THE PUBLIC SECTOR WAGE PREMIUM:
AN OCCUPATIONAL APPROACH.

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Abstract
In the aftermath of the great recession, fiscal policy appeared in the headlines of most western countries at the top of the governments’ agenda to recover the economy. Austerity policies are now the rule, not the exception. After all the efforts that were required to get out of the recession, it is only natural that the public sector payroll has been consistently under the public opinion’s spotlight. This article proposes to review the empirical evidence on the wage dynamics for both the private and public sectors of the economy. I argue that more relevance must be attributed to the occupational composition in the determination of the aggregate public sector wage differential in the economy. I contribute to the literature by providing three new robust empirical facts relating the occupational heterogeneity with the determination of the public sector wage differential. The first fact shows a negative relationship between the public sector wage differential and the private sector hourly wage across occupations. The second provides suggestive evidence for the existence of a public sector wage differential polarization. The third fact shows that the public sector wage differential is affected by the occupational employment composition across sectors and by the structural movements in occupational categories that are occurring from 1990 to the present, the so-called “job polarization”. To test the robustness of these results I execute a battery of Oaxaca-Blinder counterfactual decompositions for the average worker.

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I. Introduction

“After the party, the hangover. When debt-fuelled economic growth came to a crashing halt in the financial crisis of 2008, governments across much of the rich world sought to cut spending. One obvious target was the state’s payroll.”

- The Economist, March 08, 2014.

In the aftermath of the great recession, fiscal policy appeared in the headlines of most Western countries at the top of the governments’ agenda to recover the economy. Austerity policies are now the rule, not the exception. After all the efforts that were required to get out of the recession, it is only natural that the public sector payroll has been consistently under the public opinion’s spotlight. There is an increased attention to the time series behavior of the wage differential between the public sector workers and their private sector counterparts by both the policy analysts, the social media and the public opinion in general.

This article proposes to carefully review the empirical evidence on the wage dynamics for both the private and public sectors of the economy. My main goal is to argue that occupational heterogeneity across workers is the key to properly evaluate the public sector wage premium. This idea is related with the main literature for the public sector wage differential, which emphasizes the importance of considering some heterogeneity across workers to better understand what drives the public sector wage differentials. In particular, Katz and Krueger (1991, 1993) studied the earnings inequality in the US and found that there is a lower inequality for the public sector employees when compared to the private sector employees after correcting for differences in education and experience across sectors. In addition, using a quantile regression analysis Poterba and Rueben (1994) argued that the public sector wage distribution is more concentrated (or less dispersed) than the private sector wage distribution. This implies that the workers in a quantile on the left tail of the public sector wage distribution are more highly paid relatively to the workers that are in the same quantile of the private sector wage distribution. On the other hand, the workers in a quantile on the right tail of the public sector wage distribution are less highly paid relatively to the workers in the same quantile of the corresponding wage distribution for the private sector. This higher “wage concentration” for the public sector is one of the most robust results in the relevant literature, being also confirmed for example in Gregory and Borland (1999), Melly (2005) and Bargain and Melly (2008).

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1For example, recently the Organisation for Economic Co-operation and Development developed a broad study where they assess what compensation plan should be adopted by their member countries and how to better manage the wage bill of public sector employees (OECD (2012)). In this report it is stated that public sector compensation reduction policies are widespread to face the recent recession. More than half of the OECD countries participating in the OECD Fiscal Consolidation Survey of 2012 have proposed wage cuts or wage freezes like the 5%-10% cuts in Portugal and Spain and the wage freezes in the United Kingdom and United States. Also, several countries are proposing significant reductions in the number of public sector employees like Czech Republic, Ireland and Poland. Their focus is on the design of different compensation schemes for the public sector wages, which I am not analyzing here. Nevertheless, this is a very interesting theoretical research topic for the future.
I argue that it is important to reinforce the role of occupational composition to better structure the heterogeneity in the public sector wage differential. To do so, I follow the “routinization” hypothesis approach proposed by Autor et al. (2003) and outstandingly surveyed in Acemoglu and Autor (2011). I relate the public sector wage differential to both wage and job “polarization” arguing that the most relevant comparison across the private and public sectors is the composition of employment across occupations. The differentiation of (non-)routine manual/cognitive occupation categories should therefore be key in explaining the wage premium for the public sector that we observe using aggregate data. In particular, Acemoglu and Autor (2011) argue that occupational heterogeneity is becoming more relevant to account for wage differences across workers as time goes by. Therefore, it is the perfect environment to compare the private and the public sectors.

I contribute to the literature by providing three new robust empirical facts relating the occupational heterogeneity with the determination of the public sector wage differential. The first reflects a negative monotonic relationship between the public sector wage differential and the private sector hourly wages across occupations. The second signals the existence of a public sector wage differential polarization, in which low-skill and low-wage occupations have very high wage premiums, high-skill and high-wage occupations have wage penalties, and the occupations in the middle of the distribution have smaller differentials across sectors. Lastly, the third fact argues that the public sector wage differential is affected by the occupational employment composition across sectors and therefore it is affected by the job polarization structural trend that is occurring in the labor market since 1990. To test the robustness of these results I execute a battery of Oaxaca-Blinder counterfactual decompositions for the average worker. The main conclusion is that the occupational composition is important both for the determination of the average public sector wage differential and for the determination of the public sector labor market share over time.

Although related in spirit, these results are different in nature from the wage concentration result. Instead of comparing the distribution of workers in both the private and public sectors by understanding the public sector wage differential for different quantiles of the distribution, I proxy the value of a job by the private sector hourly wage for that job and I see how the public sector wage differential varies for each occupation category in relation to the value attributed to the workers belonging to each occupation by the private sector. To understand whether this result is influenced by the wage concentration argument, I study whether this monotonic relationship is robust for different quantiles within each occupational category. I find that the wage concentration has no major effects in my result. Explicitly, the wage concentration result affects the mass of occupational categories with wage premiums or penalties but not the negative relationship between the public sector wage differential for each occupation category and the private sector hourly wages. In particular we expect for lower quantiles within occupations to observe a large mass of points with wage premiums and for higher quantiles within occupations to observe a higher mass of occupations with wage penalties.
The importance of the public sector wage bill on the government budget is by itself self-explanatory. Throughout the Post-World War II period until the present days the average public sector payroll share on government consumption lies above 50% and the average share on total government expenditures above 25%. Although one can argue that the relative importance of the public sector wage bill on government expenditures has decreased over time, this does not decrease its significance. In fact, the share of the public sector payroll bill on the government total expenditures achieved a minimum value of 20.4% and the share on the government consumption expenditures consistently decreased to reach 47% in the year of 2013. These values are still significant enough for the public sector payroll to be one of the first targets in cutting government’s spending whenever there are some budgetary pressures to decrease it, as proven by the wave of austerity policies targeting the public sector employees across the Western countries. The public sector has also a big expression in the labor market. The public sector employment share has consistently been above 15% from 1960 onwards and it increases in all NBER recessions. This happens since the private sector employment is considerably more volatile than the public sector employment and so, in a recession, the public sector employment decreases relatively less than the private sector.

