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A MODEL OF HORIZONTAL RENTS

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Abstract

In most countries public sector workers are paid more than their private sector peers with similar characteristics. This results in the re-distribution of income to the public sector employees as their wage premiums are paid out of taxes on private sector workers. For that reason, we call such premiums "horizontal rents," as opposed to "top rents" earned by those at the top of income distribution. The paper discusses the concept of horizontal rents and presents the theoretical model of horizontal rents developed in the framework of the game theory approach. The main players in the model are the politician and the trade-union representative acting on behalf of public sector workers. The model evaluates linkages between various parameters and the rent premium paid to the public sector workers. The model outcomes indicate that an increase in the share of state spending in the GDP brings about an increase in horizontal rent while an increase in the share of people employed in public sector results in decrease in per person horizontal rent, all else equal. These effects capture the long-term dynamics between variables. The implication of these result is that the horizontal rent load will likely rise with the increase in the share of public-sector employment.

Keywords

Rent, Public Finance, Public-Private Wage Gap, Elections

1. Introduction

In recent years, there has been a resurgence of interest in economic rents, particularly due to concerns about rising income inequality and the role of rent-seeking behavior in hindering economic growth. (Stiglitz, 2012; Brueckner and Neumark, 2014; Piketty, 2014; Mazzucato et al., 2023). While rent flows going to the top income groups have become a prominent issue, much less attention has been devoted to rent-type incomes accruing on a regular basis to income groups other than the wealthy. One particular type of these unearned incomes are rents paid to public sector workers. Such rent payments that we call *horizontal rents* consist of unexplained compensation premiums paid to public-sector workers in excess of their productivity. Most of the horizontal rents are funded by taxpayers and thus represent redistribution of income from private sector of the economy to the public sector.

With competitive labor markets, average wage levels in public and private sectors should be roughly the same given comparable worker and job characteristics, geographic location, and other factors. However numerous studies have documented massive public-sector workers overpayment on both national and local level. Thus, in the U.S., a recent Congressional Budget Office study estimated "unexplained" federal employees' overpayment at 17% of compensation of private sector peers (CBO, 2017). Public-sector pay premium was reported to be 10.6% in Canada, 18.8% in Greece and 26.5% in Spain (Lammam et al., 2016; Campos et al, 2017; Abdallah et al., 2023).

The aggregate volume of public sector pay premiums can be quite significant. For example, in the U.S., in 2015, the estimated annual total of unexplained pay premiums of federal, state, and local public-sector workers amounted to 1.2% of GDP. In some European countries, public-sector rent loads are higher, such as 2.1% in Greece, 2.5% in Spain, and 2.6% in Portugal (Izyumov and Vahaly, 2021, p. 40-41). For these countries GDP shares consumed by horizontal rents exceed their spending on defense and are comparable to the level of spending on public education.

Explaining the logic behind the decisions of government politicians in awarding their public-sector workers generous pay premiums is the main focus of this paper. The proposed theoretical model evaluates linkages between various parameters and the rent premium paid to the public sector workers. The main players in the model are the politician and the trade-union representative acting on behalf of public sector workers. The politician has the

power to set the size of the pay premium enjoyed by the public sector workers thus increasing his or her electoral support. However, they need to consider a negative reaction to this pay premium on the part of private sector workers, a larger group. The politicians choose their optimal strategy maximizing their chances of re-election. The model analyzes the reaction of public and private sector workers as voters to the politicians' actions. The plan of the paper is as follows. Section 2 describes the concept of the horizontal rent. Section 3 presents the theoretical model of horizontal rent and its determinants. Section 4 concludes.

