, I compare the wage gaps between state government and private sector workers across MSAs within states. Since the revenues used to pay state government workers are collected from all areas within a state, the MSA of residence of a state government worker should not impact their pay, relative to private sector workers living in the same MSA. I add state fixed effects interacted with whether the worker is employed by the state government as controls:

$$\ln w_{ijkt} = \delta_j + \alpha_t + \beta^{gov} gov_{it} + \beta_k^{gov} gov_{it} + \beta^{elast} z_j^{elast} * gov_{it} + \beta X_{it} + \varepsilon_{ijt}.$$

Column 1 of Table 10 shows that the impact of land unavailability on state government-private sector wages gaps is negative within states which permit collective bargaining. A one standard deviation increase in land unavailability *lowers* the state government worker-private sector wage gap by 0.030 log points. In states which prohibit bargaining, the point estimate is slightly positive at 0.005.

As further falsification tests, I repeat the above analysis looking at public-private sector benefits gaps, using whether the employer contributed some to workers' health insurance premiums. Column 4 of Table 10 shows these estimates for state government workers, using within-state cross-MSA

[25] Brueckner and Neumark (2014) also use wages paid to federal government workers living in states with desirable amenities as a falsification test of their model. I follow their approach here.

variation in land unavailability. The effect is not statistically significant, regardless of whether collective bargaining is legal. Columns 5 and 6 perform this analysis for federal government workers. Using either MSA-level or state-level variation in land unavailability shows the federal government worker-private sector employer health insurance contribution gap is insignificant, regardless of collective bargaining laws.

As shown in the previous section, state level variation in housing supply elasticity increases state worker-private sector wage gaps in states permitting collective bargaining. However within these same states, variation across MSAs within a state have no, or even negative impacts on the state worker-private sector wage gap. As predicted by the model, geographic variation in housing supply elasticity only impacts government compensation when government jurisdiction also varies across these geographic areas. Further, federal worker-private sector wage gaps and benefits gaps are unaffected by state level or MSA level variation in housing supply elasticities, as also predicted by the model.

3.8.3 Worker quality

The empirical evidence shows that housing supply elasticity impacts the average wage gap between public and private sector workers when collective bargaining is permitted. A possible alternative explanation for this result other than rent-seeking and market power is that housing supply elasticity influences the type of workers state and local governments choose to employ when workers are unionized. The wage gap between public and private sector workers could represent unobserved skill differences between workers employed in the public and private sectors. If this were true, the regressions previously presented which controlled for 3-digit occupation codes should have had much smaller point estimates than those which did not control for occupation, since there is likely less variation in worker skill within occupation than between.

As an additional test of this alternative hypothesis, I assess whether public-private sector workers years of education gaps vary with state and local housing supply elasticities. Table 11 performs the same analysis used to measure state and local wage gaps, but replaces the left hand side variable with a worker's years of education. If government workers are higher skilled that private sector workers in housing inelastic areas, then this should hold both for observed skills (education) and unobserved skills (which cannot be tested). Table 11 shows that impact of land unavailability on public-private sector education gaps is not statistically significant, regardless of a state's collective bargaining status. This holds in the state government workers sample and local government workers sample. This result is also robust to including 3-digit by government worker fixed effects in both the state worker sample and local worker sample. Within the local worker sample, adding in state by government worker fixed effects also does not change this result. Overall, differences in public and private sector workers' years of schooling do not appear to relate to state and local housing supply elasticities.

Even though the unionized government workers don't appear to have higher human capital, it would be surprising if offering above market wages would lead to no selection on the types of workers

employed in the public sector. The public sector jobs in housing inelastic areas that allow collective bargaining should face excess labor supply. The lucky workers able to obtain these rationed, high paying jobs would have little incentive to change jobs in the future. This would make the public sector workforce older in age within these high rent extraction areas. I test this hypothesis in columns 6 and 7 in Table 11. Indeed, a one standard deviation increase in land unavailability leads to a local government worker–private sector age gap of 0.30 years and of 0.11 years when using state government workers. It is possible that this increase in age leads these workers to be more productive. However, the wage return to age (experience) is controlled for in all the previous wage gap analysis. An older workforce is consistent with the model's prediction that these high wages are due to rents, and not unobserved worker skills. Government workers' wages and benefits in states which permit public sector collective bargaining appear to reflect the taxation market power of state and local governments.

3.8.4 Compensating Differentials

A possible alternative explanation for these public-private wage gaps in housing inelastic areas is that they are due to compensating differentials. If government workers need to live close to where they work, it is possible that they are less willing to pay the high housing prices located in the central city. These workers might need to be offered a higher wage to offset the high housing costs. I believe a number of the previous results argue against this hypothesis. First, if this were true, we would expect a higher public-private wage gap in all housing inelastic cities, not just those with collective bargaining. Second, if this were true we would expect to see this compensating differential to show up in federal government workers' wages, as well as state government workers' wages when looking at the cross-MSA, within-state variation. However, we see no effect in these areas.

4 Conclusion

When presiding over an immobile tax base, state and local governments use their market power to increase revenue and taxes, consistent with the Leviathan Hypothesis. Public sector unions channel a portion of the additional revenue into more generous wages and benefits. However, without the influence of unions, state and local government workers capture these additional funds informally by engaging in corruption.

The spatial equilibrium model shows that the scope of governments' market power does not disappear when there is competition between a large number of governments or when each government is small. The local housing market will respond to the tax policy choices of the state and local government, mitigating the disciplining effects of workers' voting with their feet through migration.

While this paper cannot speak to whether the direct effect of public sector collective bargaining laws on government spending inefficiencies, it does appear that public sector unions take advantage of rent seeking opportunities to benefit their workers. Thus, repealing collective bargaining rights, as recently done in Wisconsin and attempted by Ohio, may be an effective method in helping state

and local governments reign in spending on worker compensation to meet budgetary constraints, especially in areas with inelastic housing supplies. However, removing collective bargaining rights likely will shift government spending to other projects which benefit special interest groups, but not the general public. Further, repealing collective bargaining laws may push public sector workers to engage in corruption as an alternative way of capturing available rents. Regardless of the legality of collective bargaining, the government's access to tax revenue from inelastic housing supply would remain.

These results also speak to the welfare effects of land-use regulation policy and other policies influencing the mobility of households. While the decision to regulate real-estate development and population expansion has many costs and benefits not studied in this paper, decreasing a city's housing supply elasticity through regulation gives the local government more taxation market power. Thus, the rise in land-use regulations since the 1970s may have had an unintended consequence of increasing rent seeking by governments and leading to overpaid government workers and more corruption.

Finally, the budgetary stress faced by state and local governments during the Great Recession often led to substantial cuts in public sector compensation. These cuts within housing inelastic areas that permit public-sector collective bargaining likely were an effective way to both increase government efficiency and help relax tight budget constraints.

References

Autor, D.H. and Katz, L.F. and Kearney, M.S. (2008). Trends in us wage inequality: Revising the revisionists. *Review of Economics and Statistics*.

Bai, Jie and Jayachandran, Seema and Malesky, Edmund J and Olken, Benjamin A. (2013). Does economic growth reduce corruption? theory and evidence from vietnam. Technical report, National Bureau of Economic Research.

Bollinger, C.R. and Hirsch, B.T. (2006). Match bias from earnings imputation in the current population survey: The case of imperfect matching. *Journal of Labor Economics 24*(3), 483–519.

Brennan, Geoffrey and Buchanan, James M. (1980). *The power to tax: Analytic foundations of a fiscal constitution*. Cambridge University Press.

Brueckner, J.K. and Neumark, D. (2014). Beaches, sunshine, and public-sector pay: theory and evidence on amenities and rent extraction by government workers. *American Economic Journal: Economic Policy forthcoming*.

Brueckner, Jan K. (1987). The structure of urban equilibria: A unified treatment of the muth-mills model. In E. S. Mills (Ed.), *Handbook of Regional and Urban Economics*, Volume 2 of *Handbook of Regional and Urban Economics*, Chapter 20, pp. 821–845. Elsevier.

Chaney, Thomas and Sraer, David and Thesmar, David. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review 102*(6), 2381–2409.

Epple, D. and Zelenitz, A. (1981). The implications of competition among jurisdictions: does tiebout need politics? *The Journal of Political Economy*, 1197–1217.

Feiveson, Laura. (2011). General revenue sharing and public sector unions. *Massachusetts Institute of Technology Mimeo*.

Frandsen, Brigham R. (2011). The effects of public sector collective bargaining rights. *Massachusetts Institute of Technology Mimeo*.

Freeman, R.B. (1986). Unionism comes to the public sector. *Journal of Economic Literature*, 41–86.

Freeman, Richard B and Valletta, Robert. (1988). The effects of public sector labor laws on labor market institutions and outcomes. In *When public sector workers unionize*, pp. 81–106. University of Chicago Press.

Gittleman, M. and Pierce, B. (2012). Compensation for state and local government workers. *The Journal of Economic Perspectives*, 217–242.

Glaeser, Edward L and Gyourko, Joseph. (2005). Urban decline and durable housing. *Journal of Political Economy 113*(2).

Gyourko, J. and Tracy, J. (1991). The structure of local public finance and the quality of life. *Journal of Political Economy*, 774–806.

Hoxby, Caroline Minter. (1996). How teachers' unions affect education production. *The Quarterly Journal of Economics 111*(3), 671–718.