The existence of such a significant and centralized employer in the labor market lead us to think that the government may have some monopsonic power. If this power is exercised, then the government can drive the wage of a given public sector worker down and make it lower than the wage of a “comparable” private sector worker. Or it can let the government to be more rigorous in their recruitment process and allow the public sector to get better (more skilled) employees for the same wage as the private sector would offer for a less skilled worker for the same vacant job. The latter would mean that a comparison for the occupation composition across sectors is extremely important to properly study the public sector wage differential and that we need to be careful when interpreting the time series for the average worker.

On the labor supply side, we need to take into account two different channels. First, the fact that the average public sector job is viewed as having a higher job security and higher non-compensatory benefits (higher pensions, better healthcare insurance, etc) than the average private sector job. Using establishment level data from the Job Openings and Labor Turnover Survey from the BLS, Davis et al. (2013) found for the years 2001 to 2006 that on average the hires and separation rates for the economy’s public sector are less than a half of the same respective rates for the total non-farm employment. One major consequence of this result is that conditionally on being hired, the public sector workers have a higher job security given the lower probability of being fired. The higher job security and the higher non-compensatory benefits associated to the public sector jobs would drive down the wages required by the public sector employees on accepting the job if they are risk averse, conditionally on getting an offer. This idea was first emphasized in Bellante and Link (1981), who argue that more highly risk-averse individuals weigh job stability higher and are more likely to search into public sector. The higher job security would also imply a lower mobility to the private sector or to unemployment.
and lower vacancies, which would make the public sector employment to be less procyclical with the business cycle than the private sector employment.

Second, given the higher job security of public sector jobs and the fact that the government may have monopsonic power in the labor market, the public sector workers have incentives to fight for their own jobs by gathering in unions and negotiating their wage through collective bargaining. Collective bargaining would give the public sector workers a higher market power in the labor market and would create an upward pressure on their wages with respect to the private sector. The Wisconsin Budget Repair Bill and the consequent protests and the fall of Issue 2 in Ohio are recent examples of the action of labor unions to protect the public sector workers benefits and job security. Through the action of collective bargaining we would expect the time series behavior of the public sector wage differential to be biased by the protection of low-skilled workers, whose wages should be higher than their private sector counterparts, rather by the high-skilled workers, whose wages should be lower.

The remaining of this article is organized as follows. In Section II, I carefully explore the time series behavior of the employment and wage dynamics of both the private and public sectors. In Section III, I show using micro-level evidence the relevance of the occupational composition in describing the forces behind the aggregate public sector wage premium that we observe in the data. In Section IV, I apply a battery of Oaxaca-Blinder counterfactual decompositions (Oaxaca, 1973, and Blinder, 1973) to understand the relative effect of demographics, occupational composition and propensities in explaining the public sector wage differential and to test the empirical facts introduced in Section III. Section V concludes and presents some possible ideas for future research.

II. Time Series Aggregate Evidence

This section reviews the time series evidence using quarterly aggregate data from the BLS Current Employment Statistics (CES) and compares it with the annual time series data that can be obtained from the March Supplement of the Current Population Survey (CPS) after aggregation across workers\textsuperscript{2}. I decompose and describe the dynamics for the total wages for each sector by understanding what happens to the wages per worker, hourly wages and hours worked across sections. I argue that the relevant wage measure to study the public sector wage differential is the hourly wage. For the quarterly data we also apply the Hodrick-Prescott filter to the average public sector wage differential per worker and other relevant variables to study their persistency, comovement with the business cycles and volatility. Using the cyclical

\textsuperscript{2}The CPS series used comes from the online Integrated Public Use Microdata Series (IPUMS-CPS) from the University of Minnesota. The data is taken from [http://cps.ipums.org/cps/](http://cps.ipums.org/cps/) The main advantage of the IPUMS-CPS data is the fact that the dataset is already cleaned and ready to be used by the researcher. For further details about this dataset please refer to “Miriam King, Steven Ruggles, J. Trent Alexander, Sarah Flood, Katie Genadek, Matthew B. Schroeder, Brandon Trampe, and Rebecca Vick. Integrated Public Use Microdata Series, Current Population Survey: Version 3.0. [Machine-readable database]. Minneapolis: University of Minnesota, 2010.”
components we compare the business cycle dynamics of both sectors to better understand in which way each sector affects the labor market dynamics we observe in the data.

We can decompose total wages in two different margins: an extensive margin for the number of employees (‘bodies’), and an intensive margin for wages per worker. The intensive margin can be further decomposed into two different effects: one that represents the contribution to this intensive margin of hours per worker (‘quantities’) and one that represents the contribution of wages per hour (‘prices’). Therefore, total wages can be decomposed as

\[
\text{Total Wages} = \text{Employment} \times \frac{\text{Total Hours}}{\text{Employment}} \times \frac{\text{Wages per Hour}}{\text{Total Wages}}
\]

(1)

Ideally, we should analyze the three effects described above separately. Unfortunately, the BLS does not have publicly available data for total hours for the private and public sectors separately. Nevertheless, I use data for total wages and employment from the CES dataset to analyze both the extensive margin and the intensive margins. To fill the gap in the data to study this decomposition, I use the data made publicly available by Francis and Ramey (2009, referred as FR in what follows) to get the employment and total hours series. I match both series by comparing the employment series for both datasets to see whether the data for total hours can be seen as reliable enough or if it differs considerably from what we would expect due to the number of workers.

Using FR data I construct a series to represent the private non farm employees by summing the private non farm employees (excluding non-profits) with the non-profits series. I observe that this series slightly over-represents the private sector employment data from the CES. However, since this difference is relatively small (the FR private employment series exceeds the CES series by less than 0.4% for all time periods), we can neglect it and argue, possibly in a slightly naive fashion, that the data on total hours taken from Francis and Ramey (2009) can be considered as a valid proxy for the actual total hours series that could be obtained from the CES aggregate data. For the public sector, the employment series provided by FR matches exactly with the one from the BLS. Using this data we are now able to get time series aggregate results for the public sector hourly wage differential, that can provide a better comparison with the Current Population Survey (CPS) time series data.

Figure 1 presents the quarterly time series data from 1947 to 2014 for the public sector differentials in wages per worker and in hourly wage, for the public sector hours per worker differential.

