PUTTING A PRICE ON TENURE

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ABSTRACT

Government employees in Brazil are granted tenure after three years of taking their entrance exams. Firing a tenured government employee is all but impossible, so tenure is a big perk. But exactly how big is it? No one has ever attempted to estimate the monetary equivalent of tenure for Brazilian government workers. We do that in this paper. We use a modified version of the Sharpe ratio to estimate what the risk-adjusted salaries of government workers should be. The difference between actual salary and risk-adjusted salary gives us an estimate of how much tenure is worth for each employee. We find that the median value of tenure is R$ 4517 for federal government employees, R$ 2560 for state government employees, and R$ 672 for municipal government employees.

Funcionários públicos brasileiros tornam-se estáveis três após o concurso público. Demitir um funcionário público estável é praticamente impossível, de modo que a estabilidade é um grande bônus. Mas exatamente quanto grande? Até hoje ninguém tentou estimar o valor monetário da estabilidade dos funcionários públicos brasileiros. Fazemos isso neste paper. Usamos uma versão modificada do índice de Sharpe para estimar qual deveria ser o salário risco-ajustado dos funcionários públicos. A diferença entre o salário real e o salário risco-ajustado nos dá uma estimativa do quanto vale a estabilidade para cada empregado. Encontramos que o valor mediano da estabilidade é de R$ 4517 para funcionários públicos federais, R$ 2560 para estaduais e R$ 672 para municipais.

Keywords: public sector labor markets. non-wage labor costs and benefits. portfolio choice
JEL codes: J450. J320. G110

Introduction

How much is tenure worth?[1]

Government employees in Brazil are granted tenure after three years of taking their entrance exams (Federal Constitution of Brazil, art. 41). Firing a tenured government employee is all but impossible, so tenure is a big perk. But exactly how big is it? No one has ever attempted to estimate the monetary equivalent of tenure for Brazilian government workers.

That lack of information distorts the public debate. Government employees in Brazil are overpaid; for instance, federal employees make 96% more than private sector employees of the same gender, race, age, working time, and schooling[2]. But current estimates of the public sector wage premium are underestimated, as they do not take tenure into account. That distorts people’s perception of public sector compensation. And it distorts research on other topics. For instance, one study[3] has found that the public sector wage premium explains 6% of economic inequality in Brazil (as measured by the Gini coefficient). But that figure is entirely based on monetary compensation and hence is probably underestimated.

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In this paper we put a price on tenure. More specifically, we calculate how much tenure is worth, in R$, for each employee of a sample of 188847 thousand government employees. We then analyse how the monetary value of tenure varies across government levels (federal, state, municipal) and across income brackets.

Basic idea

We generally expect returns to be higher for riskier assets (like stocks) and lower for safer assets (like bonds). By "risk" economists usually mean the standard deviation of the asset’s price over a certain time interval. By "return" economists mean the change in the asset’s price over a certain time interval. The relationship between risk and return can thus be expressed in a number of ways, the most popular one being the Sharpe ratio:

\[ S_a = \frac{R_a - R_f}{\sigma_a} \]

where \( S_a \) is the Sharpe ratio of asset \( a \), \( R_a \) is the return rate of asset \( a \), \( R_f \) is the return rate of a risk-free asset (often set to zero), and \( \sigma_a \) is the standard deviation of asset \( a \)'s price.

The Sharpe ratio allows us to compare different assets. Imagine two assets, \( a \) and \( b \), with standard deviations 0.1 and 0.2 respectively, and the same return rate, 0.3. In this case, setting the risk-free return rate (\( R_f \)) to zero, \( S_a \) is 3 and \( S_b \) is 2. This means that asset \( a \) gives us more return per unit of risk than asset \( b \).

We can transpose that logic to the analysis of wages. All else equal, $1 of wage from a job where you have a 50% chance of being fired is worse than $1 of wage from a job where you have a 25% chance of being fired.

The wages of tenured employees have low risk. The chance of being fired is close to zero. When the wage of a tenured employee changes, it almost always increases. In the private sector, however, you can be fired, which may cause your income to drop to zero. Then you may take up a job that pays much less than your previous one. You may be fired multiple times over the course of your career, and each time your wage may change substantially. In other words, the variation of a person’s wage gives us a measure of risk, much in the same way the variation of a stock price does.

Similarly, we can understand wages as a “price” of sorts - say, the price of a month’s worth of your labor. Just like a stock price, the price of a month’s worth of your labor can go up or down.

That is the general idea of this paper: we treat salaries more or less like financial assets, with a return rate and a risk rate, and then we calculate what public sector wages should be if they were risk-adjusted. The difference between actual public sector wages and risk-adjusted public sector wages is a measure of how much tenure is worth. The next two sections explain in detail how these estimates were produced.