2. The Political Economy of Horizontal Rents

The concept of economic rents captures the idea of excess returns derived from ownership of economic resource, which can be land, labor, capital, or knowledge. Classical economists laid the foundation for understanding of the economic rent. Neoclassical economics integrated economic rents into a broader framework of marginal productivity theory, in which rent is seen as an excess return to a factor of production. More recently, theoretical models of economic rents were developed to include the concept of rent-seeking, activities of individuals or groups aimed at capturing and/or maintaining economic rents. Building on the insights of Tullock (1967), Krueger (1974), North (1990) and others, the political economy approach to rent-seeking exposed the role of institutions and political power in shaping rent distribution. Works of new institutional economics, Olson (1982), Williamson (1985, 1996), Coase (2013) demonstrated how decisions of politicians and regulatory frameworks can influence both the rent-seeking behavior and the distribution of economic rents.

In this paper we employ the neo-classical definition of rents as payments to a factor of production in excess of its productivity. We follow specifically a variation of this approach that focuses on the income distribution outcomes of rents. The distribution approach to rents, was made prominent in the studies of the Fabian school (Webb, 1888; Shaw, 1891) and elaborated by Sorensen (1998, 2000). It posits that in a perfectly competitive economy, where every factor of production is paid its marginal revenue product no economic rent occurs. Rent, defined as income in excess of marginal productivity, is only generated when actual income of a factor of production exceeds its marginal revenue product:

$$R_i = V^A{}_i - V^C{}_i \qquad (1)$$

where R_i is economic rent for asset *i*, $V^A{}_i$ is the actual income received on asset *i*, $V^C{}_i$ is marginal revenue product, or income, that would be received under perfectly competitive market conditions (Sorensen, 2000, p. 1536). Assets in (1) include labor to allow for the fact that some workers can receive economic rents when compensated above their marginal productivity.

Following this approach, in a perfectly competitive economy the average wage levels in public and private sectors should be the same given comparable worker and job characteristics, geographic location, and similar factors. In a real economy, public sector workers receive payments in excess of compensation paid to their private sector peers indicating that compensation of the former includes an unearned rent component.

The principal source of public-sector workers compensation are taxes. Most of taxes (in developed market economies) are collected from wages of private-sector workers. Thus, effectively the pay premiums to public sector workers are extracted from incomes of their private sector peers. The re-distributive nature of these premiums explains the term *horizontal rents*. An estimate for the US indicated that, for an average public sector worker the horizontal rent premium for one year was $7,770. The corresponding "horizontal rent penalty" of an average private sector worker amounted that year to $1,580 (Izyumov and Vahaly, 2021, p. 43).

Knowing the level of the public sector pay premium and the size of public sector labor force one can estimate the total aggregate value of the horizontal rent. On the macroeconomic level, horizontal rents can be aggregated into the total *horizontal rent flow*.

For the U.S. in 2015, the estimated total horizontal rent flows amounted to $217 billion (Busygin et al., 2021, p. 10). This amount reflects the wage premium that the U.S. government entities at all levels paid their employees in excess of what would be paid to a comparable group of private sector workers.

To compare horizontal rents across time or across countries and regions an appropriate measure is the *horizontal rent-load* -- the ratio of the sum of horizontal rents to the GDP:

$$h_t = \sum R^H{}_t / (Y_t) \qquad (2)$$

where h_t is the rent load ratio in time period *t* , Y_t is the GDP, $R^H{}_t$ is money value of horizontal rent flows in time period *t*.

For the U.S. the rent load ratio was or 1.2% of the GDP (Busygin et al., 2021, p.10). This rent load measure is not the same as the cost of rent-seeking, a concept originating in works of Tullock (1967, 1993), Dougan (1991), Krueger (1974), and others. The latter generally includes the costs of rent-seeking activity itself

and the resulting efficiency losses measured by foregone GDP. In contrast, our horizontal rent-load measure focuses on the amounts of direct income transfers from rent-payers to rent recipients.