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3This data can be directly accessed from [http://econweb.ucsd.edu/~vramey/research.html](http://econweb.ucsd.edu/~vramey/research.html). The authors mention that this data was provided by Shawn Sprague of the Bureau of Labor Statistics (BLS) as the raw series used in the BLS hours index, even though I was not able to find this index on the BLS statistics website. This is a further justification on whether the series for total hours should be used to access on the aggregate what drives the time series behavior for the public sector hourly wage differential.
and for the annual hours per worker for both the private and public sectors. The differentials are in percentage terms and the hours in both sectors are in natural logarithms. The data for nominal wages and employment is taken from the CES dataset. The data for the total hours is taken from Francis and Ramey (2009). For the hours per worker panel, the blue line reflects the behavior of the private sector and the red dashed line reflects the pattern for the public sector. The gray areas show the NBER recessions.

The public sector differential for hours per worker, wage per worker and hourly wage are constructed as the percentage deviation of the corresponding public sector variable with respect to the same private sector variable. For example, I define \( (W/N)^G \) to be the public sector average wage per worker and \( (W/N)^P \) to be the private sector average wage per worker. Let the public sector wage (per worker) differential to be noted as \( Wage^{n,D} \). Therefore, \( Wage^{n,D} \) can be defined as

\[
Wage^{n,D} \equiv \left( \frac{(W/N)^G}{(W/N)^P} - 1 \right) \times 100% = \left( \frac{(W/H)^G}{(W/H)^P} \times \frac{(H/N)^G}{(H/N)^P} - 1 \right) \times 100% \tag{2}
\]

where for a sector \( i \in \{G, P\} \) we have that \( (W/H)^i \) is the hourly wage and \( (H/N)^i \) is the
average number of hours per worker. The above formulation reflects that the public sector wage per worker differential is a weighted average of both the hourly wage and hours per worker differentials.

From the evidence shown in the first panel in Figure 1 we observe the existence of a public sector wage premium per worker. This means that the average wage per worker is higher in the public sector than in the private sector. However, the average wage premium per worker has been slowly decreasing in magnitude from 1950 onwards, with extremely long-lasting movements over time. The question can now be further specialized. Are the movements in this public sector average wage per worker premium explained by variations in the quantity of labor, the differential of hours per worker across sectors? Or are these movements due to variations in the actual price, or due to variations in the hourly wage differential between the public and the private sectors?

The public sector differential in hours per worker remained stable around -5% from 1947 to the middle of the 1960s. This would imply the average private sector employee to work 5% more hours than the average worker in the public sector for this time period. From the 1960s until the present the hours per worker in the private sector systematically decreased by more than the hours per worker in the public sector. The latter even started to increase from 1980 onwards. This results in a positive sloped linear trend for the public sector hours per worker differential. In 2013, the average public sector employee works now between 10.4% and 12.1% more hours per year than the average private sector employee. Given the systematic long-run positive trend in the hours per worker differential, the medium to long run dynamics of the public sector wage premium per worker are mainly described at that frequency by the dynamics of the hourly wage differential across sectors. The main difference is in the level of the differential between sectors. In particular, from 1999 onwards we observe the hourly wage public sector differential to fluctuate around the null, letting us observe both wage premiums and wage penalties as time goes by. This would imply that the public sector wage premium described above for the average employee could be an artificial result that comes from the higher number of hours worked by the public sector employees. However, this upward sloping trend over time in the differential for the hours per worker goes against what we would expect and should be confirmed using the CPS data.

In order to compare and integrate the aggregate evidence described above with the micro-level data, I use the March supplement for the CPS dataset. The information contained in the March CPS dataset allows a richer decomposition for the total annual wage bill. Instead of considering the three distinct effects described in equation (1) - employment, hours per worker and hourly wage - we can now decompose even further the hours per worker into two different components: (i) the weeks worked in the year by each worker and (ii) the usual hours worked per week. By doing so, we can check whether the public sector differential in hours obtained from the CPS dataset is able to match such a high differential as it is indicated in the FR data and the upward sloped time trend. Finally, this specification allows us to ask whether the
variations in the average annual hours worked by the average worker across sectors come from
the difference in the number of weeks worked or in the amount of time an individual needs to
work per week. The decomposition of the annual wage bill is then

\[
\text{Total Wages} = \text{Employment} \times \frac{\text{Hours per Week}}{\text{Weeks per Worker}} \times \frac{\text{Hourly Wage}}{\text{Annual Wage per Worker}}
\]

Since we are dealing with individual-level data we need to be careful when aggregating the
variables across individuals. The CPS provides the inverse sampling probability weights of
an individual to appear in the dataset. We will use these weights to construct our aggregate variable. I am using the March CPS to get information about the individual annual earnings, implying that I am working with annual data. It is recommended by the IPUMS-CPS to
use the 1990 Census methodology for occupations only for data from 1980 onwards. This
happens due to some structural changes in the occupational classification over time. Anchoring
the Census 1990 methodology lets all observations in the sample to pass through at most
only one major occupational classification restructuring, making the homogenization of these
occupational categories to be easier and less prone to noise. Therefore, I will only consider data
from 1980 to 2013.

On the micro-level I apply several restrictions to the sample to make it usable. First, I restrict
the age of the individuals in the sample to be between 16 years and 67 years. The former is
the legal working age for the majority of jobs in the United States and the latter is the full
retirement age. Second, to be able to properly understand the wage differential between the
public and private sectors, I exclude the unemployed, the individuals not in the labor force, the
self-employed, the unpaid family workers and the armed forces. Therefore, only the persons
that are actually formally working in the labor market are considered. The armed forces are
the exception, since it is a specific task of the public sector. For the formal workers considered,
I follow the literature and drop the ones that have occupations related to farming, forestry and
fishing. For the annual earnings observed in the data we need to deal with the outliers that
may be misspecified. In order to do so, I exclude the individuals that earn per hour less than
25% of the federal minimum wage and I multiply the top-codes for annual earnings by 1.5 for

\footnote{The variable introduced to measure the annual weeks worked by each individual reports the number of
weeks, in entire weeks per year, that the respondent worked for profit, pay, or as an unpaid family worker
during the preceding calendar year. Respondents were prompted to count weeks in which they worked for even
a few hours and to include paid vacation and sick leave as work. This explains why in Figure 2 reported for the
number of weeks worked per year for the average worker extremely high values, from 48.5 weeks to 50.5 weeks
per year.}

\footnote{The key variables we use in this and the following sections are the annual earnings (incwage), the number
of weeks worked per year (WKSWORK1), the usual hours worked per week (uhrswork), the occupation clas-
fification according to the 1990 Census methodology (OCC1990) and according to the Standard Occupational
Classification System for the year 2000 (SOC 2000), and finally to identify whether the worker is in the private
or public sector we use the worker’s class (classwkr). Other important variables that will be used later in this
work are the age, race, gender, education and employment status of the individuals in the sample.}
the time period comprising all the years between 1980 and 1995. These top-codes are a feature of the CPS dataset to prevent identifying the individuals that were surveyed. Additionally, I deflate all monetary values in 2010 dollars for a higher comparability over time.

