Beaches, Sunshine, and Public-Sector Pay: Theory and Evidence on Amenities and Rent Extraction by Government Workers

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Abstract

The absence of a competitive market may enable public-sector workers to extract rents from taxpayers in the form of high pay, especially when public-sector workers are unionized. On the other hand, this rent extraction may be suppressed by the ability of taxpayers to vote with their feet, leaving jurisdictions where public-sector workers extract high rents. However, although migration of taxpayers may limit rent-seeking, public-sector workers may be able to extract higher rents in regions where high amenities mute the migration response. We develop a theoretical model that predicts such a link between public-sector wage differentials and local amenities, and we test the model's predictions by analyzing variation in these wage differentials and amenities across states. We find that public-sector wage differentials are, in fact, larger in the presence of high amenities, with the effect stronger for unionized public-sector workers who are likely better able to exercise political power in extracting rents. The implication is that the mobility of taxpayers is insufficient to prevent rent-seeking behavior of public-sector workers from leading to higher public-sector pay.

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1. Introduction

The issue of public-sector pay has become more prominent in the last few years, in part because of state budget woes but also because of high-profile political battles over the collective-bargaining rights of public-sector workers. The media and blogosphere are replete with stories about overpaid public-sector workers, from prison guards in California,[1] to teachers and other public-sector workers in New Jersey,[2] to unionized public-sector workers generally.[3] Public-sector pay is, of course, not set in competitive markets. Public-sector unionization is high (Visser, 2006), and public-sector unions are strong and active politically (DiSalvo, 2010). As a consequence, the pay of public-sector workers is likely to reflect, in part, the extraction of rents from taxpayers. Indeed, the potential for public-sector workers to influence pay (and employment) has long been noted by labor economists (Freeman, 1986).[4]

Freeman, however, argues that the ability of public-sector unions to extract high rents may be constrained by Tiebout-style mobility: "Citizens unhappy with [the] level of public services can move elsewhere, reducing the taxable population and thus the ability to pay public sector wages. Mobility places great constraints on public-sector union bargaining power" (1986, p. 51). But this view need not rule out cases where public-sector workers are overpaid. Indeed, casual inference based on the stories cited above suggests that high public-sector pay may be a phenomenon confined to particular states—specifically, those states well endowed with the amenities often emphasized by urban economists. Facing a high willingness-to-pay on the part of potential residents to live in a high-amenity state, public-sector workers may have more leeway for rent extraction, leading to a link between public-sector wages and amenities. The purpose of the present paper is to demonstrate the existence of this link in a theoretical model and then to test for it empirically.

Initial suggestive evidence for this wage-amenity connection is contained in Figure 1, which plots state-level public-sector wage residuals (representing the wage component not explained by the usual controls) against state-level private-sector wage residuals.[5] The solid line has slope equal to one, so that points on the line represent a state in which the public-sector and private-sector wage premia for the state are equal. While most of points are in fact below the line, note the identities of the states substantially above the line—states where the public-sector premium is larger than the private-sector premium and hence where public-sector workers are "overpaid." These states have warm weather (California), low rainfall (Nevada), a coastal location (e.g., New York, New Jersey, and Rhode Island), and large, dense urban areas (New York, New Jersey, and California). Thus, Figure 1 suggests that rent extraction may be occurring in places where people like to live.

We develop and test a model that explores this hypothesis. Building on existing work on the public sector (e.g., O'Brien, 1992; Rose and Sonstelie, 2010; Zax and Ichniowski, 1988), we presume that public-sector workers—especially unionized ones—have some ability to determine their pay through the political process. Consistent with Freeman's argument, we would expect that this political power faces limitations, because if public-sector workers extract rents (and thus taxes) that are too high relative to the level of desired publicly-produced goods and services, then taxpayers will vote with their feet, depriving public-sector workers of the tax base from which to extract rents.[6] However, in locations with strong amenities, public-sector workers may have more ability to extract rents, as these amenities drive wedges between the utility of taxpayers in different locations that public-sector workers can exploit.

Our stylized theoretical model takes an extreme viewpoint by assuming that the public sector is fully controlled by its workers, who have the power to set the public-good level as well as taxes, which cover both the nonlabor cost of the good as well as their own high wages. These workers set taxes along with the level of the public good to maximize the public-sector wage (and thus their utility), taking the induced migration between regions into account. The key results of the model connect the wage levels of both public- and private-sector workers to the level of a region's amenities. As captured in Figure 1, the main empirical hypothesis is that *amenities raise the public-sector wage relative to the private-sector wage*, a consequence of the improved rent-extraction potential in a high-amenity region. The model also predicts that public-sector wages should be high in an absolute sense in high-amenity regions.

Our model is related to the large literature on tax competition, in which local governments make fiscal decisions taking into account the footloose nature of business investment, which is deterred by high local taxes. Here, though, the focus is on mobile private-sector workers rather than mobile business capital. Within this literature, which is surveyed by Wilson (1999), the paper is most closely connected to models of tax competition by rent-seeking rather than benevolent local governments, as exemplified by Edwards and Keen (1996). Our framework also shares elements of models in the Roback (1982) tradition, which show how amenity differences affect interregional patterns of wages and house prices.

The model's predictions are tested using Current Population Survey data. We estimate standard log wage regressions that include a public-sector wage differential, a wage differential associated with local amenities, and an interaction between these two differentials. The interaction coefficient reveals that the public-sector wage differential is larger in the presence of strong amenities, as predicted by the theory. In addition, amenities raise the absolute level of public-sector pay. The results are remarkably robust. They emerge for public-sector workers overall, and for two large groups of public-sector workers that are the focus of much attention with regard to pay: teachers and prison guards (or correctional officers). The evidence is particularly strong for unionized public-sector workers, who are presumably better able to exercise political power to extract rents, and it also suggests greater unionized rent-extraction in states with favorable collective-bargaining environments.

The paper's empirical work bears a close resemblance to empirical studies in the Roback tradition. A common approach to implementing the Roback (1982) model, as exemplified by Blomquist, Berger, and Hoehn (1988), is to estimate two regressions relating individual wages and house prices to regional amenity levels.[7] The results of these regressions are then merged to generate estimates of consumer amenity valuations, building on the theory. Our key regression is similar to a Roback-style wage regression, except that it includes, along with the usual amenity measures, terms that interact the amenity levels with a public-worker dummy variable. The coefficients of the (uninteracted) amenity levels give the usual impact of amenities on private-sector wages, while the interaction coefficients give the differential amenity effect on public-sector wages, which the theory predicts is positive. Moreover, if unionized workers have more ability to extract rents, then their amenity interaction coefficient should be larger than the coefficient for public-sector workers as a whole. The empirical results conform to all these expectations. In addition, they confirm the prediction that amenities raise the absolute level of public-sector wages.

Section 2 of the paper develops the theoretical model, while section 3 describes the data. Section 4 presents the empirical work, and section 5 offers conclusions.

2. Model

2.1. Basic analysis

The economy has two regions, with region 1 having a positive amenity level and region 2 a zero level (a normalization). Region 1's amenity could have a consumption component (denoted a) as well as a component that raises worker productivity (denoted b). Each region has two groups of residents: private-sector workers, who are mobile across regions, and a group of public-sector workers, which is fixed in size and immobile. Empirically, interregional mobility is indeed lower among public-sector workers, and state and local public employment tends to be less variable than private employment, in line with both assumptions.[8]

Public-sector workers have captured control of that sector in each region, and thus have the ability to set the public-good level as well as taxes.[9] Taxes pay for the cost of the public good while also covering rent extraction by the public-sector workers, in the form of excessive wages. For simplicity, public-sector workers do not consume the good they produce, so that only private workers consume the public good and pay taxes. As seen below, relaxation of this assumption has no effect on the results. In setting the level of the good as well as taxes, public workers play a Nash game across regions, taking account of the fact that their decisions affect the location choices of private workers. For simplicity, the model is initially developed without consumption of housing, which plays a key role in the usual Roback-style framework. Once the basic conclusions are derived, housing is introduced with little effect on the results.

Let z_i denote the public-good level in region i, and suppose that the good is a publicly produced private good with cost per unit normalized to unity. Per capita cost is then just z_i, being independent of the size of the private-worker population. This cost represents only the cost of nonlabor inputs, not including the wages of public-sector workers, which are a separate expense covered by rent extraction. Note that, with the size of the public work force fixed in each region, an increase in z_i is achieved solely by raising non-labor inputs, whose costs are assumed to rise in proportion to z_i.[10]

Let x_i denote consumption of the private good and a_i denote the consumption amenity level in region i. We assume that the preferences of private workers are quasi-linear and given by

$$x_i \; + \; a_i \; + \; v(z_i). \tag{1}$$

In (1), suitable measurement allows the amenity to enter utility in linear fashion, just like x_i.[11] Since public-sector workers do not consume the public good, their utility is instead equal to the amenity plus x consumption.

Let L_i denote the number of private-sector workers in region i. The economy's total number of private workers is fixed at $\overline{L}$, so that $L_1 + L_2 = \overline{L}$. Letting b_i denote the level of the production amenity in region i, private-sector output in the region is given by $f(L_i)+b_iL_i$, with the wage equal to $f'(L_i)+b_i$ ($f'' < 0$ holds). The production amenity thus affects productivity in an additive fashion.[12] Profit from private production is assumed to flow to agents outside the economy.

Let R_i denote public-sector rent extraction per private-sector worker. Since taxes per private-sector worker are then equal to $z_i + R_i$, the private-sector worker's budget constraint is $x_i + z_i + R_i = f'(L_i) + b_i$. Utility for a region-1 worker is then

$$f'(L_1) \; + \; b_1 \; - \; z_1 \; - \; R_1 \; + \; a_1 \; + \; v(z_1). \tag{2}$$

Since the amenity components enter additively in (2), they can be collapsed into a single term, denoted A, with $b_1 = \alpha A$ and $a_1 = (1 - \alpha)A$, where $0 \leq \alpha \leq 1$. A pure consumption amenity corresponds to $\alpha = 0$, while a pure production amenity corresponds to $\alpha = 1$.[13] A "composite" amenity has an intermediate value of α. Although most of the analysis is unaffected by the nature of the amenity, region 1's private-sector wage, which equals $f'(L_1) + \alpha A$, depends on its nature.

Migration between the regions must equate utilities. Recalling that no amenity is present in region 2, the equilibrium condition

$$f'(L_1) - z_1 - R_1 + A + v(z_1) = f'(\overline{L} - L_1) - z_2 - R_2 + v(z_2) \tag{3}$$

must hold. Note that, in the presence of housing, cost-of-living differences between regions would enter (3), as seen in the extension below. Condition (3) determines L_1 and thus the division of population as a function of the decision variables z_1, R_1, z_2, and R_2, as well as A. Holding the decisions variables constant, an increase in A will shift workers toward region 1, with L_1 rising. Although an increase in region 1's amenity thus entices workers to live there, holding the z's and the R's fixed, our interest lies in exploring how a stronger pull of the amenity, as reflected in a larger A, affects the *levels of these decision variables*, as chosen by rent-seeking public-sector workers.