Krueger, A.B. (1988). Are public sector workers paid more than their alternative wage? evidence from longitudinal data and job queues. In *When public sector workers unionize*, pp. 217–242. University of Chicago Press.

Mian, Atif and Sufi, Amir. (2011). House prices, home equity-based borrowing, and the us household leverage crisis. *American Economic Review 101*(5), 2132–56.

Nelson, Michael A. (1987). Searching for leviathan: Comment and extension. *The American Economic Review*, 198–204.

Oates, Wallace E. (1985). Searching for leviathan: An empirical study. *The American Economic Review*, 748–757.

Roback, Jennifer. (1982). Wages, rents, and the quality of life. *Journal of Political Economy 90*(6), pp. 1257–1278.

Rosen, Sherwin. (1979). Wages-based indexes of urban quality of life. In P. Mieszkowski and M. Straszheim (Eds.), *Current Issues in Urban Economics*. John Hopkins Univ. Press.

Saiz, Albert. (2010). The geographic determinants of housing supply. *The Quarterly Journal of Economics 125*(3), pp. 1253–1296.

Tiebout, Charles M. (1956). A pure theory of local expenditures. *The journal of political economy 64*(5), 416–424.

Zax, Jeffrey S. (1989). Is there a leviathan in your neighborhood? *The American Economic Review*, 560–567.

Table 1: Summary Statistics

A.Census of Governments: Payroll, Employment & Revenue Data					
	Obs	Mean	Std. Dev.	Min	Max
Ln County Area Gov Payroll Per Capita	6069	4.48	0.33	1.59	6.42
Ln FTE Gov Employment Per Capita	6069	-3.41	0.25	-5.95	-1.40
Ln Average County Area Gov Wage	6069	7.89	0.18	7.21	8.57
Ln County Area Taxes Collected Per Capita	7569	-0.50	0.60	-4.30	1.92
Ln County Area Revenue Per Capita	7569	0.46	0.52	-2.72	2.28
B. Housing Supply Elasticity Meaure					
Land Unavailability Z-Score	269	0.00	1.00	-1.21	2.82
C. Collective Bargaining Laws: 1972-1996					
State Gov Workers Can Collectively Bargain	384	0.43	0.50	0	1
Local Police Can Collectively Bargain	384	0.50	0.50	0	1
Local Fire Fighters Can Collectively Bargain	384	0.57	0.50	0	1
Local Teachers Can Collectively Bargain	384	0.57	0.50	0	1
Other Local Gov Workers Can Collectively Bargain	384	0.48	0.50	0	1

D. CPS-MORG Data 1995-2011								
	Private Sector		Federal Gov Workers		State Gov Workers		Local Gov Workers	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Ln Weekly Wage	6.692	0.613	6.974	0.493	6.735	0.506	6.731	0.517
Age	39.357	8.585	42.706	8.152	41.540	8.588	41.410	8.535
Female	0.425	0.494	0.429	0.495	0.560	0.496	0.580	0.494
Black	0.077	0.267	0.131	0.338	0.106	0.308	0.093	0.291
Hispanic	0.120	0.325	0.070	0.256	0.061	0.239	0.077	0.267
Rural	0.199	0.399	0.200	0.400	0.294	0.456	0.257	0.437
Years of Schooling	13.502	2.737	14.486	2.365	15.296	2.670	14.968	2.488
Observations:	934123		36616		62854		109249	

E. March CPS Health Insurance Data: 1991-2011								
	Private Sector		Federal Gov Workers		State Gov Workers		Local Gov Workers	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Included in Employer	0.706	0.455	0.828	0.38	0.862	0.345	0.849	0.359
Employer Contributes to	0.672	0.470	0.788	0.409	0.833	0.373	0.822	0.393
Employer Pays All Plan	0.158	0.364	0.0939	0.2917	0.215	0.411	0.262	0.440
Observations:	679025		32122		45383		74738	

F. ICMA Voter Empowerment Measures: 1996-2002					
	Obs	Mean	Std. Dev	Min	Max
Max Number of Terms for Chief Officer	5963	13.95	3.475	1	15
Max Number of Terms for Counsil Members	5443	13.95	3.468	1	15
Chief Office Has a Term Limit	5963	0.094	0.292	0	1
Counsil Members Have Term Limits	5443	0.092	0.289	0	1
Voter Power Index	5963	1.815	1.424	0	4
G. Public Sector Corruption Convictions: 1978-2012					
	Obs	Mean	Std. Dev.	Min	Max
Public Corruption Convictions per 100,000 Capita:	236	0.296	0.1497	0.0349	1.086

Notes: Unit of observation is a county/year for Census of Government Data. All levels of local government employment are included in Panel A county level measures (county, municipalities, townships, school districts, special districts). Census of Government data reported every 5 years in years ending in 2 and 7 from 1972 through 2007 for payroll and employment data, 1962-2002 for revenue and tax data. All dollar values deflated by the CPI-U and reported in constant 2000 dollars. CPS-MORG sample includes 25-55 year old workers working at least 35 hours per week. Workers with imputed weekly earnings are dropped from the CPS-MORG analysis. March CPS sample includes 25-55 year old workers working at least 35 hours per week and 50 weeks per year. Sector of worker (local/state/federal/private) is measured by reported class of worker. MSA land unavailability measures the share of land within 50km of an MSA's center which cannot be developed due to these topographical constraints from Saiz (2010). This measure is then Z-scored. State aggregated housing supply elasticity meaures use a population weighted average of MSA level data. Public sector corruption convictions measures total number of federl, state, and local public corruption convictions by each federal district court. Federal district courts are then linked to MSA by geography. MSAs crossing state boundaries are dropped.

Table 2: Per Capita Government Revenue & Spending vs Land Unavailability & Collective Bargaining Laws

A. County Area Revenue and Taxes

	[1]	[2]	[3]	[4]
	Ln Gov Revenue Per Capita	Ln Gov Taxes Collected Per Capita	Ln Gov Revenue Per Capita	Ln Gov Taxes Collected Per Capita
Land Unavailability	0.0798***	0.0855***	0.0504**	0.0463
	[0.0211]	[0.0305]	[0.0212]	[0.0343]
Collective Bargaining			0.202***	0.278***
			[0.0309]	[0.0508]
Bargain*Unavailability			0.0302	0.0391
			[0.0233]	[0.0353]
Constant	-0.209***	-0.990***	-0.214***	-0.997***
	[0.0295]	[0.0441]	[0.0298]	[0.0442]
Total Effect: Land Unavailability w/ Collective Bargaining			0.0806***	0.0854***
			[0.021]	[0.0266]
Observations	7,569	7,569	7,569	7,569
R-squared	0.539	0.247	0.568	0.287

B. Wages and Employment

	[1]	[2]	[3]	[4]	[5]	[6]
	Ln Gov Pay per capita	Ln Gov FTE per capita	Ln Gov Avg Wage	Ln Gov Pay per capita	Ln Gov FTE per capita	Ln Gov Avg Wage
Land Unavailability	0.0477***	0.0131*	0.0347**	0.013	0.0178	-0.00476
	[0.0156]	[0.00785]	[0.0136]	[0.0168]	[0.0128]	[0.00929]
Collective Bargaining				0.142***	-0.0155	0.158***
				[0.0274]	[0.0164]	[0.0187]
Bargain*Unavailability				0.0407	-0.00603	0.0467***
				[0.0252]	[0.0157]	[0.0155]
Constant	4.364***	-3.561***	7.925***	4.284***	-3.552***	7.837***
	[0.0192]	[0.0110]	[0.0131]	[0.0195]	[0.0131]	[0.0137]
Total Effect: Land Unavailability w/ Collective Bargaining				0.0537***	0.0117	0.0419***
				[0.0179]	[0.0095]	[0.0131]
Observations	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.132	0.131	0.077	0.175	0.132	0.253

Standard errors clustered by MSA. Data from US Census Bureau Census of Governments. Revenue and tax data from 1962-2002. Wages and employment data from 1972-2007. Unit of observation is a county/year. All level of local government employment are included in county level measures (county, municipalities, townships, school districts, special districts). Data reported every 5 years in years ending in 2 and 7. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Ln Wage vs. Public Sector-Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	State Gov Workers				Local Gov Workers				
Government Worker	-0.112***		-0.158***		-0.0708***		-0.133***		
	[0.00981]		[0.00962]		[0.00758]		[0.00965]		
Gov*Collective Bargaining Allowed			0.0701***	0.0727***			0.0886***	0.0894**	
			[0.0165]	[0.0140]			[0.0122]	[0.0115]	
Gov* Land Unavailability	0.0271**	0.0253**	-0.00502	-0.00536	0.0366***	0.0297***	0.0038	-0.0016	-0.0013
	[0.0113]	[0.0119]	[0.0106]	[0.00509]	[0.00855]	[0.00769]	[0.00777]	[0.0071]	[0.00787]
Gov* Land Unavailability* Collective Bargaining			0.0310*	0.0291**			0.0321***	0.0304***	0.0208*
			[0.0155]	[0.0137]			[0.0113]	[0.0101]	[0.0116]
Total Effect: Gov Bargain *Land Unavailable			0.0260**	0.0237*			0.0359***	0.0288***	0.0195**
			[0.0113]	[0.0129]			[0.0083]	[0.0071]	[0.0084]
Constant	2.491***	4.298***	2.497***	4.300***	2.389***	4.216***	2.400***	4.2189***	4.335***
	[0.290]	[0.279]	[0.290]	[0.279]	[0.396]	[0.385]	[0.397]	[0.385]	[0.393]
State x Gov Worker FE:									X
3-Digit Occupation x Gov Worker FE:		X		X		X		X	X
Observations	959,562	959,562	959562	959562	591,046	591,046	591046	591046	591046
R-squared	0.38	0.53	0.38	0.53	0.389	0.53	0.39	0.39	0.53