Finally, to decompose the annual hours worked by each worker, I follow the methodology used in the literature that uses the CPS dataset and, in particular, Bowlus and Robinson (2012). Explicitly, I define the annual hours worked by each individual in the sample as the usual annual working hours. These are the product of both the weeks worked in the year and the usual hours worked per week. We use the usual working hours to proxy for the hours worked in each week to control for possible holidays, sickness periods and other sorts of noise in the data. We drop from the sample all the workers that usually work less than 20 hours per week or less than 20 weeks per year. This would imply that some (but not all) part-time workers are dropped from the sample.

Figure 2 presents the time series evidence for 1980 to 2013 using the March CPS dataset. From the decomposition of total wages provided by equation (3), the relevant variables are the number of employees, the annual hours worked per individual and the hourly wage. To further decompose the annual hours worked, we use the methodology above to consider the number of weeks worked per year and the usual hours worked per week. Also, to compare our results to the ones found using more aggregate data, we compute both the hourly wage and the wages per worker for each sector. On each panel in Figure 2, the blue line reflects the behavior of the private sector and the red dashed line reflects the pattern for the public sector.

The first observation is that, even after cleaning the data, the CPS has a good national coverage of the US labor market. In 2013, it represents 88.4 million workers in the private sector and 17.9 million workers in the public sector. This implies the public sector employment share to be between 16% and 20%, being roughly 19.30% in 1980 and 16.87% in 2013. These values are in accordance with the ones shown on Figure 1, implying that the CPS is not representing excessively one sector with respect to the other. With respect to the wages of the average worker in each sector, the public sector average worker wage is consistently increasing in a linear fashion while in the private sector there are larger swings. This would imply that the private sector average worker wage time series defines the dynamics of the public sector wage differential. Since this wage differential is always positive for the hourly wage and almost always positive for the wages per worker, we can think of a public sector wage premium. The exception holds for 2001 in which the public sector wage (per worker) differential is negative \( \text{Wage}_{2001}^p = -0.28\% \), but the public sector hourly wage differential is still positive. It is also important to differentiate between the contribution of the hourly wage and the contribution of usual hours worked per individual. Notice that the hourly wage has the most important role in explaining the dynamics observed in the wages per worker and that there is a considerable public sector hourly wage premium for all time periods.

The public sector wage per worker differential dynamics are matched pretty well both using the CES aggregate data and the CPS data. On the other hand, this match is far from perfect.
for the levels of these differentials. According to Abraham et al. (1999), there are some possible explanations for this fact. First, the CES under represents the workers from young establishments. Second, there are differences in the earnings concepts employed across data series and in the worker populations covered in each dataset. In particular, for the CPS dataset I am filtering the data by removing some of the part-time workers that usually work less than 20 hours per week or less than 20 weeks per year. Due to the type of contracts used in each sector this would have a higher impact on the private sector, pushing upwards the usual hours per worker in this sector. Lastly, the CPS data may understate the growth in hourly wages for both sectors since workers tend to over report the number of hours they work per year. Independently of the reason, I will continue this analysis using the CPS data.

Finally, to confirm if the upward sloping time trend exists for the public sector average annual hours per worker differential, I use the usual annual hours per worker from the March CPS. The usage of the usual annual hours prevents us from having so much noise in the data due to extraordinary events but it can also lead to a bias in the hours reported by the workers in both sectors. While for the aggregate evidence presented above in Figure 1 we have the average public sector worker to work increasingly more than the average private sector worker as time goes by, from -5% in 1982 to around 15% in 2014, we observe for the CPS dataset a very mild and relatively constant differential over time in the hours worked between the average worker
in the public and private sectors, never exceeding in absolute value 2.5%. The usual hours per worker are consistently higher in the public sector between 1980 and 1994 and between 2009 and 2013. For the former period the main driver is the number of weeks worked per worker, which is consistently higher in the public sector. For the latter period the difference is in the usual hours per week, again slightly higher in the public sector. Therefore, given the mild absolute values of both the public sector differential in the hours per worker across sectors and in its main determinants, we can assess that the differences in hours across sectors are not relevant to determine the dynamics of the public sector wage differential. I will follow the results provided by the micro-level data and argue that the hourly wage is the most important component to assess the public sector wage per worker differential.

Up to this moment, I have described the main time series facts that describe the labor market dynamics for both the private and public sectors. I have decomposed the total wages in each sector into four different channels: (i) number of employees, (ii) weeks worked per year, (iii) number of hours worked per week, and (iv) hourly wage. Since the average public sector wages per worker are almost always above the private sector wages we can think of a public sector wage premium. The most important channel to explain the dynamics of the public sector wage premium per worker is by far the hourly wage. Therefore, in the next section when I present the micro-level evidence I will use the hourly wage as the relevant variable to measure the wage premium. For the remaining part of this section I will use the CES data from the BLS and aggregate data for GDP taken from the Bureau of Economic Analysis (BEA) to describe the persistency, comovement with GDP and volatility of some key variables after application of the filter popularized by Hodrick and Prescott (1997) with a smoothing parameter appropriate for quarterly data. I take the natural logarithm of each variable, excepting those that are already in percentage terms that I keep unchanged, and I apply the HP filter to each variable re-expressing it in percentage deviations from long-run trend. I obtain the cyclical components for these variables. For persistency I use the cyclical components’ first order autocorrelations, for comovement the contemporaneous correlation with GDP and for volatility the standard deviation.

Table 1 presents the results using the methodology considered above. The key variables presented below are the nominal GDP (Y), the public sector wage (per worker) differential (Wage\textsubscript{n,D}) and, for both the private and public sectors, total employment (N\textsubscript{i}), total hours (H\textsubscript{i}), average nominal wage per worker ((W/N)\textsubscript{i}) and average hours per worker ((H/N)\textsubscript{i}), where i \in \{P, G\} is the sector considered. Not surprisingly, most of the key variables like output, the public sector wage differential, employment and the wage per worker in both sectors and both total hours and hours per worker in the private sector are very persistent variables. However, it may be surprising that total hours and hours per worker are much less persistent in the public sector than in the private sector. The fact that the public sector is more highly covered

\[6\text{The Hodrick-Prescott filter used for quarterly data was applied using a smoothing parameter equal to 1600. For further reference on what smoothing parameter value to apply for each time frequency see Ravn and Uhlig (2002).}\]
by labor unions and by their collective bargaining contracts would make us believe that both employment and hours per worker in the public sector would be at least as persistent as in the private sector. Finally, hours per worker in the public sector are not as persistent as in the private sector. This may be a feature of Francis & Ramey (2009) data and not from the public sector on its own.