Recognizing the dependence of L_1 on the decision variables, public workers in region i choose z_i and R_i to maximize their income, taking the other region's choices as given in Nash fashion. To characterize the solution to this problem, consider region 1's decisions and note that differentiation of (3) yields

$$\frac{\partial L_1}{\partial z_1} = \frac{1 - v'(z_1)}{f''(L_1) + f''(\overline{L} - L_1)} \tag{4}$$

$$\frac{\partial L_1}{\partial R_1} = \frac{1}{f''(L_1) + f''(\overline{L} - L_1)} < 0. \tag{5}$$

Greater rent extraction in region 1 naturally reduces its population, while the effect of z_1 depends on the sign of the numerator in (4), which determines whether the good is over or underprovided relative to the efficient level (an increase in z_1 raises L_1 when the good is underprovided, with $v' > 1$).

Total rent extraction by public workers in region 1 equals L_1R_1. With the number of such workers equal to M in each region, rent per public-sector worker (which corresponds to the public-sector wage) equals L_1R_1/M. Since M is fixed, maximizing the public-sector wage thus means maximizing L_1R_1 by proper choice of z_1 and R_1, viewing z_2 and R_2 as fixed. The first-order condition for z_1 is[14]

$$\frac{\partial L_1R_1}{\partial z_1} \quad = \quad R_1\frac{\partial L_1}{\partial z_1} \quad = \quad R_1\frac{1-v'(z_1)}{f''(L_1)+f''(\overline{L}-L_1)} \quad = \quad 0, \tag{6}$$

using (4). This condition reduces to $v'(z_1) = 1$, which implies that the public-good is chosen efficiently (with marginal benefit equal to the unitary marginal cost). With the public-good level set in socially optimal fashion, private-sector workers are encouraged to live in region 1, allowing more rent to be extracted by public-sector workers. Let z^* denote the optimal public-good level, which is independent of the level of amenities (an outcome that follows from quasi-linear utility).

The first order condition for R_1 is

$$\frac{\partial L_1R_1}{\partial R_1} \quad = \quad L_1 \;+\; R_1\frac{\partial L_1}{\partial R_1} \quad = \quad L_1 \;+\; \frac{R_1}{f''(L_1)+f''(\overline{L}-L_1)} \quad = \quad 0, \tag{7}$$

using (5).[15] Rearranging (7) allows R_1 to be written in terms of L_1:

$$R_1 \quad = \quad -L_1[f''(L_1)+f''(\overline{L}-L_1)]. \tag{8}$$

Public workers in region 2 maximize $(\overline{L}-L_1)R_2$ by choosing z_2 and R_2, and analogous solutions emerge. The public-good level satisfies $v'(z_2) = 1$, thus equaling z^*, and R_2 is given by

$$R_2 \quad = \quad -(\overline{L}-L_1)[f''(L_1)+f''(\overline{L}-L_1)]. \tag{9}$$

The Nash-equilibrium level of L_1 can be found by using (8) and (9) to eliminate R_1 and R_2 in the migration condition (3). Making these substitutions yields

$$f'(L_1)+L_1[f''(L_1)+f''(\overline{L}-L_1)] \;+\; A \quad = \quad f'(\overline{L}-L_1)+(\overline{L}-L_1)[f''(L_1)+f''(\overline{L}-L_1)], \tag{10}$$

where the terms involving z^* cancel. This equation determines L_1 as a function of A.

2.2. The effect of amenities on public- and private-sector wages

Using (10), the main questions of interest can be addressed: how do amenities affect public- and private-sector wages? The first step is differentiate (10), which yields

$$\frac{\partial L_1}{\partial A} \;=\; -\{3f''(L_1) \;+\; 3f''(\overline{L}-L_1) \;+\; (2L_1-\overline{L})[f'''(L_1)-f'''(\overline{L}-L_1)]\}^{-1}. \tag{11}$$

Despite the apparent ambiguity of the sign of (11) (a consequence of the presence of f'''), the expression can be signed using a stability condition for the equilibrium. However, the subsequent discussion is simpler when it relies on a local analysis around the symmetric outcome (where $A = 0$), in which case the sign of (11) is clear from inspection. With $A = 0$, $L_1 = \overline{L}/2$ holds and the last term in (11) drops out, so that

$$\frac{\partial L_1}{\partial A} \;=\; -\,\frac{1}{6f''(\overline{L}/2)} \;>\; 0. \tag{12}$$

Thus, region 1 (the high amenity region) has more private-sector workers than region 2. Note that the derivative in (11) gives the change in L_1 when a small amenity advantage is introduced in region 1, starting from a situation where neither region has amenities.

The effect of A on the private-sector wage is driven by a change in the marginal product of labor as a result of migration. In the case of a pure consumption amenity, which does not directly affect the marginal product, the private-sector wage in region 1 falls as in-migration depresses f'. But with a composite amenity, a direct productivity effect interacts with the migration effect, making the change in the marginal product ambiguous and dependent on the strength of the direct effect. Specifically, since the wage equals $f'(L_1) + \alpha A$, the effect of A is given by

$$f''\frac{\partial L_1}{\partial A} \;+\; \alpha \;=\; f''\left(-\frac{1}{6f''}\right) \;+\; \alpha \;=\; \alpha \;-\; \frac{1}{6}, \tag{13}$$

using (12). So while the private-sector wage falls with A in the case of a pure consumption amenity, where $\alpha = 0$, the wage rises with A in the case of a pure production amenity, where

$\alpha = 1$ and (13) equals 5/6. With a composite amenity, the wage falls only if the consumption component is large, with $\alpha < 1/6$.

Since region 2 loses workers, the private-sector wage rises there regardless of the nature of region 1's amenity. The wage derivative is equal to $f''\partial L_2/\partial A = -f''\partial L_1/\partial A = 1/6$, using (12).

To find the effect of amenities on the public-sector wage, (8) can be used to write

$$\frac{L_1R_1}{M} = -\frac{L_1^2}{M}[f''(L_1) + f''(\overline{L} - L_1)]. \tag{14}$$

Differentiation then yields

$$\frac{\partial L_1R_1/M}{\partial A} = -\frac{1}{M}\{2L_1[f''(L_1) + f''(\overline{L} - L_1)] \ + \ L_1^2(f'''(L_1) - f'''(\overline{L} - L_1)]\}\frac{\partial L_1}{\partial A}. \tag{15}$$

Evaluating (15) at the symmetric equilibrium using (12) yields

$$\frac{\partial L_1R_1/M}{\partial A} = -4(\overline{L}/2M)f''(\overline{L}/2)\frac{\partial L_1}{\partial A} = \frac{\overline{L}}{3M} > 0. \tag{16}$$

In addition, differentiating of $(\overline{L} - L_1)R_2$ yields

$$\frac{\partial(\overline{L} - L_1)R_2/M}{\partial A} = -\frac{\overline{L}}{3M} < 0. \tag{17}$$

Therefore, regardless of whether the amenity affects consumption or production, total rent extraction, and thus the public-sector wage, is higher in region 1 than in region 2. With a stronger amenity tending to pull private-sector workers toward region 1, public-sector workers are thus able to extract more rent as A increases. Because L_1 is large for any given R_1 when A is large, public-sector workers enjoy a bigger population base for rent extraction, allowing them to better tolerate the population loss resulting from this behavior and thus to pursue it more aggressively.

Note that when the amenity has a consumption component, the increase in A yields also yields nonpecuniary amenity benefits to region 1's public-sector workers, compounding their gain from a higher wage. Since public-sector workers are immobile, however, no migration force works to offset these benefits (region 2's public-sector workers cannot relocate).

A key final question concerns how the public-sector wage gap between the high- and low-amenity regions compares to the private-sector gap. Since the public-sector wage rises (falls) at the same rate in region 1 (2) as A increases, the regional public-sector wage gap is proportional to twice the relevant derivative from (16), or $2\overline{L}/3M$. Since the private-sector wage changes at a rate equal to $\alpha - 1/6$ in region 1 while rising at a rate of $1/6$ in region 2, the regional wage gap is proportional to $(\alpha - 1/6) - 1/6$, or $\alpha - 1/3$, which can take either sign. Thus, the regional public-sector wage gap exceeds the private-sector wage gap when

$$\frac{2\overline{L}}{3M} \;>\; \alpha \;-\; \frac{1}{3}. \tag{18}$$

When α is small, the right-hand side of (13) is negative, indicating that the private-sector wage is lower in region 1 than in region 2, an outcome that makes the regional gap negative and thus lower than the positive public-sector wage gap. But when $\alpha > 1/3$, the private-sector gap is positive, making the relationship between the public and private gaps not immediately clear. But since the right-hand side of (18) is less than 1, the inequality will be satisfied when $2\overline{L}/3M > 1$ or when $\overline{L} > (3/2)M = (3/4)(2M)$. The latter inequality states that the total private work force in both regions ($\overline{L}$) is larger than 3/4 of the total public work force, which equals $2M$.[16] Since the private work force is in reality much larger than the public work force, this condition is realistic, and the regional public-sector wage gap exceeds the private-sector gap. This conclusion and (16) yield the main empirical hypotheses generated by the model:

> **Proposition 1.** *Under the maintained assumptions, amenities raise the absolute level of public-sector wages while also raising these wages relative to private-sector wages. In other words, the public-sector wage gap between the high- and low-amenity regions is always positive, and it exceeds the private-sector wage gap, which can be either positive or negative depending on the nature of the amenity.*

In the case of a pure consumption amenity, the differential effect of the amenity on public- and private-sector wages is transparent. The in-migration generated by an increase in the amenity depresses labor's marginal product and thus the private-sector wage, while the population gain is exploited by public-sector workers to raise total rent extraction and thus their individual wage. On the other hand, with a pure production amenity, the rise in the private-sector wage compounds the gain from in-migration, expanding the scope of possible rent extraction and leading to a public-sector wage increase that exceeds the private increase.

Note that this latter outcome would be reversed if the public work force were much larger than the private-sector work force, so that (18) is not satisfied. With results of rent extraction needing to be shared across many public-sector workers, the increase in the individual wage would then be smaller, making the public-sector wage gap between high and low-amenity regions less than the private-sector gap.

2.3. Adding housing consumption

The previous results are mostly unaffected under several modifications of the model. First, the assumption that public-sector workers do not consume the public good can be relaxed without affecting any of the previous results. The appendix demonstrates this conclusion by allowing the public good to enter the utility functions of both types of workers while requiring public-sector workers to pay taxes.

The analysis so far suppresses housing consumption and housing prices, which play a key role in Roback-style models. However, these elements can also be added to the current framework without substantially affecting any of the previous results, provided the addition is done in a certain way. Specifically, private-sector workers are assumed to consume land (interpreted as housing), while public workers are not consumers of land and firms do not require a land input, using only labor. Making the latter two groups of agents land-users would require major changes to the model, with uncertain effects on the results.

Let q_1 and q_2 denote individual land consumption by private workers in the two regions, and let the (additively separable) utility from housing consumption be $s(q_i)$. Letting p_1 denote the land price in region 1, the utility expression on the left-hand side of (3) is then augmented by the terms $s(q_1) - p_1 q_1$. Since the first-order condition for choice of q_1 is $s'(q_1) = p_1$, these new terms can be replaced by $s(q_1) - s'(q_1)q_1$. The analogous expression $s(q_2) - s'(q_2)q_2$ appears on the right-hand side of (3).