Note: Data are from the CPS-MORG. Standard errors clustered by state for state worker regressions. Standard errors clustered by MSA for local worker regressions. Samples are restricted to 25-55 year old workers working at least 35 hours per week. State government worker sample includes private sector and state government workers. Local government worker sample includes private sector and local government workers. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topographical constraints. State level measures are z-scores of average MSA-level measures within the state, weighted by MSA population. Controls include 15 dummies for education categories, gender, race and hispanic origin, a quartic in age, a rural dummy, and year dummies. All regressions weighted using CPS MORG earnings weights. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Ln Wage vs. Public Sector-Housing Supply Elasticity Interactions: Teachers, Police, and Fire

	[1]	[2]	[3]	[4]	[5]	[6]
	Teachers		Police		Fire	
Government Worker	-0.196***		0.0153		0.0215	
	[0.0140]		[0.0221]		[0.0287]	
Gov*Collective Bargaining Allowed	0.0921***		0.151***		0.174***	
	[0.0165]		[0.0258]		[0.0328]	
Gov* Land Unavailability	0.0112	0.0138	0.018	0.0148	-0.0154	-0.0036
	[0.0107]	[0.0121]	[0.0158]	[0.0162]	[0.0183]	[0.0153]
Gov* Land Unavailability* Collective Bargaining	0.00117	-0.0187	0.0338	-0.00863	0.0780***	0.0214
	[0.0151]	[0.0162]	[0.0210]	[0.0202]	[0.0238]	[0.0210]
Total Effect: Gov Bargain *Land Unavailable	0.0124	-0.005	0.0518***	0.0062	0.0626***	0.0178
	[0.0109]	[0.0180]	[0.0137]	[0.0122]	[0.0153]	[0.0144]
Constant	2.398***	2.409***	2.528***	2.524***	2.471***	2.480***
	[0.420]	[0.419]	[0.422]	[0.422]	[0.417]	[0.419]
State x Gov Worker FE:		X		X		X
Observations	552,890	552,890	538,867	538,867	536,833	536,833
R-squared	0.39	0.391	0.392	0.392	0.392	0.392

Note: Standard errors clustered by state. Samples are restricted to 25-55 year old workers working at least 35 hours per week. Teachers sample includes all private sector workers and local government workers with teaching occupations. Police sample includes all private sector and local government police. Fire sample includes all private sector and local government firefighters. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topographical constraints. State level measures are z-scores of average MSA-level measures within the state, weighted by MSA population. Controls include 15 dummies for education categories, gender, race and hispanic origin, a quartic in age, a rural dummy, and year dummies. All regressions weighted using CPS MORG earnings weights. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Health Insuance Benefits vs. Public Sector Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]
	Has Employer Sponsored Health Insurance	Employer Contrib. Some to Premiums	Employed Paid Full Premium	Has Employer Sponsored Health Insurance	Employer Contrib. Some to Premiums	Employed Paid Full Premium
Gov Worker	0.107***	0.111***	0.0230**	0.126***	0.129***	0.0399
	[0.00744]	[0.00731]	[0.0105]	[0.0140]	[0.0158]	[0.0241]
Gov Worker * Collective Bargain	-0.00351	0.000417	0.0969***	-0.0134	-0.012	0.00346
	[0.0102]	[0.00972]	[0.0164]	[0.0158]	[0.0174]	[0.0316]
Gov Worker* Land Unavailability	0.00237	0.0053	-0.00393	-0.00384	-0.00356	-0.0413
	[0.00747]	[0.00736]	[0.0100]	[0.0129]	[0.0169]	[0.0307]
Gov* Land Unavailability* Collective Bargaining	0.0229**	0.017	0.0121	0.00495	0.00542	0.0517
	[0.0108]	[0.0106]	[0.0138]	[0.0137]	[0.0175]	[0.0336]
Total Effect: Land Unavailability in Collective Bargaining State	0.0253***	0.0223***	0.0082	0.0011	0.0018	0.0104
	[0.0078]	[0.0076]	[0.0094]	[0.0043]	[0.0045]	[0.0138]
Constant	-1.331***	-1.340***	-1.398***	-1.733***	-1.660***	-1.090***
	[0.414]	[0.411]	[0.316]	[0.445]	[0.389]	[0.263]
Observations	485,621	485,621	485,621	690,805	690,805	690,805
R-squared	0.095	0.092	0.045	0.085	0.083	0.032
Local Government Worker Sample:	X	X	X			
State Government Worker Sample:				X	X	X

Notes: Standard errors clustered by MSA for local government worker regressions. Standard errors clustered by state for state government worker regressions. Data from CPS March Supplement 1992-2011. Sample includes 25-55 year workers working at least 35 hours per week and 50 weeks per year. State government worker sample includes private sector and state government workers. Local government worker sample includes private sector and local government workers. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topographical constraints. State level measures are z-scores of average MSA-level measures within the state, weighted by MSA population. Controls include dummies for sex, race, marital status interacted with sex, hispanic origin, 15 categories of schooling a quartic in age and MSA and year dummies. All regressions weighted by CPS supplement weights. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Public Corruption Convictions within Federal District Court per Capita vs Housing Supply Elasticity & Collective Bargaining Laws

	[1]	[2]	[3]	[4]
Land Unavailability	0.0493	0.117**	0.141***	0.256***
	[0.0355]	[0.0488]	[0.0373]	[0.0524]
Collective Bargaining		-0.0468*		
		[0.0263]		
Bargain*Unavailability		-0.0828		-0.228***
		[0.0719]		[0.0823]
Constant	0.265***	0.300***	0.475***	0.465***
	[0.0126]	[0.0215]	[0.0418]	[0.0421]
Total Effect: Land Unavailability w/ Collective Bargaining		0.034		0.0274
		[0.0528]		[0.0634]
State FE:			X	X
Observations	236	236	176	176
R-squared	0.069	0.127	0.546	0.572

Note: Standard errors clustered by MSA. Corruption data comes from annual reports of the Public Integrity Section of the US Department of Justice. Data measures total number of annual corruption convictions within relavant federal district. Federal districts have been linked to MSAs by geogrpahy. MSA spanning multiple states are dropped from the analysis. States with only a single district court for the entire state are dropped from the state fixed effects analysis. Land unavailability measure is multiplied by the population share covered by the federal district court contained within the MSA. Population share is also included as a control. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Voter Empowerment vs Land Unavailability

	Max Number of Terms for Chief Officer		Max Number of Terms for Counsil Members		Chief Officer Has A Term Cap		Counsil Members Have Term Caps		Voter Legislation Power Index	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Land Unavailability	-0.216**	-0.319*	-0.228**	-0.174	0.0169**	0.0286**	0.0190**	0.0125	0.0504*	0.0765*
	[0.0913]	[0.165]	[0.0984]	[0.156]	[0.00746]	[0.0134]	[0.00762]	[0.0133]	[0.0263]	[0.0447]
Bargain*Unavailability		0.141		-0.0722		-0.0161		0.00858		-0.0360
		[0.189]		[0.197]		[0.0154]		[0.0161]		[0.0549]
Constant	14.90***	14.86***	14.94***	14.96***	0.0140***	0.0187**	0.00787*	0.00536	0.172**	0.183**
	[0.0621]	[0.0934]	[0.0577]	[0.0741]	[0.00495]	[0.00760]	[0.00459]	[0.00610]	[0.0778]	[0.0774]
Observations	5,963	5,963	5,443	5,443	5,963	5,963	5,443	5,443	5,963	5,963
R-squared	0.176	0.176	0.178	0.178	0.162	0.162	0.170	0.170	0.305	0.305

Notes: Outcome data come from the ICMA Form of Government Survey from 1996-2002. Max number of terms for chief officer and counsil members is coded to 15 for areas with no term limits. Counsil member term limits were ask only of city governments, not county. Chief office has a term limit is a dummy variable for whether the chief officer has a cap on the number of terms s/he can serve. The Counsil member term cap variable is defined similarly. The Voter Legislation Power Index is a score from 0 to 4, where 1 point is receieved for each voter legislation power allowed in the area: initiative, referendum, recall, and protest referendum. See text for detailed definitions of each of these. All regressions included state fixed effects. Standard errors are clustered by MSA. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Comparing Housing Supply Elasticitis and Local Amenities