For the comovement with the business cycle we have that all the public sector variables - employment, total hours, wages per worker and hours per worker - are less procyclical than in the private sector. This result is particularly well connected with the literature, appearing as well in Quadrini and Trigari (2007). Additionally, the public sector employment share is countercyclical (correlation = -0.6506). Surprisingly the public sector wage differential is acyclical. Since the wage per worker in the public sector is less procyclical than in the private sector we would expect the public sector wage differential to be countercyclical and the fact that we get such a low comovement with the cyclical component of GDP should let us believe that there may be an artificial component in the data that is generating that result. In Table 2, I decompose the public sector wage differential by time periods to understand better what happens. We observe that in the first part of the sample, from 1947 to 1969, the public sector wage differential is actually procyclical. As we consider more recent time periods, the public sector wage differential gets more and more countercyclical. This implies that the earlier period in the sample is influencing the cyclicality results for the public sector wage differential, influenced by the large wage premiums observed in the 1950s. It also implies that for the period starting in 1980 to the present we should consider the public sector wage differential to be countercyclical. Finally, we observe that both the total hours and total employment in the

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<td>1.7376</td>
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<tr>
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<td>0.1482</td>
<td>0.5746</td>
<td>0.1544</td>
<td>0.5021</td>
<td>0.8349</td>
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Table 1: Business Cycle Properties: Public vs. Private Sector (1947-2014)

<table>
<thead>
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<td>Comovement of Wage&lt;sub&gt;n,D&lt;/sub&gt; over time.</td>
<td>0.2510</td>
<td>-0.5718</td>
<td>-0.5960</td>
<td>-0.7123</td>
<td>-0.7750</td>
</tr>
</tbody>
</table>

Table 2: Public Sector Wage per Worker Differential: Comovement by Time.
private sector are more volatile than in the public sector and that the average wages per worker and hours per worker are more volatile in the public sector than in the private sector.

In this section I have illustrated the time series evidence that describe the dynamics of the public sector wage differential. I develop the analysis by using both the aggregate evidence and by making use of the micro-level CPS dataset. I argue that the hourly wage is the variable that best describes the differential in wages across sectors and I point out some issues that may occur with the aggregate data for the hours per worker. In the next section I will describe the relevance of heterogeneity to properly describe the data. The changing occupational composition in the economy and the adjustment of both sectors to improvements in technology and consequent appearances and disappearances of occupations can be one of the main factors that explains the aggregate public sector wage premium. In particular, I relate my descriptive results with the widely consistent “wage concentration” result and I describe three novel empirical facts in this literature.

III. Importance of Occupational Composition.

Analyzing just the public sector wage differential for the average worker in the economy wildly oversimplifies the dimension of the problem at stake. The fact is that workers are heterogeneous. Not everyone can be a professional football player, an engineer, a carpenter, a teacher, etc.; According to each individual’s skills and interests, each person chooses a set of possible occupations they can perform and their desired career paths. The labor market behavior incorporates these workers’ decisions with the employers’ hirings and firings decisions and determines which actual jobs these workers end up doing. This implies that the worker chooses at an earlier stage her career prospects and occupational category they want to work for and only after this decision she chooses the sector she intends to work for. The occupational categories I define are broad enough to account for the workers’ career prospects that could possibly bias the analysis. For example, the occupational category defined as “Protective Services” includes the “Police and Sheriff’s Patrol Officers” but also the “Bailiffs” and the “First-Line Supervisors/Managers of Police and Detectives”. This implies that the definition we are using for an occupational category can capture both the occupation the workers have at a given point in time and also their career progression expectations over time. On the employer side, we observe that the employers first understand for which position and tasks they need to post vacancies and then who are the best people to fill those vacancies from all the individuals that have applied to the position.

In this section I will introduce some facts that shed the importance of occupational composition when comparing the wages and salaries of the workers in the public sector with respect to their private sector occupational counterparts. I will consider the labor market equilibrium outcome for the public and private sector wages and employment and I will show that the public sector wage differential is very connected with the occupational composition of each
sector. I connect these results with the “routinization” approach proposed by Autor et al. (2003) and developed in Goos and Manning (2007), Goos et al. (2009) and Acemoglu and Autor (2011), by aggregating the major occupation categories by tasks and specific skills into (non-)routine manual and cognitive occupations. However, before doing so, I will show that the results considered in the previous section hide a considerable heterogeneity in the public sector wage differential. In particular, for the individuals that are for each sector on the left tail of their sector’s wage distribution, the public sector wage premium is much higher than what we expected from the analysis above. On the other hand, for the individuals that are in the right tail of their sector’s wage distribution, we cannot argue that there is a public sector wage premium since the differential is not always positive. This is an illustration of the so-called “wage concentration” result, which argues that the public sector wage distribution is more concentrated than the private sector wage distribution.\footnote{The “wage concentration” result appeared first in the work of Poterba and Rueben (1994). For a more recent application check Melly (2005). For any interested reader in the literature of the public sector wage differential I would recommend the very comprehensive survey by Gregory and Borland (1999).}

In order to show the implications of the wage concentration result I define the hourly wage for an individual $i$ on a sector $k \in \{G, P\}$ at a year $t$ as $(w/H)_{k,t}^i$. For an individual that is on a percentile $x\%$ of her sector’s wage distribution the hourly wage is defined as $(w/H)_{x\%,t}^k$. Then, we can construct the public sector (hourly) wage differential for a given percentile $x\%$ as

$$Wage_{h,D}^{x\%,t} = \left(\frac{(w/H)_{x\%,t}^G}{(w/H)_{x\%,t}^P} - 1\right) \times 100\% \tag{4}$$

Figure 3 uses the CPS data from 1980 to 2013 to look at the time series behavior of the public sector wage differential for the average worker and for the workers that lie on the percentiles 25%, 50%, 75% and 90% of each sector’s wage distribution. This illustration is in accordance with the “wage concentration” result and clearly show why it is so important to consider the heterogeneity across workers to better understand the differences in the wages paid on both sectors. In particular, it shows that the public sector wage differential is negatively related with the position the individuals are in their corresponding sector’s wage distribution at each point in time. The workers that earn the lowest labor wages are better paid in the public sector than in the private sector and the workers that earn the highest labor wages are better paid in the private sector. The dynamics for the public sector wage differential are quite similar across the distribution percentiles considered and also for the mean value. The wage differential increased during the 1980s and beginning of the 1990s, it decreased until the 2000s and then it kept roughly constant until 2013. The relative similar time series paths for the public sector wage differential across all percentiles and the average worker lead us to believe that we can focus on the cross section side. I will confirm the robustness of my analysis by considering the cross-occupational facts over several different time periods.
There is also a considerable heterogeneity in the public sector wage differential. By considering just the relationship between the wages for both the public and private sectors for the average worker, we would believe the public sector hourly wage differential to be a wage premium and to lie between around 3% in 1983 to 16% in 1995. On the other hand, by considering the public sector wage differential for the workers in these different percentiles of their corresponding wage distributions we see the public sector wage differential to span from -5% to roughly 35%, magnifying the range considered for the mean. The main message is that the workers that are on the left tail of their corresponding wage distributions are better off monetarily in the public sector rather than in the private sector. On the other hand, the workers that are on the right tail of their corresponding wage distributions can be better off both in the private sector or in the public sector, because the wage difference is relatively small.