With two new unknowns, q_1 and q_2, appearing in the model, additional equilibrium conditions are needed, and these conditions come from market-clearing requirements. Letting the residential land area in each region be fixed and normalized to one, the market-clearing conditions are $L_1 q_1 = 1$ and $L_2 q_2 = 1$. For region 1, q_1 is then given by $1/L_1$, so that the new terms on the left-hand side of (3) become

$$s(1/L_1) - s'(1/L_1)/L_1 \quad \equiv \quad h(L_1), \tag{19}$$

where $h'(L_1) = s''(1/L_1)L_1^{-3} < 0$. Let $g(L_1) \equiv f'(L_1) + h(L_1)$, with $g'(L_1) = f''(L_1) + h'(L_1) < 0$. Then, the equal-utility condition in (3) can be written as

$$g(L_1) \; - \; z_1 \; - \; R_1 \; + \; A \; + \; v(z_1) \quad = \quad g(\overline{L} - L_1) \; - \; z_2 \; - \; R_2 \; + \; v(z_2). \tag{20}$$

Since $g(\cdot)$ takes the place of $f'(\cdot)$, and since both functions are decreasing in L_1, the analysis leading to the key derivatives (11) and (12) is unaffected, with g' replacing f'' in (12). In addition, the impact of the amenity on public-sector rent is unaffected, with (16) and (17) continuing to hold.

Although the calculation of A's impact on the private-sector wage is altered, the previous conclusion on the effect of amenities on the wage gap is unchanged. With (12) using g' instead of f'', the wage derivative is

$$f''\frac{\partial L_1}{\partial A} \; + \; \alpha \quad = \quad f''\left(-\frac{1}{6g'}\right) \; + \; \alpha \quad = \quad \alpha \; - \; \frac{\lambda}{6}, \tag{21}$$

where $\lambda = f''/g' = f''/(f'' + h') < 1$ (the functions in this expression are evaluated at $\overline{L}/2$). Thus, the private-sector wage once again rises with the amenity level unless the consumption component represents a large share of the total amenity effect (with $\alpha < \lambda/6$). The regional public-sector wage gap is again larger than the private-sector wage gap (which equals $\alpha - \lambda/3$), assuming that the previous condition on worker populations is satisfied.[17] Proposition 1 thus continues to hold.

This modified model also generates predictions about land prices. Since $\partial L_1/\partial A > 0$ and $s'' < 0$, it follows that region 1's land price, given by $p_1 = s'(1/L_1)$ is increasing in A, with region 2's price decreasing in A. Thus, regardless of the nature of the amenity, land prices are higher in region 1 than in region 2. This prediction, as well as those above, might be modified in model that incorporates land consumption in a different fashion.[18] The model can also generate a connection between rent-seeking and land prices like that explored by Gyourko and Tracy (1989b,c), although the current focus is different.[19]

A final point that is useful in the empirical work involves the comparison between the amenity's private-sector wage impact with and without housing consumption. As seen above, when housing consumption is absent, the regional wage gap is proportional to $\alpha - 1/3$. In the presence of housing, the gap is $\alpha - \lambda/3$, a larger quantity given $\lambda < 1$. The reason for this relationship is that the increase in housing prices chokes off migration more easily in response to an amenity gap, keeping wages farther apart.

A key implication of these two formulas is that, if the amenity's consumption component is large (α is small), the regional wage gap could be positive when house prices also adjust ($\alpha - \lambda/3 > 0$) but negative when housing is absent from the model ($\alpha - 1/3 < 0$).[20] Empirically, housing can be "removed" from the model by holding housing prices constant in a regression that compares wages in high- and low-amenity regions. The previous conclusion then says that, when the amenity has a large consumption component, the private-sector wage comparison could show a negative gap between high and low-amenity regions when the regression controls for housing prices while showing a positive gap when prices are not included. Such a contrast would indicate that the amenity has an important consumption component along with its production effect.

2.4. Comparison to the Roback model

The present model differs from the standard Roback model in several ways. In addition to the presence of rent-seeking public-sector workers, firms in the model do not use land, in contrast to the standard assumption of a land input, and the usual profit-equalization condition for firms is absent. Despite these differences, the predicted amenity effects on private-sector wages and house prices are identical to those in the Roback framework. In particular, the amenity lowers the private-sector wage in the consumption-amenity case and raises it in the production amenity case, with the effect ambiguous in the case of a composite amenity. In addition, regardless of the nature of the amenity, house prices are higher in the high-amenity region than in the low-amenity region.

The new implications of the model concern the public-sector wage. This wage is higher in the high-amenity region regardless of the nature of the amenity. In addition, under reasonable conditions on the relative size of the public and private sectors, and regardless of the nature of the amenity, the public-sector wage gap between high- and low-amenity regions is larger than the private-sector wage gap (which can be negative). These predictions are tested in the remainder of the paper.

3. Data

The predictions of the model developed in the previous section are tested using data from the Current Population Survey (CPS) and other sources. The basic labor market data come from the Outgoing Rotation Group (ORG) files of the CPS, for the years 1995-2004.[21] The beginning year is the second year after the redesign of the CPS, and we extend the data set only through 2004 because some of the other data items are measured in 2000 or earlier. We begin with the standard ingredients of wage equations, for a sample with the following restrictions: workers aged 18-64 earning wages or salaries (the self-employed and those working without pay are excluded). The full set of variables extracted from the CPS and used in the regressions is provided in the notes to the tables that follow. The dependent variable is the log of the hourly wage either reported by hourly workers or constructed for non-hourly workers. The straight wage is used, with some exclusions of obvious outliers.

A key characteristic of workers is their classification as either private or public. Within the public sector, we distinguish between state, local, and federal workers, and most of our analyses focus on how amenities shift wage differentials for public-sector state and local workers. We also explore the determinants of wage differentials for unionized state and local public-sector workers, based on union membership as reported in the CPS.

Some of our analyses also focus more narrowly on public-sector workers who are kindergarten, elementary, or secondary school teachers, or alternatively corrections officers, occupations that are highly concentrated in the public sector and constitute large shares of public-sector employment.[22] These classifications were made as consistent as possible across years, given a change in occupational coding between 2002 and 2003.[23] Moreover, the estimated wage regressions include year dummy variables, so that any effects of changes in the composition of the occupations that affect wage levels are accounted for in the analysis.

We analyze the relationships between public-sector wages and four amenity variables representing mild weather, dry weather, proximity to navigable water, and population density. The main analysis measures amenities at the state level, but we also carry out additional analyses where amenities are measured at the MSA/PMSA level, a change that requires dropping observations where the worker lives outside a metropolitan area. These four amenity variables were suggested by the literature, and they were chosen and defined prior to doing any of the analysis. We did not analyze any evidence for other amenities, and we report the full evidence for each of these four amenities. Thus, there was no selection of results based on which amenities fit the model's predictions.

Mild 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* is the negative of the average monthly precipitation for those four months, in centimeters. The *Mild* and *Dry* variables are from Mendelsohn et al. (1994), and both are weighted averages of county values across a state, using 2006 Census county population estimates as weights. *Proximity* is the negative of the average distance from the state's county centroids, weighted by county population, to the nearest coast, Great Lake, or major river (Rappaport and Sachs, 2003). 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 state, based on 1990 Census data (Glaeser and Kahn, 2004), an amenity that has both consumption and production components.[24] Note that this variable differs from a simple density measure for a state because it is tract-weighted, with the goal of measuring density where people in a state live. As a result, the density measure is much higher than average tract density. In our metro-level analyses, the

MSA/PMSA amenity measures are computed using only the component counties (or Census tracts) of each metropolitan rather than all those in a state, a procedure that is explained in detail in the appendix. Note that with the state-level measures, population weighting simply gives more influence to a state's populous areas in construction the state averages.[25]

Finally, we also make use of estimated state housing price premia. These price measures are computed from 2000 Census data (5 percent sample), as the state dummy variables in a hedonic regression for house prices. The computational method is the same as in Albouy (2009), although applied at the state level. Costs are based on both owned and rented homes and include utility costs, and the regression controls for rental and condominium status, dwelling size, rooms, acreage, commercial use, kitchen and plumbing facilities, and age of building.

Table 1 shows the distribution of the sample observations, which include 1.04 million private and public-sector workers. Almost 14 percent of the observations are for public state or local workers, with over 2 percent being federal. Unionized workers represent nearly 16 percent of the sample, with unionized state and local workers representing about 6 percent.

Descriptive statistics for the amenity variables are shown in Table 2. Note that North Dakota's temperatures are the least mild, while Florida's are the mildest. Louisiana is the least dry state while Nevada is the driest. Tiny coastal Delaware has the best water access, while New Mexico is the state most remote from bodies of water. New York is the densest state, while Arkansas is the least dense.

4. Empirical Findings

The regression model takes the following form:

$$\ln(w_{is}) \;=\; \alpha \;+\; X_{is}\beta \;+\; \gamma PS_{is} \;+\; \sum_k \delta_k A_s^k \;+\; \sum_k \theta_k PS_{is} A_s^k \;+\; \epsilon_{is}, \tag{22}$$

where w_{is} is the wage for worker i in state s, X_{is} is a vector of characteristics for that worker, including union status,[26] PS_{is} is a dummy variable indicating whether the individual works in the public sector, and A_s^k is the level of amenity k in state s, with $k = 1, 2, 3, 4$.[27] The hypotheses to be tested are: $\theta_k > 0$, indicating that amenities raise public-sector wages relative to private-sector wages; and $\delta_k + \theta_k > 0$, indicating that amenities raise the absolute level of public-sector wages. Note that the sign of δ_k (indicating the effect of an amenity on private-sector wages) could be positive or negative depending on the nature of the amenity, as seen in the model. The observations in (22) actually come from multiple years, but this fact is suppressed for simplicity in writing the equation since the main variables of interest (amenities) are time invariant. A complete equation would thus include time indices on the variables and year fixed effects. Because we estimate the model using individual-level data, but the amenities are defined at higher level, we cluster the standard errors at the state level in the main regression and at the MSA/PSMA level under our metro-level analyses. Thus, although the microdata yield a huge sample, the effective number of observations is much smaller.

Note that rent extraction by public-sector workers means, literally, that they earn more than they otherwise would doing the same work in the private sector. We cannot directly observe whether this difference exists. However, labor economists typically use log wage regressions to detect wage differences net of productivity differences; examples include using wage regressions to estimate the effects of unions or discrimination on wages. The challenge is perhaps more difficult in estimating public-sector wage differentials, because work conditions may differ across sectors. Moreover, structural approaches to estimating productivity and pay differences (e.g., Hellerstein and Neumark, 1999) are likely to be inapplicable to the question at hand because of the difficulty of defining output for the public sector. Thus, our main test involves estimating the relationship between amenities and the *relative* pay of public-sector workers, rather than a more explicit attempt to ask whether high amenities are associated with above-marginal-product wages.

4.1. Benchmark regressions lacking a public-private distinction

As a benchmark, the first empirical specification (shown in the first two columns of Table 3) suppresses the distinction between the effects of amenities on wages of private- and public-sector workers, regressing the log of the wage on the amenity variables along with the large set of non-amenity controls (worker characteristics, and year fixed effects), whose coefficients are not reported. In the first column, where the state housing-price premium is omitted, the *Mild* coefficient is insignificant while the remaining amenity variables have significantly positive coefficients.

With the public-worker share in the sample being small, the results in Table 3 are presumably driven mainly by the private-worker observations. Since the analysis in section 2 shows that a positive private-sector wage effect requires an amenity to have a production component, the positive coefficients for *Dry*, *Proximity*, and *Density* evidently indicate that each of these amenities increases worker productivity in the private sector. Given the substantial evidence on agglomeration economies (see Rosenthal and Strange, 2004), the positive wage effect of density comes as no surprise. Less expected are the implied productivity benefits of a dry climate and water access.