	[1]	[2]	[3]	[4]
	Local Gov Workers			
Government Worker	-0.0822***	-0.112***	-0.111***	-0.129***
	[0.00698]	[0.0109]	[0.0112]	[0.0119]
Gov*Collective Bargaining Allowed		0.0613***	0.0567***	0.0829***
		[0.0136]	[0.0136]	[0.0146]
Gov* Land Unavailability			0.00274	0.00489
			[0.00680]	[0.00763]
Gov* Land Unavailability* Collective Bargaining			0.0164	0.0237**
			[0.0109]	[0.0114]
Gov*Mild	0.00963	-0.00596	-0.00564	0.000292
	[0.00723]	[0.0178]	[0.0175]	[0.0181]
Gov*Mild*Collective Bargaining		0.0348*	0.0243	0.013
		[0.0193]	[0.0192]	[0.0201]
Gov*Dry	0.0422***	0.0419***	0.0424***	0.0223
	[0.00851]	[0.0152]	[0.0149]	[0.0139]
Gov*Dry*Collective Bargaining		-0.0221	-0.0219	-0.00678
		[0.0174]	[0.0170]	[0.0159]
Gov*Coastal Proximity	0.0333***	0.0251*	0.0253*	
	[0.00716]	[0.0128]	[0.0130]	
Gov*Coastal Proximity*Collective Bargaining		-0.00126	-0.00895	
		[0.0162]	[0.0164]	
Gov*Pop Density	0.0122***	0.0367*	0.0353*	
	[0.00244]	[0.0201]	[0.0211]	
Gov*Pop Density*Collective Bargaining		-0.0279	-0.0276	
		[0.0202]	[0.0212]	
Total Effect: Gov Bargain *Land Unavailable			0.0191**	0.0286***
			[0.0085]	[0.0085]
Observations	583,347	583,347	583,347	583,347
R-squared	0.389	0.39	0.39	0.39

Note: Data are from the CPS-MORG. Standard errors clustered by MSA for local worker regressions. Samples are restricted to 25-55 year old workers working at least 35 hours per week. State government worker sample includes private sector and state government workers. Local government worker sample includes private sector and local government workers. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topographical constraints. State level measures are z-scores of average MSA-level measures within the state, weighted by MSA population. Controls include 15 dummies for education categories, gender, race and hispanic origin, a quartic in age, a rural dummy, and year dummies. Amenity variables come from data replication files for Brueckner & Neumark (2014). All regressions weighted using CPS MORG earnings weights. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Ln Wage vs. Public Sector-Housing Supply Elasticity Interactions, Growing and Shrinking MSAs

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	All Local Workers		Teachers		Police		Fire	
	Growing Pop	Shrinking Pop	Growing Pop	Shrinking Pop	Growing Pop	Shrinking Pop	Growing Pop	Shrinking Pop
Gov Worker	-0.133***	-0.157***	-0.198***	-0.137*	0.0214	-0.109	0.0325	-0.471**
	[0.00984]	[0.0276]	[0.0145]	[0.0759]	[0.0222]	[0.111]	[0.0305]	[0.186]
Gov Worker * Collective Bargain	0.0851***	0.128***	0.0822***	0.130*	0.146***	0.243**	0.168***	0.612***
	[0.0129]	[0.0289]	[0.0170]	[0.0764]	[0.0265]	[0.114]	[0.0348]	[0.186]
Gov* Land Unavailability* Collective Bargaining	0.0349***	-0.00278	0.00381	0.000688	0.0286	-0.000447	0.0566*	-0.0516
	[0.0119]	[0.0188]	[0.0162]	[0.0397]	[0.0220]	[0.0650]	[0.0320]	[0.0891]
Gov Worker* Land Unavailability	0.00419	0.0102	0.0118	-0.00998	0.0258	-0.0264	0.00712	0.0923
	[0.00823]	[0.0140]	[0.0118]	[0.0330]	[0.0169]	[0.0468]	[0.0279]	[0.0815]
Total Effect: Land Unavailability in Collective Bargaining State	0.0391***	0.0074	0.0156	-0.0093	0.0544***	-0.0269	0.0637***	0.0407
	[0.0086]	[0.0126]	[0.0114]	[0.0219]	[0.0140]	[0.0441]	[0.0158]	[0.0286]
Constant	2.394***	2.272**	2.384***	2.362**	2.521***	2.291*	2.467***	2.206*
	[0.418]	[1.092]	[0.441]	[1.092]	[0.444]	[1.197]	[0.440]	[1.167]
Observations	542,701	46,863	507,746	43,744	495,093	42,416	493,207	42,277
R-squared	0.391	0.370	0.392	0.371	0.394	0.369	0.394	0.369

Note: Standard errors clustered by MSA. Samples are restricted to 25-55 year old workers working at least 35 hours per week. Teachers sample includes all private sector workers and local government workers with teaching occupations. Police sample includes all private sector and local government police. Fire sample includes all private sector and local government firefighters. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topographical constraints. Controls include 15 dummies for education categories, gender, race and hispanic origin, a quartic in age, a rural dummy, and year dummies. All regressions weighted using CPS MORG earnings weights. *** p<0.01, ** p<0.05, * p<0.1

Table 10: State & Federal Government Workers Falsification Tests

	Ln Wage			Employer Contributed Some to Health Insurance Premiums		
	[1]	[2]	[3]	[4]	[5]	[6]
	State Gov Workers	Federal Gov Workers		State Gov Workers	Federal Gov Workers	
Government Worker		0.184***	0.190***		0.0846***	0.0804***
		[0.0116]	[0.0225]		[0.00839]	[0.0101]
Gov*Collective Bargaining Allowed		-0.0502***	-0.0433*		-0.0121	-0.00557
		[0.0140]	[0.0254]		[0.0120]	[0.0125]
Gov*Land Unavailable	0.00502	0.0102	0.0122	-0.00181	0.00448	-0.00851
	[0.00814]	[0.00937]	[0.0219]	[0.0134]	[0.00656]	[0.00904]
Gov*Land Unavailable*Bargain Allowed	-0.0347**	-0.0233*	-0.0345	0.0138	0.00597	0.0111
	[0.0158]	[0.0137]	[0.0264]	[0.0195]	[0.0108]	[0.0104]
Total Effect: Gov Bargain *Land Unavailable	-0.0297**	-0.0131	-0.0223	0.0120	0.0104	0.0026
	[0.0136]	[0.0100]	[0.0147]	[0.0142]	[0.0086]	[0.0051]
Constant	2.712***	2.427***	2.305***	-1.412***	-1.347***	-1.729***
	[0.413]	[0.412]	[0.292]	[0.452]	[0.412]	[0.408]
State FE			X			X
MSA FE	X	X		X	X	
State x Gov Worker FE:	X			X		
Observations	564,524	554,022	935,421	463869	459,650	676,858
R-squared	0.389	0.394	0.383	0.089	0.088	0.079

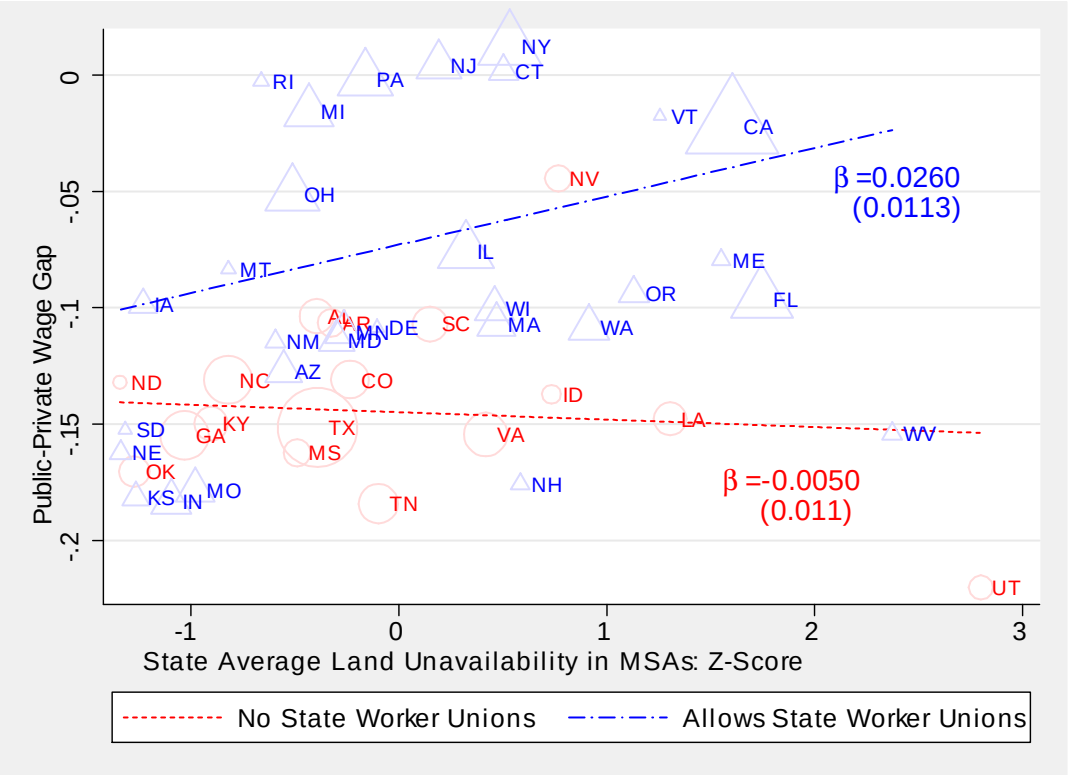
Note:Standard errors clustered by MSA for state worker regressions. Standard errors clustered by MSA for federal government worker regressions using cross MSA variation in land unavailability. Standard errors clustered by state for federal government worker regressions using cross state variation in land unavailability. Weekly wage data from 1995-2011 CPS MORG. Wage data is restricted to 25-55 year old workers working at least 35 hours per week. Health insurnace data are from 1991-2011 March CPS Supplement. State government worker sample includes private sector and state government workers. Federal government work sample includes private sector and federal government workers. Land unavailability measures a z-score of the share of land within 50km of an MSA's center which cannot be developed due to topological constraints. State level measures are z-scores of average MSA-level measures within the state, weighted by MSA population. Controls include 15 dummies for education categories, gender, race, Hispanic origin, a quartic in age, a rural dummy, and year dummies. All regressions weighted by appropriate CPS weights. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Worker Sorting into Public Sector Jobs & Housing Supply Elasticity