These results lead us to believe that the public sector pays in fact a higher compensation to their workers than does the private sector, since only at the 90% percentile we see a negative public sector wage differential for some time periods. Given the higher job security and non-compensatory benefits (such as better retirement benefits or better health insurance) provided to the workers in the public sector, it is puzzling to observe the public sector to give such a higher monetary compensation to their employees in comparison to the employees in the private sector.
that are on the same quantile in their own distribution. The literature justifies this fact by arguing that the empirical evidence shows that public sector workers are more highly educated, work in occupations that are more highly paid and are older and more experienced in the labor market than the private sector workers.

Therefore, there are two possible channels to explain this fact: or (i) the public sector has a higher share of workers to work in higher compensation occupations with respect to the share of private sector workers in these occupations; or (ii) the higher compensation occupations are better paid in the public sector than in the private. This would imply occupational composition both in terms of employment shares and relative wages to be crucial in testing the existence of a public sector wage premium and structuring the main drivers of a public sector wage differential and the relation between the public sector and the private sector. Therefore, I check if there is a relationship between the public sector wage differential and the occupational composition of the economy. To do so, I aggregate the individuals in the CPS dataset by major occupational categories, applying the same filters described in the previous section. I also aggregate the occupational data in CPS according to the major occupational categories defined according to the SOC 2000 classification.

In Figure 4, I define the major occupational categories according to the SOC 2000 classification and plot the public sector wage differential with respect to the value the private sector attributes to the average in each occupational category, measured by the hourly wage paid by the private sector to that average worker. The marker size reflects the public sector labor market share for the occupations considered and the hourly wages for both the private and public sectors are defined for all time periods in 2010 US dollars. Figure 4 shows the existence of a negative relationship between the private sector wage of a given occupation category and the public sector wage differential for that category. For occupation categories that are less valued in the private sector we observe a public sector wage premium and for the occupation categories that are more valued by the private sector we observe a higher public sector wage penalty.

The main message that can be taken is that for the average worker in each occupation category we observe that the higher the private sector values that occupation, the lower the public sector values it. This implies that there is a relatively high wage income substitutability between these

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8 Check for example Bender and Heywood (2010) note and the Bewerunge and Rosen (2012) mimeo. This branch in the literature tries to assess the monetary value of the non-compensatory benefits to estimate total compensation differentials across sectors. Their work is complementary to mine in the sense that it provides evidence to describe an additional channel that can alter the decision of an individual to work in the private or in the public sector.

9 I link the value of an occupation category for both sectors using the private sector hourly wage as the main anchor. Since the public sector provides mostly public goods, the absence of a competitive market and the existence of the free rider problem make the measurement of the public sector worker marginal productivity to be unclear. For example, Groves and Ledyard (1977) model the private sector using competitive markets and the public sector using the information communicated from the consumers to the government about their preferences as the main driver in the government decision. The valuation problem for the public sector worker wage needs to be addressed properly when modeling the labor market to match the empirical evidence for both sectors.
two sectors across occupation categories. This result is robust for all the time periods but it seems to be more accentuated from 1990 onwards, with a larger dispersion in the private sector valuation for the high compensation occupations. The robustness of this result across different time periods and data sources allow me to establish as a fact this finding.

**Fact 1 (Negative Monotonicity).** The public sector wage differential for the average workers in a given occupation category is decreasing across occupations in the hourly wage of the average private sector worker. This finding is robust across time and for different percentiles in the wage distribution.

Taking as an example the year of 2013 and analyzing Figure 4 more carefully let us understand that public sector wage differential for the average worker in a given major occupational category has a higher range than the one considered above for the wage distribution percentiles in each

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10I have applied the same approach to the Occupational Employment Statistics (OES) from the BLS for the years 2012 and 2013 and Fact 1 is also robust in this dataset for these years. I chose not to present the graphical results here since they would be a repetition of the findings presented for the March CPS and this dataset is less detailed than the CPS. The OES dataset is gathered through a semianual mail survey in which roughly two hundred thousand establishments are surveyed per panel. Each establishment is surveyed at most once every 3 years, summing up to a total of one million and two hundred thousand different establishments. The data is then yearly updated to include all the information from all the establishments. The level of disaggregation in the OES dataset is quite high, differentiating up to 800 occupations, 450 industries and geographical areas up to metropolitan areas.
sector. Using this structure, the public sector wage differential lies between a penalty of around 30% to a premium of around 80%. The maximum wage premium observed (78%) belongs to the average worker for the Protective Service occupations and the highest penalty (26%) to the average worker for the Legal occupations. Fact 1 lead us to expect an occupation category less valued by the private sector to have a higher public sector wage premium and a category that is more highly valued by the private sector to have a lower wage premium (or alternatively, a higher public sector wage penalty). Thinking of the public sector wage differential as a decreasing function on the private sector hourly wage reveals a meaningful substitution effect across sectors.

It is important to differentiate Fact 1 from the “wage concentration” result. Although similar in spirit, these two empirical facts differ in their nature. The higher wage concentration in the public sector lead us to expect a higher (lower) public sector wage differential for the workers that are on lower (higher) quantiles of their respective wage distribution when compared to a worker on the same quantile in the other sector’s wage distribution. It is therefore a result about the wage distributions on both sectors, in which the public sector wage differential is negatively related to the relative position the worker is on her sector’s wage distribution, if sorted from the lowest to the highest wage. On the other hand, Fact 1 shows that the public sector wage differential is negatively related to the value attributed by the private sector to an hour of labor of the average worker in a given occupation category. It is therefore an argument that relates the study of the public sector wage differential with the economy’s occupational composition and relative importance of the public sector for each occupational category.