As explained in section 2.3, if housing prices are held constant, then the wage impact of the amenity's production component is attentuated, providing a better chance for the negative influence of the consumption component to manifest itself. To investigate this possibility, column 2 of Table 3 adds the housing-price premium to the regression. The housing-price coefficient is itself positive and significant, indicating that wages are higher in states with expensive housing. With housing prices included, the coefficients of *Dry* and *Proximity* lose significance, while the coefficients of *Mild* and *Density* become significantly negative. These negative relationships, as well as the sign change for the *Proximity* coefficient, are what we would expect if each amenity has an important consumption component (with high density being favorable). Therefore, the results suggest that the amenity variables contain both production and consumption components.

The theoretical analysis showed that, regardless of the nature of the amenity, house prices should be higher in high- than in low-amenity regions. Column 3 of Table 3 tests this prediction by regressing the state housing-price premium on the amenity variables. As can be seen, all the amenity coefficients are significantly positive, as predicted.

Before turning to the regressions that distinguish between private- and public-sector workers, it is useful to sketch the connection between the results presented so far and the standard empirical implementation of the Roback (1982) model, as seen in Blomquist, Berger, and Hoehn (1988). In the standard implementation, wage and house-price regressions like those in columns 1 and 3 of Table 3 are estimated, and the results are then merged to generate estimates of amenity consumption benefits, following guidance from the theory. For positive wage impacts like those in column 1 to emerge, amenity production effects must dominate consumption effects, just as in the present framework.

The previous literature also contains an analog to the regression in column 2 of Table 3. In particular, Henderson (1982) shows theoretically that if a house-price measure is included as a covariate in a Roback-style wage regression, then the resulting amenity coefficients directly measure the consumption benefits of amenities. He carries out such an estimation, generating plausible numerical values. By constrast, under the present model, a regression that controls for house prices does not yield a direct measure of consumption benefits. But the regression gives these benefits a better chance to show their existence by generating negative wage coefficients, as explained in section 2.3.

4.2. Main results

To test the main prediction of the model, as embodied in Proposition 1, public- and private-sector workers must be distinguished. Accordingly, the subsequent regressions include a dummy variable identifying public state or local workers, and they also include interactions of this variable with the amenity measures. Note that the dummy coefficient reveals the difference in the *wage levels* of public- and private-sector workers, while the interactions show the *difference in the wage impact of amenities* between public- and private-sector workers.

Before considering these results, it should be noted that we face a limitation in estimating the effects of amenities on wages. Because these amenities are time-invariant, we cannot distinguish between actual effects of the amenities on wages and correlations between these amenities and other unmeasured state-specific factors that affect wages. However, in the main analyses described in this section, we focus mainly on the interactions between the amenities and public-sector status. Thus, even if unmeasured state-specific factors influence wages, as long as they do not affect the difference between wages for otherwise similar private- and public-sector workers, these factors will not affect our results. In other words, we can still identify how local amenities affect public-sector wage differentials in the face of unmeasured state-specific influences on overall wage levels, even if we cannot identify the main effects of amenities. Indeed, the public-sector/amenity interactions are still identified if we to include fixed state effects in the regressions. In some of the specifications reported below, we control for other state-specific factors, including some that may affect the public-sector wage differentials that we estimate. In addition, we show that the estimates of the public-sector/amenity interactions are robust to the inclusion of fixed state effects.

The basic results are shown in columns 1 and 2 of Table 4, with the specification in column 2 including the housing-price premium. The (uninteracted) amenity level coefficients in column 1, which show the amenity impact on private-sector wages, follow the same pattern as in Table 3, being significantly positive for *Dry*, *Proximity*, and *Density*. In addition, the public-sector wage dummy is negative and significant, indicating that wages for state or local public workers are about 7 percent less than private-sector wages, conditional on all the covariates, a finding that matches previous results in the literature (Borjas, 2002; Schmitt, 2010).[28]

All the public-sector/amenity interaction coefficients in column 1 are positive, and the *Proximity* and *Density* coefficients are significant. In addition, an F test for joint significance rejects the hypothesis that the interaction coefficients are jointly zero at a high confidence level. These results provide strong confirmation of the model's predictions by showing that amenities raise public-sector wages relative to private-sector wages. Note that, with private-sector wages themselves rising with amenities given the positive level coefficients, the positive interaction coefficients indicate that public-sector wages rise by more. The implication is then that public-sector wages are high in absolute terms in high-amenity regions, as predicted by the model. Formal confirmation comes from significance tests on the sum of the amenity level and interaction coefficients. As seen in the bottom panel of Table 3, the sum of these coefficients is positive for each amenity, with three out of four sums significantly different from zero.

As seen in column 2, controlling for housing prices once again reverses the signs of the amenity impacts on private-sector wages, with all four point estimates negative and the *Mild* and *Density* coefficients significant. However, the interaction coefficients remain positive, indicating that amenities raise public-sector wages relative to private-sector wages when housing prices are held constant, again matching the model's predictions. Since the theory also predicts that public-sector wages should rise in an absolute sense with amenities regardless of whether housing is present in the model, the sum of the amenity level and interaction coefficients should again be positive. The bottom panel shows that this condition is met for *Proximity* and

Density, for which the summed coefficients are significantly positive. Given the similarity of the main results, and the potential endogeneity of the housing-price premium, the subsequent regressions in the paper do not include this variable.

The specification in column 3 of Table 4 drops local public-sector workers from the sample, so that the comparison is between state workers and other workers, excluding those in the local public sector. Similarly column 4 drops local public-sector workers so as to make a comparison between state workers and other workers. The estimates are qualitatively almost identical to those in column 1 (note that the *Mild* interaction coefficient becomes significant in column 4). The implication is that rent extraction by public-sector workers occurs both at the state and local levels.

What do the estimates in Table 4 imply for actual public-sector vs. private-sector wage differentials? To provide some idea of magnitudes, consider (from Table 2) the implied difference in the public-sector wage differential for workers in the worst state compared to the best state for each amenity. For example, for *Mild*, the implied effect of being located in Florida instead of North Dakota is the difference in the amenity values in Table 2 multiplied by the corresponding public-sector/amenity interaction coefficient of 0.0011 from column 1, or a log differential of 0.050 (or approximately 5 percent). For *Dry*, *Proximity*, and *Density*, the corresponding magnitudes for the difference between the worst and best states are 4.6, 10.6, and 10.7 percent, respectively. Effects of these magnitudes are non-neglible and plausible.[29]

4.3. The effect of unionization and collective-bargaining laws on rent extraction

Within the public sector, unionized workers may have more ability to extract rents than nonunionized workers. To test for such a difference, columns 1 and 2 of Table 5 show the interaction coefficients for specifications that compare state and local public-sector workers who are, respectively, unionized and nonunionized, to other workers. In the regressions, the other category of public-sector workers (nonunionized and unionized, respectively) is dropped from the sample. In each case, three out of the four interaction coefficients are positive and significant, showing an amenity-associated wage gap for each type of public-sector worker relative to private-sector workers. Comparing pairs of significant coefficients across the two regressions, the coefficient magnitude is considerably larger for unionized than nonunionized workers, indicating that the wage gap relative to private-sector workers is greater in the unionized case. This finding confirms expectations of higher rent-extraction ability for such workers.

The scope of a state's collective bargaining laws may also affect the ability of unionized public-sector workers to extract rents. To test for such an effect, we use Freeman and Han's (2012) classification of states into four categories indicating the extent of public-sector collective bargaining. Columns 3 and 4 of Table 5 compare unionized public-sector workers to other workers in two subsamples: states where the extent of collective bargaining is high (23) or medium (11), and states where it is low (9) or nonexistent (7) (see the table notes for details). For the high/medium states, three of the four interaction coefficients are positive and signficant, while for the low/nonexistent states, none of the interaction coefficients is significant, and the estimated *Density* and *Proximity* interactions are smaller or negative. Thus, among the latter states, higher amenities do not raise (unionized) public-sector wages relative to those in the private sector. The evidence of rent-extraction in the unionized sample (column 1) is thus due to wage and amenity patterns in the high/medium collective bargaining states.

4.4. Metro-area analyses

As described above, the first additional test replaces the state-level amenity measures with variables measured at the MSA/PMSA level. The two weather variables, *Mild* and *Dry*, are fairly constant across metropolitan areas within a state, and much of the variation across metro areas in water access (and thus in *Proximity*) also occurs across states, reflecting coastal vs. noncoastal state locations. Thus, there is little reason to expect a substantial difference in the regression results relative to those presented so far. This expectation is borne out in Table 6, which shows the estimates for the smaller MSA/PMSA sample (non-metropolitan workers are lost, reducing the sample size to 700,000).

The estimates in columns 1, 3, and 5 of Table 6 use earlier specifications, while the remaining columns add a new variable, as explained below. In column 1, which shows the basic regression, the sign and significance pattern of the estimated coefficients is exactly the same as in column 1 of Table 4, which shows the same regression with state-level amenities. The regression comparing local workers to all workers (the comparison for which amenities measured at the metro-level may be most relevant) is shown in column 3 of Table 6, and it is qualitatively similar to the corresponding regression in column 5 of Table 4 (one interaction coefficient loses significance, and one coefficient sum gains it). The estimates for the interaction coefficients in column 5 qualitatively match those in the corresponding regression in column 1 of Table 5, and the remaining unreported coefficients from that regression are qualitatively similar to the previous ones.

With a metropolitan-level focus, the specification can be expanded to include the metro area's population size by itself and interacted with public-sector status, allowing us to control for possible effects of jurisdiction size on public-sector wages like those found by Brown and Medoff (1989) and Sonstelie and Rose (2010).[30] Such effects could arise, for example, if teachers require higher wages to teach in large urban school districts with many disadvantaged students. If amenities are positively correlated with metropolitan population, failure to include these controls could generate spurious results favorable to the theory. Accordingly, columns 2, 4, and 6 add a MSA/PMSA population variable along with an interaction term. The coefficients are insignificant in each case, but more importantly, inclusion of these variables has almost no qualitative effect on the signs and significance of the amenity interaction coefficients and the coefficient sums, leaving the main findings unchanged. However, the amenity level coefficients almost uniformly lose significance with inclusion of the population variables.

4.5. Omitted state-level influences

Returning to the approach based on state-level amenities, recall that these variables are potentially correlated with other unobserved state characteristics. Although these correlations can contaminate estimates of the effects of amenities on private-sector wages, they will not bias the estimated effects of the public-sector/amenity interactions, as long unobservables shift private- and public-sector wages similarly, which seems like a reasonable assumption. For example, if public goods are normal, and high-income people sort into high-amenity areas, then high-amenity areas may have higher levels or qualities of public goods. While this sorting could generate a link between amenities and public-sector pay, it need not imply that amenities are associated with higher public-sector pay relative to private-sector pay.

One potential state "effect" that could shift public-sector wages relative to private-sector wages, and hence bias the estimated public-sector/amenity interactions, is the political composition of a state. In particular, if more-Democratic states pay public-sector workers higher wages, and this same political composition does not lead to similarly higher private-sector wages, then our key estimated interactions would be biased if the amenities vary systematically across more- and less-Democratic states. To check for such bias, we added data on the Democratic vote share in the 1988 and, alternatively, the 1992 presidential election.[31] Specifically, we added the vote share and the vote share interacted with the dummy variable for public-sector status.