Data

We got all our data from RAIS (Relação Anual de Informações Sociais), a database maintained by the federal government. RAIS contains employment data for almost everyone who is formally employed in Brazil, be it in the private or public sector. For every employee RAIS contains monthly wages, employer ID, and a myriad of other data. Importantly, RAIS does not have any data on informal workers, self-employed workers, business owners, and some company officers. That means we are underestimating the riskiness of private sector work, as the incomes of informal workers and self-employed workers certainly fluctuate more than the incomes of formally employed workers. That cannot be helped; even if we had access to every worker’s tax returns we would still not have income data on informal workers, and we would only have yearly income data on self-employed workers (as opposed to the monthly data we have on RAIS).

Due to limitations in computing power we could not use the entire RAIS. Instead we randomly sampled, for each of the following categories, 100 thousand people: private sector employees; tenure-track federal government employees; tenure-track state government employees; and tenure-track municipal government employees. That yielded a total of 400 thousand people. By “tenure-track” we mean both tenured government employees and “pre-tenure” government
employees, i.e., those employees who are still in the three-year probationary period. Practically all pre-tenure government employees eventually become tenured, so for simplicity we will consider them as tenured employees and refer to them as such.

We sampled those 400 thousand people from RAIS 2005, the first year for which RAIS has sufficient employer information (prior to 2005 the "employer nature" field - which tells us whether the employer is a government organization, a private company, a non-profit, etc - followed a different logic). We then checked, for each year in the 2005-2019 period (2019 is the last year for which RAIS data are publicly available), whether any of the sampled employees switched categories in that year - i.e., whether any private sector workers became government workers, and whether any government workers became private sector workers or switched to a different government level (federal to state, municipal to federal, etc). We discarded all people who had switched categories at any point. That left us with a total of 273094 people, distributed as follows:

| Category               | Count  |
|------------------------|--------|
| Private sector         | 84247  |
| Federal government     | 69428  |
| State government       | 61634  |
| Municipal government   | 57785  |
| Total                  | 273094 |

### Methods

The first step was to calculate a modified version of the Sharpe ratio - called the Sortino ratio - for each of the 84247 private sector employees in the sample, for the 2005-2019 interval.

The (unmodified) Sharpe ratio treats ups and downs equally. If a stock price or salary goes up this increases the price’s standard deviation, which decreases the Sharpe ratio. That is often not what we want; whether we are talking about stock prices or wages, the risk we are interested in is the downside risk, not the upside risk. The Sortino ratio solves this problem by replacing the standard deviation with the downside deviation (also called the lower semi-deviation), which only captures negative fluctuations. In our case this means the following:

\[ S'_i = \frac{R_i - R_f}{DD_i} \]

where \( S'_i \) is the Sortino ratio of employee \( i \)'s wage; \( R_i \) is the return rate of employee \( i \)'s wage, i.e., the change between employee \( i \)'s first and last wages; \( R_f \) is the return rate of a risk-free asset, which here we set to zero; and \( DD_i \) is the downside deviation of employee \( i \)'s wage.

The second step was to calculate the mean Sortino ratio of every income bracket of the 84247 private sector employees. We could have used deciles to create those brackets. But the top decile has a range that is too wide. In 2005, for instance, the top decile comprehends salaries between R$ 1434 and R$ 69852.

So instead of deciles we used Jenks natural breaks, which is a clustering algorithm for 1-dimensional data (the Jenks algorithm minimizes each cluster’s mean deviation from the cluster mean and maximizes each cluster’s deviation from the means of the other clusters). The result was the following income brackets and corresponding mean Sortino ratios:

- Private sector 84247
- Federal government 69428
- State government 61634
- Municipal government 57785
- Total 273094

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6In some cases people disappear from RAIS for a time. For example, an employee who was fired in 2007, became self-employed, and was hired again in 2010 will not be on RAIS in the 2008-2009 interval. We could drop such cases and keep only people who were on RAIS 2005-2019 uninterrupted. But that would drop precisely the people who are most at risk of losing their jobs. So instead we keep all 274690 people and we concatenate all the monthly data points we have for each of them (which results in time series of different lengths for different people; for instance, someone who was on RAIS for the whole 2005-2019 interval will have a time series of 180 data points, but someone who was not on RAIS in 2008 and 2009 will have a time series of only 156 data points).

7For instance, if your first wage was R$ 1000 and your last wage was R$ 1200 then \( R_i = \frac{(1200 - 1000)}{1000} = 0.2 \).