To extend Fact 1 to different positions in the wage distribution I sort the workers in each occupational category by their wage and I construct the public sector wage differential for these workers. Define the hourly wage for an individual $i$ working on occupation category $j$ on a sector $k \in \{G, P\}$ at a year $t$ as $(w/H)^{k}i,j,t$. The hourly wage for an individual that is on a percentile $x\%$ is defined as $(w/H)^{k}x\%,j,t$. Then, we can construct the public sector (hourly) wage differential for the worker that is on the percentile $x\%$ for the wage distribution of occupation $j$ and sector $k$ in a year $t$ as

$$\text{Wage}_{x\%}^{h,D,j,t} = \left( \frac{(w/H)^{G}x\%,j,t}{(w/H)^{P}x\%,j,t} - 1 \right) \times 100\% \quad (5)$$

In Figure 5, I present some empirical evidence that relates the public sector wage differential with the private sector hourly wage for workers sorted into major occupational for the years 1980 and 2013. In particular, I consider the wages for the workers that are on the percentiles 10%, 25%, 50%, 75% and 90% of their corresponding wage distributions. The marker size reflects the public sector labor market share for the occupation categories considered. The orange dashed line represents the fitted values of a weighted regression that have as dependent variable the wage differentials and as independent variables a constant term and the private sector hourly wage. The weights are defined by the public sector employment share for each occupation.
Figure 5: Public Sector Wage Differential by Major Occupational Categories (1980 vs. 2013).
category and so, they measure the relative public sector expression in the labor market for these occupation categories. The value for $\beta$ that appears in each panel is the coefficient of the private sector hourly wage on the public sector wage differential in this weighted regression. The value of $\beta$ is highly statistically significant for all percentiles and for both year considered, being the t-statistic associated to these coefficients always more negative than -2.62, with an associated p-value below 1.8%. Intuitively, $\beta$ measures how much do we expect the wage differential to change in percentage points if we consider an occupation category that has a private sector valuation of an additional US dollar, keeping everything else constant.

The first idea that pops up from the analysis of Figure 5 is that the public sector wage differential is decreasing across occupations in the hourly wage valuation attributed by the private sector to the workers in these occupations for all the percentiles considered and for both the year 1980 and 2013. This strengthens the results synthesized in Fact 1, since it allows an extension of the result considered for the average worker in each occupation category and each sector to workers in completely distinct positions in their corresponding wage distributions. This result can also be observed by checking that $\beta_x$% is negative. That is, by checking that the coefficient on the impact of the private sector hourly wage on the public sector wage differential for the workers that are in the percentile $x$% in their occupational wage distributions is negative. This implies that we expect the public sector wage differential to be higher (lower) for occupation categories that have a low (high) private sector valuation, keeping everything else constant. Interestingly enough, the absolute value of $\beta_x$% decreases as we consider higher percentiles in the occupational wage distribution for both sectors. This implies a relatively large variation in the public sector wage differential with respect to the private sector hourly wage valuation for the workers that are on lower percentiles in their corresponding sector-occupation wage distribution, and a relatively smaller variation in the public sector wage differential with respect to the private sector hourly wage valuation as we consider workers that are in higher percentiles (that are more highly paid) in their corresponding sector-occupation wage distribution.

On the cross-occupational side two occupation categories should be mentioned separately from the remaining ones given their intrinsic labor market characteristics across sectors: the Protective Services occupations and the Sales and Related occupations. The former is mainly concentrated in the public sector, with a public sector market share of 73.7% and the largest public sector wage premium in 2013 for all percentiles considered. The latter has a very small labor market expression in the public sector, being the public sector share around 1.5%, and it has a high public sector wage penalty (of almost 13% for the average worker in 2013) considering the low hourly wage that the private sector is paying to the average worker in this occupation category (around 21 dollars). The fact that these occupation categories are so concentrated in one of the sector magnifies the public sector wage premium or penalty to be higher than what we would otherwise expect. This happens because one of the sectors specializes in services that use these occupation categories and the other does not need many workers in those occupations. This generates the issue of analyzing comparable workers across sectors.
For the remaining occupation categories in 2013, we observe large public sector wage premiums for Education, Training, and Library; for Community and Social Services; for the Production; and for the Construction and Extraction occupations. It is not surprising that the Education, Training, and Library category and the Community and Social Services category have larger public sector wage premiums. The former set of occupations are a textbook case for labor union coverage and collective bargaining agreements that increase both the salaries and the benefits of the majority of the workers in these occupations. The later set of occupations provide services that increase the well-being of citizens in the community they are inserted and these services are usually provided by public entities or non-profit entities that may or may not be subsidized by the government. However, there is (still) no apparent reason in the inherent characteristics of each set of occupations that would explain the Production and the Construction and Extraction occupations to have high public sector wage premiums. However, notice that these occupations have in common the fact that they share the same sets of skills and tasks. In the literature developed by Autor et al. (2003), they are defined as non-routine manual occupations. On the other hand, we observe lower public sector wage differentials (and even public sector wage penalties) for the Legal; Healthcare Practitioners and Technical; Life, Physical, and Social Sciences; Management; Business and Financial Operations; and Computer and Mathematical occupations to name a few. Again, these occupations have in common the fact that they require similar skills and tasks, being considered non-routine cognitive occupations.

In fact, there is a large similarity on the public sector wage differentials across some specific occupations that can be defined according to their necessary set of skills and tasks. This leads me to follow the literature on the routinization approach to explain the impact of occupational composition in the determination of the public sector wage differential. This approach has been very successful in providing answers to questions like the determinants of the recent technological change (in Autor et al., 2003) and the disappearance of the routine jobs as the main cause of the recent jobless recoveries (Jaimovich and Siu, 2014). Therefore, I aggregate these major occupation categories according the “routinization hypothesis” proposed by Autor et al. (2003) and developed by Goos and Manning (2007), Goos et al. (2009) and surveyed in Acemoglu and Autor (2011). In particular, I follow the aggregation procedure used in Jaimovich and Siu (2014). The Non-Routine Cognitive Occupations (NRC) category comprises all the workers that are in the Management; Business and Financial Operations; Computer and Mathematical; Architecture and Engineering; Life, Physical and Social Sciences; Community and Social Service; Legal; Education, Training, and Library; Arts, Design, Entertainment, Sports and Media; and Healthcare Practitioners and Technical occupations. The Routine Cognitive Occupations (RC) category contains all the workers in Sales and Related and Office and Administrative Support occupations. The Routine Manual Occupations (RM) category includes all the workers in Production; Transportation and Material Moving; Construction and Extraction and Installation, Maintenance, and Repair occupations. Finally, the Non-Routine Manual Occupations (NRM) category comprehends the workers in Healthcare Support; Protective Service; Food Preparation and Serving Related; Building and Grounds Cleaning and
The public sector hourly wage premium for the average worker in each sector was constructed by comparing the hourly wage of the public sector average worker with the hourly wage of the average worker in the private sector. We can decompose this relative wage across sectors to account for the occupational heterogeneity after separating the workers by their occupation category. In particular, let \((w/H)^k\) be the hourly wage for the average worker in sector \(k \in \{G, P\}\) and \(N^k\) to be the total employment in each sector. For an occupation \(j \in \Gamma \equiv \{NRM, RM, RC, NRC\}\) define the hourly wage for the average worker in occupation \(j\) and sector \(k\) to be \((w/H)^k_j\) and \(N^k_j\) to be the total employment for occupation \(j\) in sector \(k\). Using these definitions, we have that the relative hourly wage for the average public sector worker in relation to the average private sector worker can be deconstructed as