As shown in columns 1–4 of Table 7, this specification leads to estimates of the public-sector/amenity interaction coefficients that are qualitatively similar to those in the corresponding previous regressions (column 1 of Table 4 and Table 5), with some coefficients in fact gaining significance. The conclusion is that our findings are robust to controlling for what is likely the most important alternative source of public/private-sector wage differentials across states (politics).

Another way to test for bias in our results due to omitted state characteristics is to estimate a specification that includes state fixed effects. Recall that, under such a specification, the amenity-level impacts on wages are absorbed in the state fixed effects but that the interaction effects are still identified. Columns 5 and 6 of Table 7 show that the interaction coefficients are nearly identical in magnitude (with the same significance pattern) to those in the corresponding previous regressions (column 1 of Tables 4 and 5). This finding provide further evidence that our main results are not contaminated by omitted-variable bias.[32]

A final set of sensitivity tests partitions the sample into subsamples of workers residing in urban and nonurban areas, workers with less than a bachelor's degree and those holding such a degree, and workers of different races (black, hispanic, non-black/non-hispanic). The amenity interaction coefficients show the previous pattern in each subsample, with at least two being positive and significant in each case. These findings further demonstrate the substantial robustness of our results.

4.6. Results for teachers and corrections officers

It is useful to test the model's predictions on even narrower classes of public-sector workers, specifically elementary- and secondary-school teachers and corrections officers. Table 8 shows distributional information for these workers, which indicates that three quarters of teachers are public workers, with the rest being privately employed. Almost 10 percent of teachers self-report that they are state-employed,[33] while about half of all teachers are union members, regardless of sector. Among corrections officers (who staff prisons and jails), 95 percent are state or local employees, and more than half are union members.

Columns 1 and 2 of Table 9 show regressions where public-sector workers are limited to state and local teachers, with columns 3 and 4 pertaining to unionized teachers. Across these columns, most of the interaction coefficients are positive and significant, showing that amenities raise public-sector teachers' wages relative to those of private-sector workers, extending the pattern seen in previous results. As for the other estimates, the teacher-dummy coefficient shows that teachers (unionized or not) earn 30 percent less than otherwise-comparable non-teachers, while the coefficient for public workers (all of whom are teachers) show that these individuals earn 13 to 15 percent more than other teachers.

The specifications in columns 2 and 4 of Table 9 include the statewide student-teacher ratio by itself and interacted with the public-teacher dummy, an addition that captures the quality of the work environment. Note that the interaction term controls for another possible source of omitted-variable bias that could affect the main results. For example, if the student-teacher ratio were to affect teacher wages in the public sector, and if the ratio were somehow correlated with amenities, then omitting the ratio would bias the amenity interaction coefficients.[34] However, the insignificant coefficients for both student-teacher-ratio variables and the lack of any change in the interaction coefficients discounts this possibility.

Columns 5–8 of Table 9 show regressions where state and local employees are limited to corrections officers, with columns 7 and 8 pertaining to unionized corrections officers. Across these columns, the main results are even stronger than in the previous regressions, with all except one of the amenity interaction coefficients positive and significant. Thus, as in the case of teachers, amenities raise the wages of public-sector corrections officers relative to those of other workers. Turning to the other coefficients, corrections officers (unionized or not) earn 7 percent more than otherwise comparable workers, a premium that is unaffected if they are public state or local employees. Columns 6 and 8 include a work-environment measure, inmates per officer, by itself and interacted with the corrections-officer dummy. As in the case of teachers, the coefficients of this variable are mostly insignificant and the amenity interaction results are largely unaffected.

Finally, the regressions in Table 10 provide a falsification test by using federal rather than state or local workers to represent public-sector employees. With federal wages mostly uniform across the country,[35] or in some cases reflecting local private-sector pay, public-sector wage differentials in federal employment should not show the same positive relationship to state amenities as the differentials for state and local workers. This prediction is confirmed by the results in column 1, where none of the public-sector/amenity interaction coefficients is positive.[36] Restricting attention to unionized federal workers (column 2) has little effect on the results.

5. Conclusion

Non-competitive influences on public-sector pay have been long debated. On the one hand, the lack of a competitive market, the presence and continuing strength of public-sector labor unions, and the high level of political involvement of these unions all suggest that public-sector workers can influence their pay. On the other hand, public-sector pay (and employment) decisions are not made in a vacuum, as taxpayers can migrate away from locations in which public-sector goods and services are provided in an excessively costly fashion, limiting the potential for rent extraction. However, residents who enjoy the beaches and sunshine of southern California, or who benefit from the higher productivity of dense urban areas like Manhattan, are reluctant to leave, giving public-sector workers more leeway to extract rents in such high-amenity places.

The data bear out this connection between amenities and rent-seeking behavior. In estimating standard log wage regressions, we find that public-sector wage differentials are in fact larger in the presence of strong amenities, as are the absolute levels of public-sector wages. The results are the same whether we look at state or local public-sector workers, and they also emerge when we look at important subsets of these workers who receive much attention in the debate over public-sector pay—teachers and prison guards. Furthermore, the relationship between public-sector wage differentials and amenities is stronger for unionized public-sector workers, consistent with their greater ability to extract rents through both organization and influence over the political process. Moreover, among unionized workers, this relationship is stronger in states with extensive collective bargaining. The data also pass a falsification test since we find no evidence of a connection between amenities and wage differentials for federal workers.

Despite our compelling evidence, the paper by no means offers a "complete" theory of public-sector wage determination. The productivity of public-sector worker matters, as does the level of alternative wages they can earn in the private sector, a factor not included in our stylized model. Developing a fuller understanding of these various influences on public-sector wages can clarify the policy debate on public-sector pay and may prove useful in considering possible reforms to reduce rent extraction by public-sector workers.

In principle, our approach could be extended to analyze differences in fringe benefits between the private and public sectors. Studying the connection between benefits and amenities may be particularly informative in light of recent concerns over public-sector pensions. Finally, the same considerations regarding rent extraction and amenities may apply to other workers who are not necessarily concentrated in the public sector but whose pay is strongly influenced by government regulations, political power (in part through unionization), and other non-competitive forces. More generally, a similar story may apply to any group that attempts to use political influence to achieve goals that impose costs on other taxpayers. High levels of amenities may impede the taxpayer mobility that otherwise constrains raiding the public till.

Although the phenomenon analyzed in this paper is mostly beyond the reach of public policy, one possible policy implication comes from our results on the effect of collective-bargaining laws. Since we showed that a favorable collective-bargaining environment is especially conducive to higher public-sector pay in high-amenity states, stronger collective-bargaining laws might be expected to notably raise cost of operating the public sector in such states, while weaker laws would be especially effective in reducing these costs.

Appendix

Adding public-worker consumption of the public good

The preceding results are unaffected when public-sector workers consume the public good along with private-sector workers. Suppose that, instead of caring only about x, public workers value the public good and pay the same tax as private workers. This tax equals $z_i + R_i$, so that public workers are paying to cover their own rent extraction (R_i now denotes rent extraction per worker, public and private). Their income equals $w + (L_i + M)R_i/M$, where w is some fixed base wage, and where the second term is rent per public worker (of which there are M in each jurisdiction). This term equals the rent component of the tax (R_i) times the total number of workers paying the tax ($L_i + M$), divided by the number of public workers.

A public worker's budget constraint is then $x_i = w + (L_i + M)R_i/M - z_i - R_i = w + L_iR_i/M - z_i$. Note that the portion of the tax covering rent extraction cancels the corresponding part of income, so that rent extraction continues to yield L_iR_i/M per public worker. Assuming that public-sector workers share private-worker preferences, the public-sector workers in region 1 seek to maximize

$$w \ + \ L_1R_1/M \ - \ z_1 \ + \ v(z_1) \qquad (a1)$$

subject to the migration constraint in (3). The choice variables are z_1, R_1, and L_1, with z_2 and R_2 viewed as fixed.

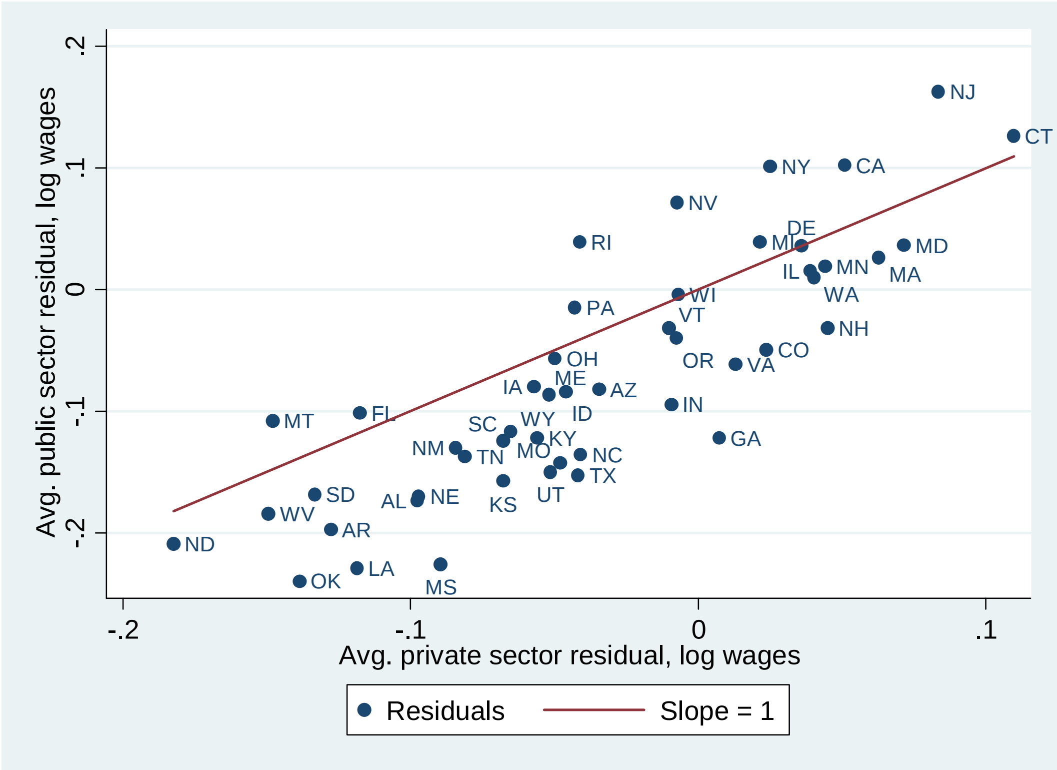
Letting μ denote the multiplier associated with the constraint, the first-order condition for choice of z_1 is $(1 + \mu)[v'(z_1) - 1] = 0$. Therefore, the condition $v'(z_1) = 1$ again emerges, so that $z_1 = z^*$. But with z_1 fixed at this value, the remainder of the optimization problem is to maximize L_1R_1/M subject to (3). Since this problem has already been solved via the previous analysis, the previous conclusions are unaffected.

Construction of metropolitan-level amenity measures

To construct the metropolitan-level amenity measures, we began with a list of the 1999 metropolitan areas (CMSAs, MSAs, and PMSAs) and their components from the Census (http://www.census.gov/population/estimates/metro-city/99mfips.txt, viewed December 1, 2012). From this source we constructed a data file that contains MSA/PMSA codes and titles along with the FIPS codes and county names for the counties within the metropolitan areas. The Census information indicates if only a part of the county is within the metropolitan area, and we created an indicator variable equal to 1 for counties for which only part appears in the metropolitan areas. In addition, we created a variable equal to the number of times a county appears in a different metropolitan area. For example, the variable is equal to one if the county appears in just one metropolitan area, equal to two if the county appears in two separate metropolitan areas, etc. We merged this file with a list of the MSA/PMSAs available in the CPS ORG, creating a file that uniquely identifies counties within MSA/PMSAs.