	Years of Schooling					Worker Age	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	State Gov Workers		Local Gov Workers			State Gov	Local Gov
Government Worker	1.938***		1.265***			1.980***	1.961***
	[0.0637]		[0.0547]			[0.0950]	[0.126]
Gov*Collective Bargaining Allowed	-0.347***	-0.06	0.193***	0.146***		0.0244	-0.135
	[0.121]	[0.0526]	[0.0727]	[0.0402]		[0.143]	[0.153]
Gov* Land Unavailability	-0.0168	-0.00723	0.0156	-0.0101	0.0499	0.141	0.0661
	[0.0559]	[0.0233]	[0.0493]	[0.0258]	[0.0411]	[0.124]	[0.119]
Gov* Land Unavailability* Collective Bargaining	0.0178	0.0777	-0.0622	0.0616	-0.0497	-0.0256	0.235
	[0.0987]	[0.0513]	[0.0705]	[0.0413]	[0.0498]	[0.196]	[0.150]
Total Effect: Gov Bargain *Land Unavailable	0.0009	0.0705	-0.0466	0.0515	0.0002	0.1156	0.3016***
	[0.0813]	[0.0473]	[0.0506]	[0.0335]	[0.0286]	[0.1501]	[0.0908]
Constant	13.86***	4.057***	13.89***	14.56***	14.56***	42.17***	42.85***
	[0.187]	[1.208]	[0.173]	[0.130]	[0.130]	[0.356]	[0.394]
State x Gov Worker FE:					X		
3-Digit Occupation x Gov Worker FE:		X		X	X		
Observations	959562	959562	591046	591046	591046	959,562	591,046
R-squared	0.18	0.50	0.19	0.50	0.51	0.03	0.035

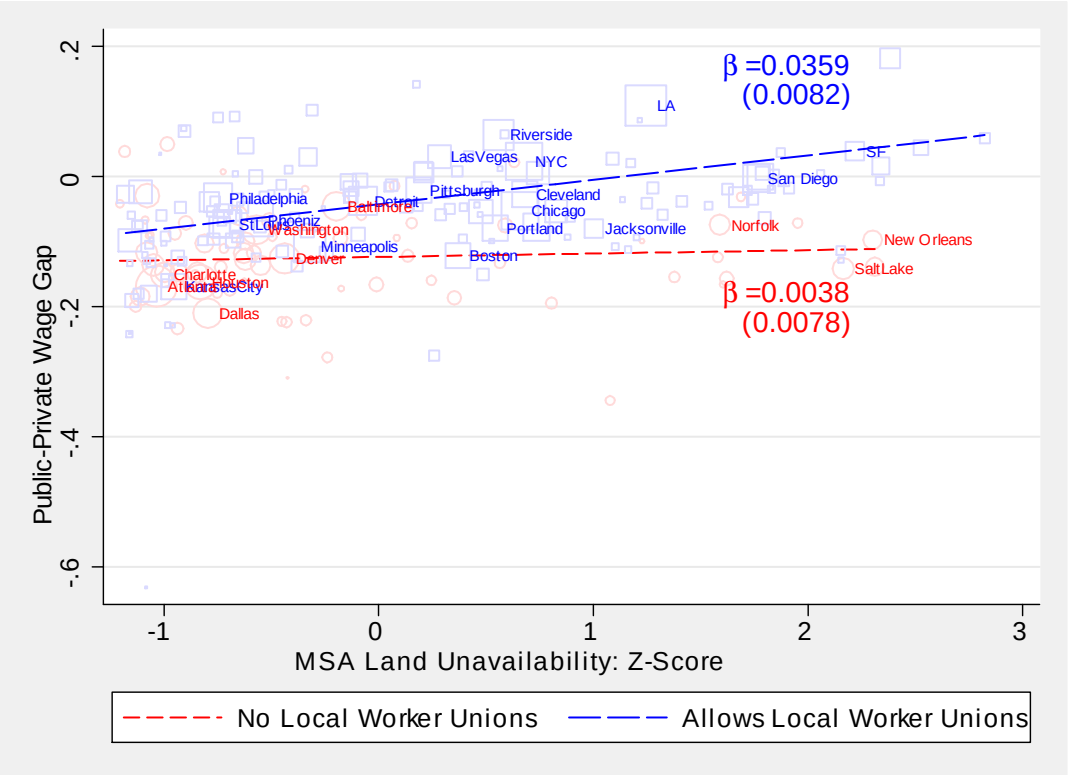
Note: Data are from the CPS-MORG. Standard errors clustered by state for state worker regressions. Standard errors clustered by MSA for local worker regressions. Lefthand side variable is years of schooling completed by worker in columns 1-5. Lefthand side variable is worker age in columns 6 and 7. Samples are restricted to 25-55 year old workers working at least 35 hours per week. Controls include gender, race and hispanic origin, a quartic in age, schooling, a rural dummy, and year dummies. Age is removed as a control in the age regressions and schooling is removed as a control in the schooling regressions. All regressions weighted using CPS MORG earnings weights. *** p<0.01, ** p<0.05, * p<0.1

Figure 1: State Goverment-Private Sector Wages Gaps vs. State Land Unavailability & Collective Bargaining Laws



Notes: Data from CPS-MORG. State wage gaps calculated after residualizing wages against 15 dummies for education categories, gender, race, hispanic origin, a quartic in age, a rural dummy, and year dummies. Regression weighted using CPS earnings weights.

Figure 2: Local Goverment-Private Sector Wages Gaps vs. MSA Land Unavailability & Collective Bargaining Laws



Notes: Data from CPS-MORG. MSA wage gaps calculated after residualizing wages against 15 dummies for education categories, gender, race, Hispanic origin, a quartic in age, a rural dummy, and year dummies. Regression weighted using CPS earnings weights.

A Government Taxation under Income and Property Taxes

In all the cases below I do not model the public sector labor market. This allows the analysis to focus on the role of the tax instrument in rent extraction.

A.1 Income Tax

A.1.1 Government

The local government of city j charges an income tax τ_j to workers who choose to reside within the city. The local government also produces government services, which cost s_j for each worker in the city. N_j measure the population of city j. The local rent seeking government maximizes:

$$\max_{\tau_j, s_j} \tau_j w_j N_j - s_j N_j$$

A.1.2 Workers

All workers are homogeneous. Workers living in city j inelastically supply one unit of labor, and earn wage w_j. Each worker must rent a house to live in the city at rental rate r_j and pay the local income tax τ_j. Workers value the local amenities as measure by A_j. The desirability of government services s_j is represented by $g(s_j)$. Thus, workers' utility from living in city j is:

$$U_j = w_j(1 - \tau_j) - r_j + A_j + g(s_j).$$

Workers maximize their utility by living in the city which they find the most desirable.

A.1.3 Firms

All firms are homogenous and produce a tradeable output Y. Cities exogenously differ in their productivity as measured by θ_j. Local government services impact firms productivity, as measured by $b(s_j)$. The production function is:

$$Y_j = \theta_j N_j + b(s_j) N_j.$$

I

I assume a completely elastic labor demand curve to focus on the role of housing supply elasticity in setting tax rates.

The labor market is perfectly competitive, so wages equal the marginal product of labor:

$$w_j = \theta_j + b(s_j).$$

A.1.4 Housing

The housing market is identical to the setting described in the main text in Section 2.4. The housing supply curve is:

$$\begin{aligned} r_j &= a_j + \gamma_j \log(N_j), \\ \gamma_j &= \gamma x_j^{\text{house}} \end{aligned}$$

where x_j^{house} is a vector of city characteristics which impact the elasticity of housing supply.

A.1.5 Equilibrium in Labor and Housing

Since all workers are identical, all cities with positive population must offer equal utility to workers. In equilibrium, all workers must be indifferent between all cities. Thus:

$$U_j = w_j(1-\tau_j) - r_j + A_j + g(s_j) = \bar{U}.$$

Plugging in labor demand and housing supply gives:

$$(\theta_j + b(s_j))(1-\tau_j) - a_j - \gamma_j \log N_j + A_j + g(s_j) = \bar{U}. \tag{11}$$

Equation (11) determines the equilibrium distribution of workers across cities.