8The downside deviation is calculated by summing up all the negative fluctuations, squaring each of them, summing up the squares, dividing that sum by the total number of observations (both positive and negative fluctuations), and taking the square root of that fraction.

9We used 2005 salaries for this.
Table 2: mean Sortino ratios, per income bracket

| income bracket   | mean Sortino ratio |
|------------------|--------------------|
| (R$ 1, R$ 488)   | 35.13              |
| (R$ 488, R$ 986) | 18.01              |
| (R$ 986, R$ 1853)| 15.46              |
| (R$ 1853, R$ 3223)| 15.55             |
| (R$ 3223, R$ 5249)| 13.61             |
| (R$ 5249, R$ 8203)| 13.17             |
| (R$ 8203, R$ 12782)| 6.70              |
| (R$ 12782, R$ 20790)| 7.34             |
| (R$ 20790, R$ 32898)| -0.03            |
| (R$ 32898, R$ 69852)| -0.34            |

The third step was to compute the Sortino ratio for each of the 188847 government employees in the sample, for the 2005-2019 interval.

The fourth step was to find, for each government employee, the mean Sortino ratio of the corresponding private sector income bracket. We then used that information to find out, for every government employee, what her return rate should have been in order to equalize her Sortino ratio with the average Sortino ratio of the corresponding income bracket in the private sector.[10]

A concrete example may help. Imagine for instance a government employee whose first salary in the dataset was R$ 15000 and whose last salary in the dataset was R$ 25000. That is a return rate of 0.66. Assume that the downside deviation of this employee in the same interval was 0.05. That results in a Sortino ratio of 13.33.

The private sector income bracket that contains R$ 1500 is the one that goes from R$ 12782 to R$ 20790 (see Table 2 above). That income bracket has a mean Sortino ratio of 7.34. Keeping the government employee’s downside deviation constant, what should her return rate have been to produce a Sortino ratio of 7.34? The answer is 7.34(0.05) = 0.367.

If we apply a return rate of 0.367 to the government employee’s starting salary of R$ 15000 we find a salary of R$ 20505. The difference between the actual last salary and the risk-adjusted last salary is an estimate of how much tenure is worth to that employee. In this example, tenure is worth R$ 25000 minus R$ 20505, which gives us R$ 4495.

Results

The median value of tenure is R$ 4517 for federal workers, R$ 2560 for state workers, and R$ 672 for municipal workers. The histograms below show the distribution of tenure values for each government level (in each case we removed the bottom 2.5% and the top 2.5% values, to avoid distorting the visualization).

Interestingly, as the histograms show, for some government workers tenure has a negative value. From a risk-reward perspective those workers might be better off in the private sector: they might face a higher chance of being fired, but the extra risk would be more than compensated by the higher salary returns. Such cases are not the norm though: they represent 16% of the federal workers, 21% of the state workers, and 27% of the municipal workers.

For the vast majority of workers, tenure is worth a considerable, positive sum. For the median federal worker tenure is worth a sum equivalent to 47% of her salary. For the median state and municipal workers that figure is 44% and 31% respectively. That means the public debate about civil service compensation is missing an important component. Controlling for age, education, etc, is important when comparing public and private wages, but without taking tenure into account we end up underestimating the salary premium of government workers. The World Bank estimates that federal workers make 96% more than their private sector counterparts[?] but that figure is certainly much higher - probably closer to 140%.

[10] There are government salaries higher than R$ 69852. They have no equivalent private sector bracket (private sector salaries only go up to R$ 69852 in 2005), so in these cases we used the average Sortino rate of the top income bracket.
Figure 1: value of tenure for federal workers

Figure 2: value of tenure for state workers
Conclusion

In this paper we bring the notion of risk-adjusted returns to the research on public sector compensation. We hope that this contribution will help inform the public debate and policy-making on the subject.

The approach we take here could be refined and extended in a number of ways. Here we are only interested in the value of tenure, not in the public sector wage premium. A natural next step would be to do both estimations simultaneously. That would require surveying private and public sector employees for a number of years. RAIS does not have enough data on education, work experience, etc, and the main alternative - IBGE’s PNAD (Pesquisa Nacional por Amostra de Domicílios) - has that data but it does not track the same people over time. That data collection effort might be worth it, especially if it allows us to incorporate categories that are not on RAIS (informal workers, self-employed workers, etc).

Another direction would be to estimate the price of tenure in completely different ways and then compare the estimates with the ones found here. For instance, we could ask a sample of government employees how much additional $ they would require in order to give up tenure. That answer, biased as it might be (employees might inflate their true preferences when answering the survey) could let us estimate the gap between actual risk and perceived risk.