Our analysis of the determinants of horizontal rents is based on game theory approach employed in institutional economics and public choice studies by Buchanan et al. (1980), Tirole and Fudenberg (1991), Coate and Conlin (2004), McCarty and Meirowitz (2007), Bénabou (2010) and others. The logic of using game theory approach is based on the fact that wages and salaries of the public sector employees are set in contracts that are negotiated between their trade unions and politicians. Politicians standing for elections and/or re-elections have an incentive to offer public sector workers attractive pay packages, including premiums over the private sector pay. Public sector trade unions knowing that has an incentive to press for additional jobs and larger pay especially during the election season. Public sector trade unions in many countries are known to be well-organized and having strong bargaining power. In the U.S. for example, of the largest five trade-unions three belong to the public sector, the most prominent of which are the American Federation of Teachers (1.7 million members) and American Federation of State, County and Municipal Employees (1.5 million).

By giving public sector workers sizeable pay premiums politicians can ensure loyalty of a significant number of voters. They, however, have to consider the negative reaction to these overpayments from the private sector workers, a larger voting bloc. In the U.S., for example, the current size of public labor force (federal, state and local) is 22 million compared to 146 million employed in the private sector (U.S. Bureau of Labor Statistics, 2024). The other limitation on politicians' choices is the budget constraint. Politicians are interested in maximizing both the size of the public labor force and the per-person premium, but with the given budget they face a trade-off between these two variables. To overcome the budget constraint, a politician can use borrowing, especially if the loans are paid off after the politician leaves office.

A politician's decision to increase the number of jobs and/or pay of public sector workers is analyzed through a game-theoretic lens. In this game, the politician objective is to maximize their chances of re-election. The strategies available to the politician include various policy choices, such as increasing the number of public sector jobs and/or increasing the wages. The payoff for the politician is the probability of winning the next election.

3. The Model

For simplicity, consider a model with two players: a politician and a public trade-union representative. Also assume taxpayers are passive observers to the interaction between the politician and union representative.

The first step is to describe the politician's motivation. Let r be the rent premium that is the unexplained portion of overpayment of public-sector employees compared to private-sector workers with w being the private-sector average wage. Thus $w(1+r)$ is the average wage in the public sector. Let $P_1(r)$ denote the probability of private-sector workers voting for the politician. This determines the expected value of relative number of votes the politician receives from private-sector voters. Similarly, $P_2(r)$ reflects the probability of public-sector workers voting for the politician. More specifically, $P_1(r)$ and $P_2(r)$ represent the relative level of voter support from private and public voters.

The politician cares about her probability of re-election. If α is a share of people employed in public sector, she maximizes:

$$(1-\alpha)P_1(r) + \alpha P_2(r) \rightarrow \max_{r,\alpha} \quad (3)$$

Under the following budget constraint:

$$w(1+r)\square L = B = b * Y \quad (4)$$

where B is the total state budget, L is total public and private employment and b represents state government spending share of state's GDP. At this stage, we do not include state in the budget constraint. The horizontal rent-load (h) using the average public-sector difference in wages is:

$$h = \frac{rw\alpha L}{Y} \quad (5)$$

Thus we may rewrite budget constraint:

$$h + \frac{w\alpha L}{Y} = b \quad (6)$$

Thus, an increase in state's government spending share in GDP brings about an increase in horizontal rent while an increase in share of people employed in public sector results in decrease in per person horizontal rent all else equal. These effects capture the long-term dynamics between variables. It is also the case that the short-time

dynamics can be different. This is illustrated by the tendency of the private sector to be more responsive to market fluctuations. In economic expansions, private-sector wages go up faster than in the public sector and decrease faster when economy contracts (Hirsch, 1978; Card and Krueger, 1995; Lane, 2003; Abdallah et al., 2023).

We can also interpret $P_1(r)$ as the probability of information about wage difference becoming known to the public. As Δw grows, this probability increases. This in turn decreases the support of the politician from private sector workers unhappy with the growing wage mismatch. At the same time, we can assume that the growth of wage difference itself also increases the probability of it being revealed to the private sector workers. So we conclude that:

$$\frac{\partial P_1(r)}{\partial r} < 0 \text{ and } \frac{\partial^2 P_1(r)}{\partial (r)^2} > 0. \quad (7)$$