A.1.6 Government Tax Competition

The government maximizes:

$$\max_{s_j,\tau_j} \tau_j w_j N_j - s_j N_j.$$

The first order conditions are:

$$\begin{aligned} 0 &= w_j\tau_j \frac{\partial N_j}{\partial s_j} + \tau_j N_j \frac{\partial w_j}{\partial N_j}\frac{\partial N_j}{\partial s_j} - N_j - s_j \frac{\partial N_j}{\partial s_j} \\ 0 &= \tau_j \left(\frac{\partial w_j}{\partial N_j}\frac{\partial N_j}{\partial \tau_j} N_j + w_j \frac{\partial N_j}{\partial \tau_j} \right) + w_j N_j - s_j \frac{\partial N_j}{\partial \tau_j}. \end{aligned} \tag{12}$$

Differentiating equation (11) to solve for $\frac{\partial N_j}{\partial s_j}$ and $\frac{\partial N_j}{\partial \tau_j}$gives:

$$\begin{aligned} \frac{\partial N_j}{\partial s_j} &= N_j \frac{(1-\tau_j)\, b'(s_j) + g'(s_j)}{\gamma_j} > 0 \\ \frac{\partial N_j}{\partial \tau_j} &= -N_j \frac{(\theta_j + b(s_j))}{\gamma_j} < 0. \end{aligned} \tag{13}$$

Population increases with government services and decreases in taxes. Plugging these into (12) and combining the first order conditions shows that government services are provided such that the

marginal benefit $\left(\left(1-\tau_j^*\right)b'\left(s_j\right)+g'\left(s_j\right)\right)$ equals marginal cost (1) :

$$\left(1-\tau_j^*\right)b'\left(s_j^*\right)+g'\left(s_j^*\right)=1.$$

This is the socially optimal level of government service, given the tax rate.

The equilibrium tax revenue per capita is:

$$w_j\tau_j^*=\gamma_j+s_j^*. \tag{14}$$

To analyze the effect of housing supply elasticity on governments' ability to extract rent from taxes, I differentiate the tax markup with respect to the slope of the inverse housing supply curve, γ_j.

$$\frac{\partial}{\partial\gamma_j}\left(w_j\tau_j^*-s_j^*\right)=1>0. \tag{15}$$

The government can extract more rent through higher taxes in a city with a less elastic housing supply with a income tax instrument.

A.2 Property Tax

A.2.1 Government

The local government of city j charges a property tax τ_j to workers who choose to reside within the city. The local rent seeking government maximizes:

$$\max_{\tau_j,s_j}\tau_j r_j N_j-s_j N_j$$

A.2.2 Workers

Workers' utility from living in city j facing a property tax τ_j is:

$$U_j=w_j-r_j\left(1+\tau_j\right)+A_j+g\left(s_j\right).$$

A.2.3 Firms

The production function is:

$$Y_j=\theta_j N_j+b(s_j)N_j.$$

I assume a completely elastic labor demand curve to focus on the role of housing supply elasticity in setting tax rates.

The labor market is perfectly competitive, so wages equal the marginal product of labor:

$$w_j=\theta_j+b(s_j).$$

A.2.4 Housing

The housing market is identical to the setting described in the main text in Section 2.4. The housing supply curve is:

$$\begin{aligned} r_j &= a_j + \gamma_j \log(N_j), \\ \gamma_j &= \gamma x_j^{\text{house}} \end{aligned}$$

where x_j^{house} is a vector of city characteristics which impact the elasticity of housing supply.

A.2.5 Equilibrium in Labor and Housing

Since all workers are identical, all cities with positive population must offer equal utility to workers. In equilibrium, all workers must be indifferent between all cities. Thus:

$$U_j = w_j - r_j(1+\tau_j) + A_j + g(s_j) = \bar{U}.$$

Plugging in labor demand and housing supply gives:

$$(\theta_j + b(s_j)) - \left(a_j + \gamma_j \log N_j\right)(1+\tau_j) + A_j + g(s_j) = \bar{U}. \tag{16a}$$

Equation (16a) determines the equilibrium distribution of workers across cities.

A.2.6 Government Tax Competition

The government maximizes:

$$\max_{s_j,\tau_j} \tau_j r_j N_j - s_j N_j.$$

The first order conditions are:

$$0 = r_j\tau_j \frac{\partial N_j}{\partial s_j} + \tau_j N_j \frac{\partial r_j}{\partial N_j}\frac{\partial N_j}{\partial s_j} - N_j - s_j \frac{\partial N_j}{\partial s_j} \tag{17}$$

$$0 = \tau_j \left(\frac{\partial r_j}{\partial N_j}\frac{\partial N_j}{\partial \tau_j} N_j + r_j \frac{\partial N_j}{\partial \tau_j}\right) + r_j N_j - s_j \frac{\partial N_j}{\partial \tau_j}. \tag{18}$$

Differentiating equation (16a) to solve for $\frac{\partial N_j}{\partial s_j}$ and $\frac{\partial N_j}{\partial \tau_j}$gives:

$$\begin{aligned} \frac{\partial N_j}{\partial s_j} &= N_j \frac{b'(s_j) + g'(s_j)}{\gamma_j(1+\tau_j)} > 0 \\ \frac{\partial N_j}{\partial \tau_j} &= -N_j \frac{r_j}{\gamma_j(1+\tau_j)} < 0. \end{aligned} \tag{19}$$

Combining the first order conditions shows that government services are provided such that the marginal benefit $(b'(s_j) + g'(s_j))$ equals marginal cost (1), which is the same finding for an income

tax and head tax:

$$b'\left(s_j^*\right) + g'\left(s_j^*\right) = 1.$$

Plugging (19) into (18) and rearranging shows the equilibrium tax revenue per capita is:

$$r_j \tau_j^* = \gamma_j + s_j^*. \tag{20}$$

Differentiating the tax markup with respect to the slope of the inverse housing supply curve, γ_j.

$$\frac{\partial}{\partial \gamma_j}\left(w_j \tau_j^* - s_j^*\right) = 1 > 0. \tag{21}$$

The government can extract more rent through higher taxes in a city with a less elastic housing supply using a property tax instrument. In the case of a property tax, as opposed to a head tax, there are four mechanisms through which a tax rate change impacts government revenue. To break these down, I rewrite the tax rate first order condition:

$$0 = \underbrace{\tau_j r_j \frac{\partial N_j}{\partial \tau_j}}_{\substack{\text{Decline in revenue due} \\ \text{to population decrease}}} + \underbrace{\tau_j \frac{\partial r_j}{\partial N_j}\frac{\partial N_j}{\partial \tau_j} N_j}_{\substack{\text{Decline in revenue} \\ \text{due to rent decrease}}} + \underbrace{r_j N_j}_{\substack{\text{Additional tax revenue} \\ \text{from each resident}}} - \underbrace{s_j \frac{\partial N_j}{\partial \tau_j}}_{\substack{\text{Government services} \\ \text{cost savings}}} \tag{22}$$

First, the amount of out-migration driven by a tax hike is influenced by the local housing supply elasticity. This is the first term of equation (22). Second, the out-migration lowers rents and directly impacts tax revenues since the tax revenue is a percentage of housing rents. This is the second term of equation (22). However, the housing supply elasticity will not impact the size of the rental rate decrease in response to a tax hike. To see this, recall the equilibrium condition, equation (16a). For workers to derive utility $\bar{U}$ from this local area, the utility impact of a tax increase must be perfectly offset by a rent decrease.[26] Thus, the equilibrium rental rate response to a given tax increase does not depend on the local housing supply elasticity. Indeed, the housing supply elasticity determines the migration response required to change housing rents in order to offset the utility impact of the tax increase. Thus, a more inelastic housing supply decreases the elasticity of government revenue with respect to the tax rate, giving the government more market power when using a property tax instrument.

The third and forth terms of equation (22) show a tax increase raises government revenues from each household and lowers the cost of government services due to out-migration. These channels also appear in the case of a head tax instrument.

[26] Since I have assumed a perfectly elastic labor demand curve, the rental rate response to a tax increase would be the same in any city. However, if labor demand was not perfectly elastic, then the rental rate response to a tax increase could differ with housing supply elasticity, since housing supply elasticity would influence the relative incidence of the tax rate on wages versus rents.

B Public Sector Compensation & Employment by Type of Worker

Appendix Table A.1 reports summary statistics on government payrolls, employment, FTEs, and wages spent on air transport, corrections, elementary & secondary education, higher education, financial administration, fire protection, judicial & legal, other government administration, health & hospitals, housing & community development, libraries, natural resources, parks & recreation, police protection, public welfare, sanitation, water transport, utilities, and other spending not otherwise classified. Note that many counties do not have expenditures in every spending category. Thus, to retain the zeros in the data, regressions run on these data will be estimated in levels, not logs so that 0 spending and employment levels can be included in the regressions. All dollar amounts are deflated by the CPI-U and reported in constant 2000 dollars.[27]

Table A.2 reports positive point estimates indicating less land availability raises government payrolls per county resident in 16 of the 19 categories of government spending when collective bargaining is prohibited. Eight of these estimates are statistically significant. In states outlawing bargaining, a one standard deviation increase in land unavailability increases monthly government payrolls per county resident by $14.66 on corrections. Relative to counties' average monthly spending on corrections payroll per county resident of $132, this represents an 11% increase. Similarly, financial administration payrolls increase by 8.6% ($15.20, relative to a mean spending of $177), other government admin payrolls increase by 5.9% ($12.50, relative to a mean of $211), housing and community development increase by 10.7%, libraries increase by 21%, parks and recreation increase by 11.2%, sanitation increases by 5%, and water transport increases by 159%. Increased spending on parks & recreation and water transport can likely be attributed directly to the topography in these areas, such as presence of bodies of water and other land features which would be likely be used as park areas. It is hard to offer a unifying reason of why the additional specific categories show statistically significant responses to land unavailability. Overall, many types of government spending appear to increase in land unavailable areas that have no collective bargaining provisions.