Using this file we proceeded in the following steps to create the metropolitan amenities data set. First, we merged the metropolitan-area files into the file containing amenities at the county level. For counties that are in multiple metropolitan areas, we divide the county population by the number of times the county appears in separate metropolitan areas. We then collapse the county level amenities to the metropolitan area, weighting the amenity variables by county population. There are isolated counties for which only part of the county appears in one metropolitan area; we included such counties. For the tract-weighted density data, we first created a dataset of tract-weighted county density and county populations. We then merged these county-level density data with the metropolitan definition files, divided the county population by the number of times the county appears in separate metropolitan areas, and collapsed to the metropolitan area, weighting the tract-weighted county densities by county population. The resulting density variable contains tract-weighted metropolitan-area densities.

Figure 1: Plot of Public Sector vs. Private Sector Wage Differentials by State



Notes: Plotted points are state averages of residuals from separate log wage regressions estimated for state or local public-sector workers and private-sector workers. Estimates are weighted, and include controls for education (16 categories), age and its square, union membership, sex, race, Hispanic ethnicity, marital status (7 categories), residence in a metro area, and year dummy variables.
Source: CPS ORG files, 1994-2005.

Table 1: Descriptive Statistics on Distribution of Workers by Sector and Union Membership

Public state or local	0.138
Public state only	0.042
Public federal	0.024
Union member	0.155
Union member and public state or local	0.064
Union member and public state only	0.015
Union member and public federal	0.009

Notes: The sample size is 1,039,161, covering the 48 continental states. Estimates are weighted.
Source: CPS ORG files, 1995-2004.

Table 2: Descriptive Statistics on Amenities by State

	Mean	Std. dev.	Min. (state)	5 worst states	Max. (state)	5 best states
Mild	-40.1	11.4	-62.7 (ND)	ND,MN,SD,ME,VT	-17.1 (FL)	FL,LA,CA,TX,MS
Dry	-7.5	2.9	-12.1 (LA)	LA,MS,WA,AL,GA	-1.7 (NV)	NV,AZ,NM,WY,ID
Proximity (1,000s)	-0.190	0.241	-0.96 (NM)	NM,UT,WY,CO,MT	-0.010 (DE)	DE,RI,NJ,NY,FL
Density (10,000s)	0.322	0.403	0.075 (AR)	AR,MS,WV,SD,VT	2.74 (NY)	NY,CA,NJ,IL,MA

Notes and sources: The data cover the 48 continental states. Definitions of variables (and sources) are as follows. “Mild” is the negative of the sum of the absolute values of the difference between monthly average temperature and 20 degrees Celsius, summed over January, April, July, and October. “Dry” is the negative of the average monthly precipitation for those four months, in centimeters. Both are county-weighted state averages, using 2006 Census population estimates to weight. “Proximity” is the negative of the average distance from the state’s county centroids, weighted by county population, to the nearest coast, Great Lake, or major river. “Density” is the tract-weighted population density (per square mile) in the state, based on 1990 Census data (Glaeser and Kahn, 2004). Note that this is different from a simple density measure for a state, because it is tract-weighted. The idea is to measure density where people in a state live. As a result, this density measure is much higher than average density measures. For the 5 worst (best) states, the states are listed in increasing (decreasing) order.

Table 3: Wage and State Housing Price Premium Regressions on Amenity Variables

	Log wages		Housing price premium ($1,000s)
	(1)	(2)	(3)
Mild	-0.0004 (0.0006)	-0.0017 (0.0007)**	0.038 (0.018)**
Dry	0.015 (0.003)***	0.0005 (0.003)	0.382 (0.096)***
Proximity	0.153 (0.038***	-0.008 (0.034)	3.689 (1.577)**
Density	0.019 (0.008)**	-0.015 (0.006)***	1.534 (0.362)***
State housing price premium ($1,000s)		0.027 (0.004)***	

Notes: For the wage regressions, the sample size is 1,039,161. For the housing price regressions the sample size is 48. Wage regression estimates are weighted by CPS earnings weights. Housing price regressions are weighted by the same weights, which provides approximate weighting by population size while weighting observations in different states the same as in the wage regressions. The wage regressions include controls for education (16 categories), age and its square, union membership, public state or local employment, sex, race, Hispanic ethnicity, marital status (7 categories), residence in a metro area, and year dummy variables. State housing price premia are computed from 2000 Census data (5 percent sample), as the state dummy variables in a hedonic regression for house prices. The computational method is the same as in Albouy (2009), although applied at the state level. Costs are based on both owned and rented homes and include utility costs, and the regression controls for rental and condominium status, dwelling size, rooms, acreage, commercial use, kitchen and plumbing facilities, and age of building. Standard errors for the wage regressions are clustered at the state level, and are reported in parentheses. ***, **, and * indicates that the estimate is statistically significant at the 1-, 5-, or 10-percent level, based on a *t*-distribution with degrees of freedom equal to the number of states (clusters) minus one.

Source: CPS ORG files, 1995-2004; 2000 Census 5% sample.

Table 4: Wage Regressions with Public Sector-Amenity Interactions, Public State and Local Workers, State Only, and Local Only

	Public state and local workers vs. all workers		Public state workers vs. all workers	Public local workers vs. all workers
	(1)	(2)	(3)	(4)
Mild	-0.0007 (0.0007)	-0.0018 (0.0008)**	-0.0006 (0.0007)	-0.0006 (0.0007)
Dry	0.014 (0.003)***	-0.0007 (0.0030)	0.013 (0.003)***	0.013 (0.003)***
Proximity	0.122 (0.037)***	-0.038 (0.040)	0.123 (0.037)***	0.121 (0.037)***
Density	0.018 (0.009)**	-0.017 (0.006)***	0.019 (0.009)**	0.018 (0.008)**
Public state or local	-0.068 (0.009)***	-0.066 (0.009)***	-0.060 (0.009)***	-0.075 (0.010)***
Housing price premium ($1,000s)		0.027 (0.004)***		
Public state or local × mild	*0.0011* *(0.0007)*	*0.0013* *(0.0007)**	*0.0002* *(0.0006)*	*0.0016* *(0.0008)**
Public state or local × dry	*0.0044* *(0.0032)*	*0.0043* *(0.0031)*	*0.0027* *(0.0024)*	*0.0052* *(0.0039)*
Public state or local × proximity	*0.112* *(0.053)***	*0.117* *(0.057)***	*0.100* *(0.044)***	*0.122* *(0.058)***
Public state or local × density	*0.040* *(0.005)****	*0.039* *(0.004)****	*0.029* *(0.008)****	*0.046* *(0.004)****
Joint significance (p-value)	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Mild + interaction	0.0005 (0.0006)	-0.0006 (0.0003)*	-0.0003 (0.0007)	0.0009 (0.0006)
Dry + interaction	0.018 (0.003)***	0.004 (0.003)	0.016 (0.003)***	0.019 (0.003)***
Proximity + interaction	0.233 (0.064)***	0.079 (0.030)**	0.223 (0.058)***	0.244 (0.070)***
Density + interaction	0.058 (0.012)***	0.022 (0.007)***	0.049 (0.016)***	0.064 (0.011)***
N	1,039,161	1,039,161	944,958	986,008

Notes and source: See notes to Table 3. The amenity variables are demeaned (based on the same population weights used for the regression, and using the same sample), so that the main effects capture the effect at the sample means. The regressions include controls for education (16 categories), age and its square, sex, race, Hispanic ethnicity, marital status (7 categories), residence in a metro area, federal employment, year dummy variables, a dummy variable for union membership, and interactions between the union membership dummy variable and the amenities included in the specification. "All others" refers to all workers except public state and local workers. Thus in column (4) public local workers are excluded from the sample, and in column (5) public state workers are excluded. The "amenity + interaction" rows report the sum of the main amenity effect and its interaction with the public-sector worker variable. Given that the regressions also include union-amenity interactions, these sums should be interpreted as the differences within the union or nonunion, and do not reflect differences in unionization between the private and public sectors.
Sources: CPS ORG files, 1995-2004; 2000 Census 5% sample.

Table 5: Wage Regressions with Public Sector-Amenity Interactions, Public State and Local Workers, by Union Status and Collective Bargaining Laws

			Union public state and local workers vs. all workers	
	Union public state and local workers vs. all workers	Nonunion public state and local workers vs. all workers	High or medium collective bargaining	Low or no collective bargaining
	(1)	(2)	(3)	(4)
Public state or local × mild	*-0.0001* *(0.0007)*	*0.0012* *(0.0009)*	*0.0014* *(0.0006)***	*0.0019* *(0.0014)*
Public state or local × dry	*0.0090* *(0.0043)***	*0.0061* *(0.0037)**	*-0.0002* *(0.0050)*	*0.0061* *(0.0072)*
Public state or local × proximity	*0.354* *(0.099)****	*0.108* *(0.055)**	*0.214* *(0.129)***	*-0.039* *(0.100)*
Public state or local × density	*0.053* *(0.008)****	*0.029* *(0.008)****	*0.046* *(0.0087)****	*0.029* *(0.204)*
Joint significance (p-value)	*<0.001*	*<0.001*	*<0.001*	*<0.080*
N	948,035	982,931	696,638	251,397

Notes and source: See notes to Tables 3 and 4. The main effects and the sums of the interactive and main effects are not reported. The coding of collective bargaining for public-sector workers in columns (3) and (4) is from Freeman and Han (2012, Table 1). The "high" (23) or "medium" (11) states are those with collective bargaining laws, which either allow (high) or prohibit (medium) agency fees. The "low" (9) states do not have collective bargaining laws but allow it, and the "no" (7) states ban collective bargaining.
Sources: CPS ORG files, 1995-2004.