Similarly, $P_2(r)$ can be interpreted as the level of public-sector workers support for the politician. More of these workers are willing to vote for her as the unearned part of their wage increases. On the other hand, it is posited that the rate of increase of their support decreases with additional increments in the wage difference. Thus:

$$\frac{\partial P_2(r)}{\partial r} > 0 \text{ and } \frac{\partial^2 P_2(r)}{\partial (r)^2} < 0. \quad (8)$$

The starting point is to assume homogeneity among private and public sector employees leading to an equal level of support under zero-rent-premium level. This can be expressed as:

$$P_1(0) = P_2(0) \quad (9)$$

Expressing α using the budget constraint obtains:

$$\alpha = \frac{b*Y}{w(1+r)L} \quad (10)$$

The unconditional optimization problem for the politician support from both public and private sector workers is:

$$\mathrm{F}(r) = \left(1 - \frac{b*Y}{\mathrm{w}(1+r)L}\right) P_1(r) + \frac{b*Y}{w(1+r)L} P_2(r) \to \max_r \quad (11)$$

Further, we will omit the arguments of P_i as they depend on r only in their current form. First-order conditions give us this proportion:

$$\frac{b*Y}{w(1+r)^2 L}(P_1 - P_2) + \frac{b*Y}{\mathrm{w}(1+r)L}(P_2' - P_1') + P_1' = 0. \quad (12)$$

We have to be convinced that the optimal rent premium r is located inside the interval $[0; r^{max}]$, where r^{max} indicates the greatest possible value of rent premium that does not disrupt system stability. To achieve this, we suggest three conditions for P_1 and P_2:

$$(1-\alpha)P_1'(0) + \alpha P_2'(0) > 0 \quad (13)$$

$$(P_2 - P_1) \le (1+r)(P_2' - P_1') \quad (14)$$

$$(1-\alpha)P_1'' + \alpha P_2'' \le 0 \quad (15)$$

Proposition 1: Conditions (13)-(15) are sufficient for existence of stable optimal solution for r.

The proof is provided in the Appendix

Additional closed form analysis, however, encounters major difficulties and requires additional assumptions. Alternatively, the model could be demonstrated with empirical examples.

Using the model, we could check the impact of modifying parameters on the rent premium and on the horizontal rent load.

1) ***Dependence on the GDP***
We designate:

$$G(r,b,Y) = \frac{bY}{w(1+r)^2L}(P_1 - P_2) + \frac{bY}{w(1+r)L}(P_2' - P_1') + P_1' = 0. \qquad (16)$$

As (10) states $G(r,b,Y) = 0$.
Using derivative of the implicit function, we obtain:

$$\frac{\partial r}{\partial G} = \frac{-\partial G(r,b,Y)/\partial Y}{\partial G(r,b,Y)/\partial r} \qquad (17)$$

And $\partial G\,(r,b,Y)/\partial\, Y = \frac{b}{w w(1+r)^2 L}(P_1 - P_2) + \frac{b}{w(1+r)L}(P_2' - P_1') > 0$ due to (12).

Also $\partial G\,(r,b,Y)/\partial\, \Delta w = \partial^2 F/\partial\,(r)^2 < 0$ as required for a local maximum (11). Therefore $\frac{\partial r}{\partial G}$ should be greater than zero.

Using relationship between Δw and h described by $h = \frac{rw\alpha L}{Y}$, we conclude that:

$$\frac{d(h)}{d(w)} = \frac{d(r)}{d(Y)}\frac{w\alpha L}{Y} - \frac{w\alpha Lr}{Y^2} = \frac{w\alpha L}{Y}\left(\frac{d(r)}{d(Y)} - \frac{r}{Y}\right). \qquad (18)$$

The sign of the expression above cannot be precisely determined without additional information. Therefore, results can be ambiguous.