Government payrolls are significantly larger across many government categories in inelastic areas which allow public sector collective bargaining. Table A.2 shows 16 of the 19 categories have positive point estimates of the effect of land unavailability, with 11 of them being statistically significant. Land unavailability raises government payrolls broadly across many types of government spending all states, but significantly more when collective bargaining is legal.

Table A.3 shows whether these increased government payrolls led to wage increases for government employees. There appears to be no wage effects in states which prohibit collective bargaining. The point estimates for the wage effects across government categories are 50% positive, 50% negative, with only 2 estimates being significant at the 10% level, which is expected due to running 19 regressions.

In the states which allow collective bargaining, 100% of the point estimates show a positive wage response to land unavailability, with 17 of the 19 being statistically significant. Collective bargaining

[27] Regression analysis on elemetary & secondary education, fire protection, and police protection use the public sector collective bargaining law data explicitly for teachers, fire fighters, and police, respectively.

seems to channel these extra payroll dollars into higher government wages across essentially all types of government spending.

Table A.4 shows the effects of land unavailability on government FTEs per county resident. In states which prohibit collective bargaining, the categories which showed a significant positive government payroll response to land unavailability also show a statistically significant FTE per county resident response as well. These additional dollars all appear to go to a larger government workforce when collective bargaining is prohibited.

Within states which allow collective bargaining, government FTEs appear to statistically significantly rise in air transport, higher education, and parks & recreation. FTEs fall in elementary & secondary education, and libraries. The other point estimates are a mix of both positive and negative effects. There does not appear to be a clear increase in FTEs in collective bargaining states. Table A.5 looks at government employment counts per county resident and shows very similar results as those for the government FTEs.

Table A.1: Summary Statistics for County Area Government Employment and Payroll by Type of Worker

	Monthly Gov Worker Payroll per 100 Residents			Gov Worker Employment per 100 Residents			Gov Worker FTE per 100 Residents			Ln Average Gov Worker Wage		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
County Area Overall	6069	9275.80	3142.16	6069	4.02	1.06	6069	3.41	0.90	6069	8.89	0.18
Air Transport	6069	19.67	89.11	6069	0.01	0.02	6069	0.01	0.02	2528	7.88	0.30
Correction	6069	132.07	141.04	6069	0.05	0.05	6069	0.05	0.05	5250	7.77	0.29
Elementary & Secondary Education	6069	5518.47	1825.90	6069	2.32	0.69	6069	2.01	0.60	6045	7.91	0.19
Higher Education	6069	209.43	411.07	6069	0.11	0.22	6069	0.06	0.13	1779	8.10	0.20
Finacial Admin	6069	177.40	92.89	6069	0.08	0.04	6069	0.07	0.03	6058	7.81	0.24
Fire Protection	6069	267.40	244.02	6069	0.11	0.08	6069	0.08	0.06	5535	7.99	0.31
Judicial & Legal	6069	126.34	140.21	6069	0.05	0.05	6069	0.05	0.05	4368	7.88	0.31
Other Gov Admin	6069	211.04	125.20	6069	0.13	0.09	6069	0.08	0.04	6055	7.86	0.26
Health & Hospitals	6069	567.17	936.87	6069	0.26	0.40	6069	0.23	0.36	5530	7.79	0.26
Housing & Community Development	6069	63.46	84.36	6069	0.03	0.03	6069	0.02	0.03	4709	7.83	0.26
Libraries	6069	67.68	92.42	6069	0.05	0.07	6069	0.03	0.06	5004	7.62	0.27
Natural Resources	6069	30.20	96.01	6069	0.01	0.04	6069	0.01	0.03	4680	7.67	0.36
Parks & Recreation	6069	117.17	119.73	6069	0.08	0.09	6069	0.05	0.05	5564	7.67	0.25
Police Protection	6069	595.46	349.78	6069	0.22	0.09	6069	0.20	0.08	6058	7.94	0.26
Public Welfare	6069	180.42	245.63	6069	0.08	0.12	6069	0.08	0.11	4811	7.68	0.29
Sanitation	6069	181.96	135.87	6069	0.08	0.05	6069	0.07	0.05	5922	7.79	0.26
Water Transport	6069	5.73	33.79	6069	0.00	0.01	6069	0.00	0.01	681	7.99	0.36
Other NEC	6069	252.84	261.69	6069	0.14	0.16	6069	0.10	0.10	6034	7.75	0.26
Utilities	6069	278.58	445.27	6069	0.10	0.12	6069	0.09	0.11	5790	7.88	0.25

Notes: Data from Census of Governments cover 1972-2007 reported in five year intervals in years ending in 2 and 7. All dollar amounts are deflated by CPI-U to constant 2000 dollars.

Table A.2: County Area Government Payroll per 100 Residents by Category vs. Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Monthly Gov Pay/100 Residents	Air Transport	Correction	Elementary & Secondary Education	Higher Education	Finacial Admin	Fire Protection	Judicial & Legal	Other Gov Admin	Health & Hospitals
Land Unavailability	127.1	-1.969	14.66*	113.3	-15.49	15.20**	12.27	5.248	12.50*	-57.27
	[165.6]	[2.183]	[7.920]	[123.1]	[17.02]	[6.849]	[20.66]	[8.432]	[7.050]	[50.98]
Collective Bargainings	1279.1***	0.659	36.14***	612.0***	157.9***	14.05*	33.07*	49.12***	61.51***	-64.28
	[260.0]	[4.356]	[9.952]	[136.9]	[28.41]	[8.455]	[19.47]	[9.216]	[10.37]	[68.30]
Bargain*Unavailability	470.0*	10.05**	21.78*	-111.7	68.93**	14.28*	41.59*	16.1	20.64*	82.16
	[254.6]	[4.080]	[12.22]	[141.8]	[27.67]	[7.817]	[23.44]	[11.72]	[11.95]	[69.57]
Constant	7629.4***	9.870***	29.24***	4,838***	83.21***	142.1***	208.1***	-24.61***	226.5***	484.5***
	[161.38]	[2.119]	[4.769]	[114.5]	[19.34]	[6.198]	[12.19]	[5.940]	[7.924]	[49.43]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.16	0.01	0.254	0.107	0.048	0.153	0.065	0.374	0.21	0.007

	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18	[19]	[20]
	Housing & Community Develop	Libraries	Natural Resources	Parks & Recreation	Police Protection	Public Welfare	Sanitation	Water Transport	Other NEC	Utilities
Land Unavailability	6.791**	14.08**	7.922	13.08*	12.89	15.37	9.014*	9.153**	12.06	8.319
	[2.740]	[7.037]	[5.730]	[6.851]	[16.08]	[16.80]	[4.882]	[4.554]	[11.63]	[16.02]
Collective Bargainings	8.216*	14.66*	11.19**	14.85	93.63***	124.1***	-1.444	-1.306	20.56	40.16
	[4.338]	[7.838]	[5.549]	[10.41]	[29.26]	[25.00]	[8.403]	[3.211]	[15.29]	[28.46]
Bargain*Unavailability	6.999*	-9.442	2.263	23.89***	94.63***	18.85	16.73**	-2.404	38.59**	35.63
	[4.029]	[7.862]	[5.467]	[8.965]	[28.93]	[22.30]	[7.786]	[4.309]	[15.15]	[30.93]
Constant	41.95***	41.52***	25.92***	83.97***	393.1***	75.65***	162.7***	8.328***	212.5***	197.5***
	[2.801]	[5.014]	[4.378]	[6.966]	[16.03]	[11.81]	[5.969]	[2.712]	[10.83]	[17.73]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.035	0.06	0.013	0.082	0.178	0.091	0.026	0.045	0.056	0.012