Table 6: Wage Regressions with Public Sector-Amenity Interactions, Public Local Workers, MSA/PSMA-Level Analysis

	Public state and local workers vs. all workers		Public local workers vs. all workers		Union public and local workers vs. all workers	
	(1)	(2)	(3)	(4)	(5)	(6)
Mild	-0.0005 (0.0010)	-0.0007 (0.0010)	-0.0004 (0.0010)	-0.0006 (0.0010)	-0.0005 (0.0010)	-0.0006 (0.0010)
Dry	0.008 (0.004)*	0.006 (0.006)	0.008 (0.004)*	0.006 (0.006)	0.008 (0.004)*	0.006 (0.006)*
Proximity	0.103 (0.045)**	0.079 (0.087)	0.102 (0.044)**	0.078 (0.086)	0.105 (0.043)**	0.080 (0.086)
Density	0.026 (0.007)***	0.017 (0.019)	0.027 (0.007)***	0.017 (0.019)	0.027 (0.007)***	0.018 (0.019)
Population		0.0006 (0.0011)		0.0006 (0.0011)		0.0006 (0.0011)
Public state and local or local only	-0.059 (0.010)***	-0.057 (0.010)***	-0.067 (0.011)***	-0.065 (0.011)***	-0.086 (0.014)***	-0.084 (0.014)***
Public local × mild	*0.0010 (0.0009)*	*0.0009 (0.0010)*	*0.0015 (0.0011)*	*0.0013 (0.0011)*	*0.0002 (0.0008)*	*0.0001 (0.0009)*
Public local × dry	*0.0054 (0.0037)*	*0.0047 (0.0039)*	*0.0056 (0.0044)*	*0.0042 (0.0045)*	*0.0082 (0.0043)**	*0.0072 (0.0043)*
Public local × proximity	*0.119 (0.032)****	*0.110 (0.040)****	*0.116 (0.028)****	*0.096 (0.035)****	*0.291 (0.046)****	*0.271 (0.046)****
Public local × density	*0.031 (0.004)****	*0.025 (0.007)****	*0.035 (0.006)****	*0.027 (0.006)****	*0.038 (0.006)****	*0.033 (0.007)****
Joint significance (p-value)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Public state and local or local only × population		0.0003 (0.0004)		0.0005 (0.0004)		0.0003 (0.0002)
Mild + interaction	0.0005 (0.0006)	0.0002 (0.0007)	0.0011 (0.0007)*	0.0007 (0.0008)	-0.0002 (0.0008)	-0.0006 (0.0009)
Dry + interaction	0.014 (0.002)***	0.011 (0.004)**	0.014 (0.003)***	0.011 (0.005)**	0.016 (0.005)***	0.013 (0.007)*
Proximity + interaction	0.222 (0.048)***	0.1882 (0.066)***	0.219 (0.045)***	0.173 (0.066)**	0.396 (0.052)***	0.350 (0.076)***
Density + interaction	0.057 (0.011)***	0.042 (0.016)***	0.062 (0.012)***	0.044 (0.017)**	0.065 (0.012)***	0.050 (0.021)**
N	701,217	701,217	670,102	670,102	640,225	640,225

Notes and source: See notes to Tables 3 and 4. The construction of the amenity variables at the MSA/PMSA level is described in the text. (The dummy variable for residence in a metro area is dropped in this table, since all observations are in metro areas.)
Sources: CPS ORG files, 1995-2004.

Table 7: Wage Regressions with Public Sector-Amenity Interactions, with Vote Share or Fixed State Effects

	Adding vote shares				Adding fixed state effects	
	Using state vote share for Michael Dukakis, 1988		*Using state vote share for Bill Clinton, 1992*			
	Public state and local workers vs. all workers	Union public state and local workers vs. all workers	Public state and local workers vs. all workers	Union public state and local workers vs. all workers	Public state and local workers vs. all workers	Union public state and local workers vs. all workers
	(1)	(2)	(3)	(4)	(5)	(6)
Public state or local	-0.068 (0.008)***	-0.106 (0.014)***	-0.067 (0.009)***	-0.106 (0.014)***	-0.066 (0.009)***	-0.107 (0.015)***
Vote share	0.0029 (0.0026)	0.0028 (0.0026)	0.0052 (0.0019)**	0.0052 (0.0020)**		
Public state or local × vote share	-0.0033 (0.0020)	-0.0046 (0.0040)	0.0006 (0.0019)	0.0019 (0.0031)		
Public state or local × mild	*0.0007 (0.0007)*	*-0.0007 (0.0009)*	*0.0011 (0.0007)**	*0.0000 (0.0007)*	*0.0011 (0.0007)*	*0.0001 (0.0008)*
Public state or local × dry	*0.0067 (0.0029)***	*0.0119 (0.0040)****	*0.0044 (0.0028)*	*0.0076 (0.0041)**	*0.0045 (0.0032)*	*0.0083 (0.0047)**
Public state or local × proximity	*0.143 (0.061)***	*0.398 (0.119)****	*0.107 (0.052)***	*0.320 (0.115)****	*0.117 (0.056)***	*0.330 (0.101)****
Public state or local × density	*0.047 (0.006)****	*0.063 (0.009)****	*0.037 (0.007)****	*0.048 (0.010)****	*0.038 (0.004)****	*0.056 (0.009)****
Joint significance (p-value)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
N	1,039,161	948,035	1,039,161	948,035	1,039,161	948,035

Notes: See notes to Tables 3 and 4. Specifications correspond to columns (5) and (7) of Tables 5 and 7. The only difference is that state fixed effects are added, which result in the main effects of the amenity variables being dropped from the regression equations.
Sources: CPS ORG files, 1995-2004.

Table 8: Descriptive Statistics on Distribution of Teachers and Corrections Officers by Sector and Union Membership

	Teachers	Corrections officers
	(1)	(2)
Public state or local	0.765	0.950
Public state only	0.093	0.467
Public federal	0.007	0.050
Union member	0.568	0.574
Union member and public state or local	0.526	0.551
Union member and public state only	0.055	0.299
Union member and public federal	0.003	0.023

Notes: The sample in column 1 is restricted to elementary and secondary school teachers, defined based on the following Census of Population occupational codes: for 2002 and earlier (1990 Census codes), teachers in kindergarten or pre-kindergarten (155), elementary school (156), secondary school (157), or special education (158); and for 2003 and after (2002 Census codes), preschool and kindergarten teachers (2300), elementary and middle school teachers (2310), secondary school teachers (2320), and special education teachers (2330). The sample size is 41,831. The sample in column 2 is restricted to corrections officers, defined based on the following Census of Population occupational codes: for 2002 and earlier (1990 Census codes), sheriffs, bailiffs, and other law enforcement officers (423, which does not include police), and correctional institution officers (424); for 2003 and after (2002 Census codes), first-line supervisors/managers of correctional officers (3700), and bailiffs, correctional officers, and jailers (3800). The sample size is 3,560. See notes to Table 1. See notes to Table 1.
Source: CPS ORG files, 1995-2004.

Table 9: Wage Regressions with Public Sector-Amenity Interactions, for Public State or Local Teachers and Corrections Officers

	Public-sector teachers vs. all workers		Union public-sector teachers vs. all workers		Public-sector corrections officers vs. all workers		Union public-sector corrections officers vs. all workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public state or local	0.148 (0.023)***	0.148 (0.023)***	0.134 (0.024)***	0.134 (0.025)***	-0.001 (0.031)	-0.003 (0.031)	-0.023 (0.031)	-0.025 (0.030)
Teacher	-0.303 (0.018)***	-0.303 (0.018)***	-0.303 (0.018)***	-0.303 (0.018)***				
Corrections officer					0.066 (0.030)**	0.067 (0.030)**	0.066 (0.030)**	0.067 (0.030)**
Student-teacher ratio		0.002 (0.004)		0.002 (0.004)				
Student-teacher ratio × public teacher		-0.003 (0.006)		0.003 (0.010)				
Inmates per officer						-0.011 (0.008)		-0.011 (0.008)
Inmates per officer × public corrections						-0.025 (0.014)*		-0.024 (0.015)
Public state or local × mild	*0.0019 (0.0007)***	*0.0020 (0.0008)***	*-0.0001 (0.0011)*	*-0.0003 (0.0012)*	*0.0027 (0.0016)*	*0.0037 (0.0018)***	*0.0026 (0.0012)***	*0.0037 (0.0015)***
Public state or local × dry	*0.0016 (0.0027)*	*0.0047 (0.0062)*	*0.0099 (0.0056)**	*0.0072 (0.0093)*	*0.0173 (0.0065)****	*0.0217 (0.0060)****	*0.0205 (0.0046)****	*0.0247 (0.0046)****
Public state or local × proximity	*0.191 (0.049)****	*0.214 (0.074)****	*0.438 (0.113)****	*0.420 (0.134)****	*0.261 (0.154)**	*0.282 (0.148)**	*0.370 (0.181)***	*0.358 (0.178)***
Public state or local × density	*0.078 (0.009)****	*0.075 (0.010)****	*0.087 (0.013)****	*0.089 (0.017)****	*0.097 (0.010)****	*0.080 (0.011)****	*0.099 (0.009)****	*0.085 (0.007)****
Joint significance (p-value)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
N	924,576	924,576	912,480	912,480	895,229	895,229	893,408	893,408

Notes: See notes to Tables 3 and 4. The main effects and the sums of the interactive and main effects are not reported. The only difference relative to Table 5 is that only teachers are included among public-sector workers in columns (1)-(4), and only corrections officers in columns (5)-(8). The student-teacher ratio and the inmate-officer ratio are demeaned (based on the same population weights used for the regression, and using the same sample), so that the main effects capture the effect at the sample means.
Sources: CPS ORG files, 1995-2004; student-teacher ratios are for 2007-8, and are taken from http://www.nea.org/home/29402.htm (viewed October 13, 2010); inmate-staff ratios are taken from Stephan (2008, Appendix Table 14).

Table 10: Falsification Test, Wage Regressions with Public Sector-Amenity Interactions, for Public Federal Workers

	Union and nonunion federal public-sector workers vs. all private workers	Only union federal public-sector workers vs. all private workers
	(1)	(2)
Mild	-0.0006 (0.0007)	-0.0005 (0.0007)
Dry	0.014 (0.003)***	0.013 (0.003)***
Proximity	0.124 (0.037)***	0.123 (0.037)***
Density	0.020 (0.009)**	0.020 (0.008)**
Public federal	0.135 (0.013)***	0.032 (0.009)***
Public federal × mild	*-0.0004* *(0.0006)*	*-0.0011* *(0.0005)***
Public federal × dry	*-0.0077* *(0.0031)***	*-0.0100* *(0.0031)****
Public federal × proximity	*-0.022* *(0.050)*	*-0.039* *(0.054)*
Public federal × density	*-0.031* *(0.012)***	*0.006* *(0.006)*
N	891,805	872,285

Notes: See notes to Tables 3 and 4. The only difference relative to Table 4 is that only federal workers are included among public-sector workers. The housing cost premia are excluded.
Sources: CPS ORG files, 1995-2004.

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Footnotes

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[1]See, for example, http://reason.org/studies/show/public-sector-private-sector-salary, and and http://www.prisoncensorship.info/archive/etext/agitation/prisons/campaigns/ca /caprisoncrat.html (both viewed December 15, 2010).

[2]See, for example, http://www.post-gazette.com/pg/10164/1064943-373.stm and http://blog.nj.com/njv_editorial_page/2010/02/post_7.html (both viewed December 15, 2010).

[3]See, for example, http://www.northshoreoflongisland.com/Blog-31542.112114-6239.112114-Yes-School-Administrators-and-Teachers-are-Vastly-Overpaid.html, http://politics.usnews.com/opinion/mzuckerman/articles/2010/09/10/public-sector-workers-are-the-new-privileged-elite-class.html, and http://www.nytimes.com/2010/10/12/opinion/12brooks.html?_r=2&src=tptw (all viewed December 15, 2010). In this vein, Gramlich (1976) argues that the large sizes of public-sector work forces, when amplified by sympathetic friends and relatives, guarantees substantial political influence. He notes that "there are now about 450,000 full and part-time city government employees in New York City. If each was married, lived in the city, and had one close friend or relative who would vote alike on city issues, conceivably 1,350,000 votes, 30 percent of the entire voting age population and roughly half of the probable number of voters, could be marshalled in favor of making some strategic concession to, or dealing leniently with, unions."

[4]Not surprisingly, the reality is more complex. Although for both men and women, data from 2000 reveal a positive pay gap between the public and private sectors (about 11 percent for men and 20 percent for women), in earnings regressions with the usual controls, there is a negative pay differential for working in the public sector of 6 percent for men, and no pay differential for women (Borjas, 2002; similar figures are reported by Schmitt (2010)). On the other hand, researchers have pointed to pensions and other benefits for public-sector workers that are very generous, particularly when account is taken of underfunded pension liabilities and how they are calculated (Biggs, 2010a, 2010b; DiSalvo, 2010). In addition, the power of public-sector unions, as exemplified by the extensive union involvement in efforts to recall governors in California (Malanga, 2010), suggests that substantial scope for rent extraction may exist.