2) ***Dependence on the share of people employed in public sector (α)*****:**
Again, the derivative of implicit function can be calculated from

$$\frac{\partial r}{\partial \alpha} = \frac{-\partial G(r,b,\alpha)/\partial \alpha}{\partial G(r,b,\alpha)/\partial r} \qquad (19)$$

The numerator is $\partial G\,(r,b,\alpha)/\partial\,\alpha = \frac{\alpha}{(1+r)}(P_1 - P_2) + (P_2' - P_1') > 0$ by condition (14). The denominator is the same as in previous case: $\partial G\,(r,b,\alpha)/\partial\, r = \partial^2 F/\partial\,(r)^2 < 0$, because it serves as a sufficient condition for a maximum in equation (11).

Overall, we have $\frac{\partial r}{\partial \alpha} < 0$, and rent premium decreases when α grows. Using the expression $h = \frac{rw\alpha L}{Y}$ we obtain:

$$\frac{\partial(h)}{\partial(\alpha)} = \frac{\partial(r)}{\partial(\alpha)}\frac{w\alpha L}{Y} + \frac{rwL}{Y} = \frac{wL}{Y}\left(\frac{\partial(r)}{\partial(\alpha)}\alpha + r\right) \geq \frac{wL}{Y}\left(\frac{\partial(r)}{\partial(\alpha)} + r\right) > 0. \qquad (20)$$

The product of $\frac{\partial(r)}{\partial(\alpha)} + r$ should be greater than zero as the marginal impact of decreasing rent premium due to a small increase in would not outweigh the current value of the rent premium. Therefore, the horizontal rent load will likely rise with increases in the share of public-sector employment.

3) ***Dependence on debt financing.***
To demonstrate the relationship between the rent premium and debt we should consider time periods. The approach is based on studies of Domar (Domar,1944). The size of state debt from year t, (Dt) is equal to the size of debt from a previous period (Dt-1), in addition to the expenses with public debt interest rates (calculated based on the real interest rate r) and deducting the primary budget surplus (St), calculated as a difference between budget revenues and budget expenditures, excluding public debt interest expenses:

$$D_t = D_{t-1}(1 + r) - S_t. \qquad (21)$$

By using the ratio with GDP and knowing that

$$Y_t = Y_{t-1}(1 + g), \qquad (22)$$

where g represents the real growth rate of the economy, the equation may be expressed this way:

$$\frac{D_t}{Y_t} = \frac{(1+r)D_{t-1}}{(1+g)Y_{t-1}} - \frac{S_t}{Y_t}. \quad (23)$$

Expressing variables as shares of the GDP and using approximation $\frac{(1+r)}{(1+g)} \sim 1 + r - g$, obtains:

$$d_t = (1 + r - g)d_{t-1} - s_t. \quad (24)$$

The above relationship allows us to understand the evolution of the state's indebtedness depending on the interest rate on loans and the growth rate of GDP. Expanding the model by relaxing the budget constraints by allowing the politician to employ debt financing, increases the model's complexity and the number of potential scenarios.

4. Conclusions

The determinants of economic rents continue to be a vital topic of research and debate. Recent studies have shed new light on the nature, causes, and consequences of economic rents, including the specific type of these rents–pay premiums accruing to the public sector workers in comparison to their private sector peers with the same labor characteristics. Most of these premiums are funded by additional taxes on the private sector and thus represent a transfer of income to public sector workers from their private sector colleagues. The re-distributive nature of these payments allows to classify them as "horizontal rents".

Our analysis of the determinants of horizontal rents is based on game theory approach employed in institutional economics and public choice studies of Buchanan (1980), Tirole and Fudenberg (1991), Coate and Conlin (2004) and others. The main players in the model are the politicians and the trade-union representatives acting on behalf of public sector workers. In this game, the politicians' objective is to maximize their chances of re-election. For trade-union leaders the goal is to maximize the number of jobs and/or the pay premiums enjoyed by their workers. The politician has the power to set the size of the pay premium enjoyed by the public sector workers thus increasing his or her electoral support. However, they need to consider a negative reaction to the pay premium on the part of private sector workers, a larger group. The strategies available to the politicians include such choices as increasing the number of public sector workers and/or increasing their wages.