Notes: Standard errors clustered by MSA. Data on monthly government payroll per capita is measured in constast 2000 dollars. Counties with zero spending in a given category are included in regressions. Controls include year dummies. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: County Area Average Gov Wage by Category vs. Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Average Gov Wage	Air Transport	Correction	Elementary & Secondary Education	Higher Education	Finacial Admin	Fire Protection	Judicial & Legal	Other Gov Admin	Health & Hospitals
Land Unavailability	-0.00476	-0.00725	0.00294	-0.00339	0.0196*	0.00404	-0.0125	0.0225	0.00624	-0.00174
	[0.00929]	[0.0144]	[0.0166]	[0.00844]	[0.0104]	[0.0137]	[0.0249]	[0.0253]	[0.0183]	[0.00908]
Collective Bargainings	0.158***	0.129***	0.166***	0.153***	0.0820***	0.0758***	0.100***	0.0459	0.0403*	0.134***
	[0.0187]	[0.0220]	[0.0289]	[0.0157]	[0.0191]	[0.0232]	[0.0315]	[0.0309]	[0.0234]	[0.0173]
Bargain*Unavailability	0.0467***	0.0597***	0.0918***	0.0395***	0.0144	0.0692***	0.101***	0.0560**	0.0763***	0.0672***
	[0.0155]	[0.0215]	[0.0231]	[0.0146]	[0.0160]	[0.0198]	[0.0301]	[0.0260]	[0.0229]	[0.0152]
Constant	7.837***	7.778***	7.658***	7.887***	8.171***	7.759***	7.910***	7.776***	7.797***	7.664***
	[0.0137]	[0.0198]	[0.0195]	[0.0121]	[0.0180]	[0.0157]	[0.0241]	[0.0278]	[0.0174]	[0.0155]
Observations	6,069	2,528	5,250	6,045	1,779	6,058	5,535	4,368	6,055	5,530
R-squared	0.253	0.092	0.175	0.183	0.16	0.192	0.089	0.092	0.151	0.163
	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
	Community Development	Libraries	Natural Resources	Parks & Recreation	Police Protection	Public Welfare	Sanitation	Water Transport	Other NEC	Utilities
Land Unavailability	0.000652	-0.00503	0.02	-0.00923	-0.00654	0.00816	0.00553	-0.0354	-0.0235*	-0.00411
	[0.0152]	[0.0143]	[0.0190]	[0.0119]	[0.0155]	[0.0255]	[0.0145]	[0.0388]	[0.0124]	[0.0121]
Collective Bargainings	0.135***	0.102***	0.220***	0.143***	0.172***	0.105***	0.237***	0.133**	0.131***	0.172***
	[0.0211]	[0.0213]	[0.0285]	[0.0193]	[0.0279]	[0.0322]	[0.0246]	[0.0512]	[0.0217]	[0.0202]
Bargain*Unavailability	0.0436**	0.0573***	0.0451*	0.0437**	0.0761***	0.0791***	0.0336	0.0789*	0.0862***	0.0443**
	[0.0188]	[0.0185]	[0.0249]	[0.0178]	[0.0234]	[0.0288]	[0.0221]	[0.0455]	[0.0186]	[0.0181]
Constant	7.765***	7.647***	7.558***	7.678***	7.818***	7.645***	7.637***	7.900***	7.674***	7.779***
	[0.0174]	[0.0198]	[0.0239]	[0.0143]	[0.0163]	[0.0257]	[0.0182]	[0.0384]	[0.0159]	[0.0140]
Observations	4,709	5,004	4,680	5,564	6,058	4,811	5,922	681	6,034	5,790
R-squared	0.118	0.099	0.135	0.133	0.203	0.129	0.257	0.092	0.152	0.161

Notes: Standard errors clustered by MSA. Data on government wages are measured in constast 2000 dollars. Controls include year dummies. *** p<0.01, ** p<0.05, * p<0.1

Table A.4: County Area FTE Gov Workers per 100 Residents by Category vs. Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	FTE Gov/100 Residents	Air Transport	Correction	Elementary & Secondary Education	Higher Education	Finacial Admin	Fire Protection	Judicial & Legal	Other Gov Admin	Health & Hospitals
Land Unavailability	0.0696	-0.000288	0.00661*	0.0575	-0.00662	0.00597***	0.00614	0.00173	0.00378*	-0.027
	[0.0530]	[0.000635]	[0.00364]	[0.0445]	[0.00562]	[0.00200]	[0.00580]	[0.00388]	[0.00219]	[0.0202]
Collective Bargainings	-0.0952	-0.000265	0.00395	-0.0863**	0.0429***	0.00061	-0.000332	0.0141***	0.0187***	-0.0535**
	[0.0594]	[0.00104]	[0.00332]	[0.0395]	[0.00875]	[0.00232]	[0.00480]	[0.00339]	[0.00279]	[0.0271]
Bargain* Unavailability	-0.0279	0.00222**	0.000153	-0.131***	0.0181**	-0.000822	0.000661	0.0000124	-0.000823	0.0125
	[0.0600]	[0.000979]	[0.00427]	[0.0465]	[0.00806]	[0.00219]	[0.00591]	[0.00414]	[0.00309]	[0.0256]
Constant	2.986***	0.00401***	0.0160***	1.801***	0.0219***	0.0595***	0.0721***	-0.00719***	0.0900***	0.240***
	[0.0441]	[0.000556]	[0.00192]	[0.0378]	[0.00606]	[0.00197]	[0.00374]	[0.00220]	[0.00256]	[0.0223]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.12	0.01	0.226	0.125	0.037	0.057	0.027	0.388	0.199	0.011

	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
	Housing & Community Development	Libraries	Natural Resources	Parks & Recreation	Police Protection	Public Welfare	Sanitation	Water Transport	Other NEC	Utilities
Land Unavailability	0.00287***	0.00713**	0.00327	0.00702**	0.00828	0.00722	0.00386**	0.00349*	0.00837*	0.00416
	[0.00103]	[0.00291]	[0.00256]	[0.00288]	[0.00558]	[0.00660]	[0.00176]	[0.00178]	[0.00476]	[0.00550]
Collective Bargainings	-0.000587	0.00580*	0.00188	-0.000793	-0.00557	0.0497***	-0.0175***	-0.00101	-0.00516	-0.00738
	[0.00154]	[0.00345]	[0.00209]	[0.00401]	[0.00585]	[0.0101]	[0.00298]	[0.00118]	[0.00524]	[0.00752]
Bargain* Unavailability	0.000751	-0.00666**	-0.000597	0.00656*	0.00838	-0.000636	0.00326	-0.00159	0.00446	0.00485
	[0.00132]	[0.00336]	[0.00205]	[0.00339]	[0.00704]	[0.00854]	[0.00284]	[0.00159]	[0.00567]	[0.00767]
Constant	0.0180***	0.0180***	0.0123***	0.0384***	0.154***	0.0337***	0.0783***	0.00290***	0.0943***	0.0805***
	[0.00120]	[0.00211]	[0.00193]	[0.00280]	[0.00384]	[0.00470]	[0.00241]	[0.000954]	[0.00439]	[0.00583]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.023	0.034	0.008	0.068	0.134	0.069	0.04	0.042	0.051	0.01

Notes: Standard errors clustered by MSA. Counties with zero employment in a given category are included in regressions. Controls include year dummies. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: County Area Gov Worker Employment per 100 Residents by Category vs. Housing Supply Elasticity Interactions

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Gov Emp/100 Residents	Air Transport	Correction	Elementary & Secondary Education	Higher Education	Finacial Admin	Fire Protection	Judicial & Legal	Other Gov Admin	Health & Hospitals
Land Unavailability	0.0809	-0.000292	0.00662*	0.072	-0.0106	0.00516**	0.00271	0.00127	0.00102	-0.0304
	[0.0549]	[0.000661]	[0.00368]	[0.0504]	[0.00994]	[0.00214]	[0.00624]	[0.00422]	[0.00276]	[0.0223]
Collective Bargainings	0.1419**	-0.000183	0.00551	-0.0574	0.0798***	0.0104***	0.0167***	0.0174***	0.0541***	-0.0509*
	[0.0697]	[0.00109]	[0.00341]	[0.0458]	[0.0153]	[0.00274]	[0.00575]	[0.00371]	[0.00529]	[0.0300]
Bargain* Unavailability	-0.0863	0.00211**	-0.000227	-0.141***	0.0352**	-0.00302	-0.00124	-0.000495	-0.0159***	0.00942
	[0.0678]	[0.00100]	[0.00436]	[0.0511]	[0.0149]	[0.00252]	[0.00640]	[0.00452]	[0.00450]	[0.0285]
Constant	3.4391***	0.00433***	0.0165***	2.076***	0.0347***	0.0690***	0.100***	-0.00901***	0.119***	0.256***
	[0.0486]	[0.000584]	[0.00197]	[0.0425]	[0.0107]	[0.00204]	[0.00559]	[0.00243]	[0.00429]	[0.0242]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.11	0.01	0.224	0.102	0.041	0.059	0.021	0.405	0.196	0.01

	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
	Housing & Community Development	Libraries	Natural Resources	Parks & Recreation	Police Protection	Public Welfare	Sanitation	Water Transport	Other NEC	Utilities
Land Unavailability	0.00262**	0.00854**	0.00328	0.0120**	0.00793	0.00805	0.00392**	0.00363**	0.00906	0.00445
	[0.00109]	[0.00413]	[0.00255]	[0.00526]	[0.00595]	[0.00707]	[0.00181]	[0.00183]	[0.00589]	[0.00586]
Collective Bargainings	-0.000371	0.0117**	0.00183	0.00576	0.0038	0.0541***	-0.0159***	-0.000949	0.0223***	-0.00572
	[0.00160]	[0.00526]	[0.00216]	[0.00717]	[0.00641]	[0.0109]	[0.00306]	[0.00123]	[0.00786]	[0.00781]
Bargain* Unavailability	0.000871	-0.0106**	-0.00101	0.00478	0.00977	-0.00161	0.00297	-0.00158	-0.0072	0.00354
	[0.00142]	[0.00477]	[0.00206]	[0.00619]	[0.00771]	[0.00921]	[0.00294]	[0.00165]	[0.00760]	[0.00796]
Constant	0.0199***	0.0256***	0.0154***	0.0522***	0.177***	0.0349***	0.0804***	0.00316***	0.123***	0.0831***
	[0.00140]	[0.00341]	[0.00202]	[0.00497]	[0.00432]	[0.00511]	[0.00242]	[0.00100]	[0.00613]	[0.00617]
Observations	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069	6,069
R-squared	0.02	0.04	0.007	0.062	0.112	0.069	0.034	0.043	0.046	0.01

Notes: Standard errors clustered by MSA. Counties with zero employment in a given category are included in regressions. Controls include year dummies. *** p<0.01, **