[5]The data are explained in more detail in the notes to the figure, and later in the paper.

[6]The resulting emigration might be expected to depress land values in regions with high rent-seeking. Gyourko and Tracy (1989b,c) test for such an effect and find empirical support for it. Their approach is discussed further in section 2.3 below.

[7]For additional studies, see Albouy (2009), Beeson (1991), Beeson and Eberts (1989), Gabriel and Rosenthal (2004), Gyourko and Tracy (1989a), Gyourko, Kahn, and Tracy (1999) and Henderson (1982).

[8]Since public-sector workers in the model exploit the mobility of private-sector workers in the process of rent-seeking, making them mobile as well is theoretically impractical. To gauge the realism of this assumption empirically, we cannot use our data set (the monthly Outgoing Rotation Group CPS files), which contains no information on migration. However, the March CPS files have such information, and using the data for 2005, which give state mobility rates over both 1-year and 5-year periods, interstate mobility rates are indeed substantially lower for public-sector workers. One-year rates are 0.025 for private workers and 0.013 for state and local workers. Five-year rates are 0.100 for private workers and 0.064 for public state and local workers. Of course, these estimates do not strictly fit the model's assumption of no mobility among public-sector workers, but the assumption is in the right direction. Note that we would expect lower mobility of public-sector workers because of their more-generous pensions and substantial job security. As for employment variability, CES data show that state government employment is much less variable than private employment, with a coefficient of variation (monthly, seasonally adjusted, for 1995-2004, the period of our CPS data) of 0.052 vs. 0.091 for the private sector. However, local employment has a higher coefficient of variation, so that the coefficient of variation for state plus local employment is slightly higher than for private employment (0.101 vs. 0.091). The standard deviation of private employment, however, is much higher than that for public employment, whether we look at state, local, or the two combined.

[9]Since the number of public-sector workers is fixed in the model, the empirical analysis focuses only on public-sector wages and not on employment levels. Putting the model aside, there is no standard empirical approach that one could adapt for identifying differences in public-sector employment across states associated with rent-seeking. In contrast, for the analysis of wages, the human-capital model provides a baseline specification for the determinants of wages that can then be used to estimate and explore state-level differences not captured by that model.

[10]A production function consistent with this setup has $z = \rho K N$, where K is the capital input and N the number of public-sector workers. Letting r denote the price of capital and fixing N at M, capital cost in terms of z is $rz/\rho M \equiv cz$, where $c = r/\rho M$.

[11]If the amenity were instead g_i and its contribution to quasi-linear utility equal to $t(g_i)$, a redefinition that sets $a_i = t(g_i)$ would yield (1).

[12]The marginal product could instead depend on a nonlinear function of the amenity, but suitable redefinition would yield the linear additive relationship (see footnote 10). On another issue, note that the production amenity could reduce costs rather than increase worker productivity. For example, suppose that heating and cooling cost per worker is given by a function $t(h_i)$, where h_i is a measure of climate unpleasantness. Then, with this cost subtracted off from the marginal product in measuring the worker's contribution, the wage would equal $f'(L_i) - t(h_i)$. This expression can be written as $f'(L_i) + b_i$ by suitable redefinition of the climate amenity, matching the productivity formulation.

[13]This formulation assumes that the consumption and production amenities are positively correlated, with an increase in A generating both consumption and production benefits. The less natural case where a region's features yield consumption benefits but reduce worker productivity can be handled by a reformulation of the model. To capture this case, α would be negative, so that $b_i = \alpha A$ is negative while $a_i = (1 - \alpha)A$ remains positive.

[14]It can be shown that the second-order conditions for the maximization problem are satisfied.

[15]Note that, after rearrangement, condition (7) requires the elasticity of L_1 with respect to R_1 to equal -1.

[16]Since the right-hand side of (18) is less than 2/3, the weaker condition $\overline{L} > M = (1/2)(2M)$ (indicating that $\overline{L}$ exceeds half of the total public-sector work force) actually suffices. The stronger form of the sufficiency condition is needed, however, when housing consumption is added to the model, as seen below.

[17]The private-sector wage increase in region 1 is now proportional to $-f''\partial L_1/\partial A + \alpha = -f''/6g' + \alpha = \alpha - \lambda/6$. As a result, the regional wage difference is proportional to $(\alpha - \lambda/6) - \lambda/6 = \alpha - \lambda/3$. Since this expression is less than unity, the rent-per-worker difference will exceed it when $2\overline{L}/3M > 1$, as before.

[18]If public workers were also to consume land, then a change in rent extraction would affect their utility via the impact of L_1 on the $h(L_1)$ term, which would be added to (20). This additional consideration would require a new version of the above analysis, possibly changing some of the results. In addition, to bring the model fully in line with the Roback tradition, firms would also be users of land. In this case, the market-clearing conditions would include this land usage, and a zero-profit condition would be added for each region. These extra conditions would be needed to determine the quantities of land used in production.

[19]To understand their approach, note that, when housing is incorporated in the model, (20) involves subtraction of a housing price term (equal to $s'(1/L_i)$) on each side of the equation. Holding amenities fixed, an exogenous increase in R_1 then leads to a decrease in price as L_1 falls in response to greater rent-seeking (recall $s'' < 0$). Gyourko and Tracy (1989b,c) test for the resulting inverse relationship between housing prices and rent-seeking, using a measure of union influence as a proxy for R_1.

[20]Since the presence of housing chokes off migration more easily when A rises, the decline in $f'(L_1)$ is not as large, keeping the private-sector wage ($f' + \alpha A$) from declining even when α is relatively small. Conversely, since the labor inflow is larger when housing is absent, α does not need to be as small (the consumption component of the amenity does not need to be as large) to generate a wage decline as when housing prices adjust.

[21]In generating the data set, individuals with allocated wages or weekly earnings (for those not paid hourly) were dropped. The reason is that the imputation procedure in the CPS does not take account of union or public-sector status, implying that both characteristics can be classified incorrectly in the allocated data, weakening the results. For discussion of this issue, see Hirsch and Schumacher (2006).

[22]Elementary and secondary school teachers are by far the largest occupation in local government, and elementary and secondary school teachers and "bailiffs, correctional officers, and jailers" (all of which we term "corrections officers") are the second and third largest occupations in state employment (after post-secondary teachers); see Schmitt (2010). We also focus on corrections officers and elementary and secondary school teachers because their pay is often prominent in public debate.

[23]Elementary and secondary school teachers are defined based on the following Census of Population occupational codes: for 2002 and earlier (1990 Census codes), teachers in kindergarten or pre-kindergarten (155), elementary school (156), secondary school (157), or special education (158); and for 2003 and after (2002 Census codes), preschool and kindergarten teachers (2300), elementary and middle school teachers (2310), secondary school teachers (2320), and special education teachers (2330). Correction officers are defined using the same Census codes as follows: for 2002 and earlier (1990 Census codes), sheriffs, bailiffs, and other law enforcement officers (423), and correctional institution officers (424); for 2003 and after (2002 Census codes), first-line supervisors/managers of correctional officers (3700), and bailiffs, correctional officers, and jailers (3800). Inspection of the share of the workforce in these two occupation groups as defined indicated that the definitions were consistent across the change in the data between 2002 and 2003.

[24]While high density offers consumer benefits (more sources of entertainment are then available, for example), it also yields production benefits via agglomeration effects. Localization effects (productivity benefits from spatial concentration of a particular industry) arise more easily

in dense areas (Arzaghi and Henderson (2008), Duranton and Overman (2005)), and better matching between workers and jobs, which also raises productivity, is another effect of high densities (Baum-Snow and Pavan (2012)).

[25] A potential objection to *Density* as an amenity is that it can reflect other influences as well. First, unlike the other amenity variables, *Density* is potentially endogenous. However, although high wage levels overall may attract residents, our concern is with the estimated wage gap between public- and private-sector workers. Taking the model seriously, a high *relative* public-sector wage should imply less population in a state, conditional on amenities, implying that, if anything, endogeneity should bias the estimated effect of *Density* on the public/private-sector wage gap downward, making our evidence of a positive effect of density on this gap even stronger. Second, high density can correspond to high urbanization, and working conditions in urban areas may be worse (think of teachers in poor urban districts), necessitating higher wages in the public-sector specifically. Discounting this second concern, when we focus on two particularly important subgroups of public-sector workers, teachers and corrections officers, we add control variables that should to some extent proxy for these working conditions, and the results are unaffected. In addition, note that in some of our metro-level analyses, we include an interaction between population and public-sector status along with the interaction between *Density* and public-sector status. The first interaction should capture such influences as poorer public-sector working conditions in large urban areas.

[26] In addition to a union dummy, the regression includes interactions between this dummy and amenities in an attempt to rule out spurious results favorable to the theory. With union wages higher and public-sector workers more unionized than average, a positive correlation between amenities and unionization in a state would, in the absence of this additional variable, generate spurious positive coefficients for the amenity/public-sector interaction variables, giving false support for the theory.

[27] We do not control for occupation because many occupations exist largely in only the private or only the public sector, and even when they do exist in both sectors, they may be quite different. Thus, occupation controls are not necessarily human capital controls, and could potentially capture difference between private- and public-sector workers instead. Below, however, we do look at results for two specific occupations that constitute large shares of the public sector: teachers and corrections officers.

[28] Factors leading to lower public-sector wages could be better benefits and greater job security. Sorting of inferior workers into public-sector jobs could be another factor, but this explanation has been discounted in the literature. Indeed, Krueger (1988) presents estimates of wage changes for workers displaced from private sector jobs who enter state- or local-government employment. These estimate may be particularly compelling because they include individual fixed effects and avoid endogeneity of sector switches (because the workers are displaced). The point estimates are insignificant, but negative.

[29]These are the differences in the public-sector vs. private-sector wage differential. The overall wage difference for public-sector workers between two states would be this difference plus the main effect of the amenity, which would be computed by applying the amenity difference to the estimates in the last four rows of Table 4.

[30]Epple and Zelenitz (1981) and Hoyt (1999) offer theoretical perspectives on this issue, showing in rent-seeking models that large jurisdictions are able to sustain higher per-capita spending levels.

[31]We use data from prior to the sample period to reduce the likelihood of reverse causality. Taking our model seriously, in states where public-sector workers can extract rents because of high amenities, public-sector unions likely work harder to support the political party (presumably Democrats) that enables them to extract rents. Recall that the 1992 election also included Ross Perot, who received substantial vote shares in many states.

[32]If this approach is extended to include state-by-year fixed effects, the results are essentially unchanged.

[33]Our understanding is that most teachers (except some in prisons and some special needs teachers) are local-government employees. However, given the heavy involvement of state government with education, many teachers may report themselves as state employees.

[34]Since we are not addressing the potential endogeneity of student-teacher ratios (which may respond to wages), the results must just be interpreted as asking whether the partial correlations between the public-sector wage differential and amenities remain the same when the student-teacher ratio is partialed out.

[35]See http:/www.opm.gov/oca/09tables/locdef.asp (viewed December 30, 2010).

[36]The negative (and sometimes significant) estimates may indicate that federal pay differentials do not fully reflect private differentials.