The model outcomes indicate that an increase in the share of state spending in the GDP brings about an increase in horizontal rent while an increase in the share of people employed in public sector results in decrease in per person horizontal rent, all else equal. These effects capture the long-term dynamics between variables. The implication of these result is that the horizontal rent load will likely rise with the increase in the share of public-sector employment. At the same time the model indicates that the relationship between horizontal rent load and the GDP is ambiguous. Expanding the model by relaxing the politician's budget constraints, that is by allowing the politician to employ debt financing, increases the model's complexity and the number of potential scenarios.

Further development of the proposed model might consider additional determinants of horizontal rents, such as differences between the public and private sector in the level of unionization, share of foreign-born employees, information asymmetries, and other factors. Better understanding of the logic and dynamics of rent-seeking and rent extraction in the public sector can help develop effective strategies to reduce rents and ensure a more equitable distribution of incomes.

Appendix

Proof of Proposition 1
We have the following:

$(1-\alpha)P_1'(0)+\alpha P_2'(0)>0$ (1)
$(P_2-P_1)\leq(1+r)(P_2'-P_1')$ (2)
$(1-\alpha)P_1''+\alpha P_2''\leq 0$ (3)

Rewriting first-order conditions:

$\frac{\alpha}{(1+r)}(P_1-P_2)+\alpha(P_2'-P_1')+P_1'=0$ (4)
yields: $P_1'=\frac{\alpha}{(1+r)}[(P_2-P_1)+(1+r)(P_2'-P_1')]$ (5)

We show existence of solution using properties of functions in (4).
Given zero rent premium, the left side of expression (4) is greater than zero under the homogeneity assumption:

$$\frac{\alpha}{(1+0)}\big(P_1(0)-P_2(0)\big)+\alpha\big(P_2'(0)-P_1'(0)\big)+P_1'(0)=(1-\alpha)P_1'(0)+\alpha P_2'(0)>0$$

On the other hand, consider such r^{cr} that (12) turns into equality:

$$\big(P_2(r^{cr})-P_1(r^{cr})\big)=(1+r^{cr})\big(P_2'(r^{cr})-P_1'(r^{cr})\big)$$

Then we have:

$$\frac{\alpha}{(1+r^{cr})}\big(P_1(r^{cr})-P_2(r^{cr})\big)+\alpha\big(P_2'(r^{cr})-P_1'(r^{cr})\big)+P_1'(r^{cr})=\frac{\alpha}{(1+r^{cr})}\big(P_1(r^{cr})-P_2(r^{cr})\big)+$$
$$\frac{\alpha}{(1+r^{cr})}\big(P_2(r^{cr})-P_1(r^{cr})\big)+P_1'(r^{cr})=P_1'(r^{cr})<0$$

Assuming the continuity of functions considered, there exists $\Delta w\in[0;r^{cr}]$ for which (16) holds.
As for the maximum of internal solution ensure that $F(\Delta w)$ is concave in a neighborhood of r^{cr}:

$$F''(r)=\frac{2\alpha}{(1+r)^3}(P_2-P_1)+\frac{2\alpha}{(1+r)}(P_1'-P_2')+\alpha(P_2''-P_1'')+P_1''\leq 0 \qquad (6)$$

Using (2) provides:

$$F''(r)\leq\frac{2\alpha}{(1+r)^3}(1+r)(P_2'-P_1')+\frac{2\alpha}{(1+r)}(P_1'-P_2')+\alpha P_2''+(1-\alpha)P_1''=\frac{2\alpha}{(1+r)^3}\big(P_2'-P_1'+(1+r)(P_1'-P_2')\big)+$$
$$\alpha P_2''+(1-\alpha)P_1''=\frac{2\alpha r}{(1+r)^3}(P_1'-P_2')+\alpha P_2''+(1-\alpha)P_1''<0 \qquad (7)$$

The last expression is valid due to (3), $\frac{\partial P_1(r)}{\partial r}<0$ and $\frac{\partial^2 P_1(r)}{\partial (r)^2}>0$

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