\[
\frac{(w/H)^G}{(w/H)^P} = \sum_{j \in \Gamma} \left[ \frac{(w/H)^G_j}{(w/H)^P_j} \cdot \frac{N^G_j}{N^P} \cdot \frac{N^G_j}{N^P} \right]
\]

where the first term reflects the hourly wage differential for the average worker in the public sector with respect to the average worker in the private sector. The second term reflects the relative ratio between the private sector hourly wage for the average worker in occupation category \(j\) with respect to the average private sector worker. Finally, the last term reflects the occupational composition for the public sector by presenting a weighting term that yields the relative importance of occupation \(j\) in the public sector employment. This term tells us that the employment share of each occupation \(j\) is also important for the dynamics of the public sector hourly wage differential. The second term in equation (6) hides also the important of the occupational composition for the private sector employment in determining the public sector average hourly wage premium. Intuitively, \((w/H)^P\) can be defined as a weighted average of the private sector hourly wage per occupation, weighted by the employment share this occupation has on the private sector employment

\[
(w/H)^P = \sum_{j \in \Gamma} \left[ (w/H)^P_j \cdot \frac{N^P_j}{N^P} \right]
\]

implying that we end up with four different mechanisms that can affect the public sector hourly wage differential for the average worker when we consider the occupational heterogeneity as the main decomposition factor: (1) the public sector hourly wage differential for the average worker in each occupation category; (2) the private sector hourly wage valuation of each occupation category; (3) the private sector occupational composition of employment; and (4) the public sector occupational composition of employment.

Figures 6 and 7 present the empirical evidence that allows the identification of the contribution for each factor described in (6) and (6*) to the dynamics of the public sector hourly wage
differential between the average workers in each sector. In particular, Figure 6 reports the relationship between the public sector wage differential and the private sector hourly wage for the occupation categories defined by the (Non-)Routine Manual/Cognitive Occupations for all the years in the sample (1980 to 2013). Figure 7 top panels describe the public sector hourly wage for the average workers in each sector and the public sector hourly wage differential for the average workers each occupation category for each sector. The bottom panels show the occupation employment composition for each sector. The orange solid line and the orange triangles represent the average worker in Non-Routine Manual Occupations (NRM). The red long-dashed line and squares represent the average worker in Routine Manual Occupations (RM). The green dashed-dotted line and rhombi represent the average worker in Routine Cognitive Occupations (RC). Finally, the blue dashed line and circles represent the average worker in Non-Routine Cognitive Occupations (NRC).

![Public Sector Wage Differential: 1980-2013](image)

Figure 6: (Non-)Routine Manual/Cognitive Occupations: Wage Differential Decomposition.

Figure 6 relates the public sector hourly wage differential for the average worker in each occupation category to the private sector hourly wage valuation of each occupation category. The public sector wage differential for the years 1980 to 2013 and more aggregate occupation categories is decreasing in the private sector hourly wage valuation of these occupations’ average worker as it was before for the major occupational categories defined according to the SOC 2000. This implies Fact 1 to be robust to this more aggregate occupation classification.
There is also a certain labor market polarization for the public sector wage differential. The Non-Routine Manual Occupations are characterized by having a very high public sector wage differential and a low private sector hourly wage. The Non-Routine Cognitive occupations are on the other hand characterized by a negative public sector wage differential and a very high private sector hourly wage. For this set of occupations, I would like to stress the positive bias in the public sector wage differential created by the Community and Social Service occupations. Accounting for the inherent characteristics in these occupations we would find that the Non-Routine Cognitive occupations would have a much lower (higher) public sector wage differential (penalty). The average workers in Routine Manual/Cognitive occupations have a similar relationship between the public sector wage differential and the private sector hourly wage. There is a polarization in the labor market for the public sector wage differential because non-routine occupations are both in the high public sector wage differential / low private sector hourly wage (for the manual occupations) or in the low public sector wage differential / high private sector hourly wage (for the cognitive occupations) positions. On the other hand, the routine occupations for both manual and cognitive skills and tasks have a middle public sector wage differential and a middle private sector hourly wage valuation. These results are summarized in Fact 2 that states the existence of a public sector wage differential polarization in the economy.

**Fact 2 (Public Sector Wage Differential Polarization).** There is a public sector wage premium for low-skill, low-wage occupations (NRM) and a public sector wage penalty for high-skill, high-wage occupations (NRC). For the middle wage occupations (RC, RM) the difference between the public and private sector hourly wages is positive but moderate.

A closer inspection to the public sector wage differential polarization result with respect to the hourly wage valuation attributed by the private sector to the routine occupations uncovers the fact that manual occupations have for the average worker higher public sector wage differentials than cognitive occupations. In particular, sorting the occupation categories from highest public sector wage premium to the largest public sector wage penalties we would have first the Non-Routine Manual occupations, then the Routine Manual, the Routine Cognitive and finally the Non-Routine Cognitive occupations. This implies that the polarization result stated in Fact 2 has two different small-scale results attached. On the one hand, Non-Routine Occupations are polarized in the sense that they have the lowest and highest private sector hourly wage valuation in the labor market. This implies that Routine occupations are the middle wage jobs in the economy. On the other hand, the Manual occupations have larger public sector wage premiums than the Cognitive occupations.

Figure 7 analyzes the importance of the employment occupational composition for both the private and public sectors and the dynamic evolution of these employment shares and of the public sector wage differential over time. The heterogeneity present for the public sector wage differential for the average worker for the different occupations is high enough for it to be
one very important channel in explaining the dynamics of the aggregate public sector wage premium. On the other hand, the occupations that are have a higher (lower) public sector wage differential are the ones that have the lower (higher) hourly wage in the private sector. This implies that the employment composition for each sector is also a key factor in determining the aggregate public sector wage differential.

The Public Sector Wage Differential Polarization fact summarizes the relationship between the public sector hourly wage differential for the average worker in each occupation category and the private sector hourly wage valuation of each occupation category. However, it keeps silent about the fact that the employment occupational composition for both the private and public sector can affect the public sector aggregate wage premium as shown in (6) and (6⋆) and its relationship with the public sector wage differential in each occupation. Figure 7 shows the evidence to explicitly analyze these channels.

Given the importance of the occupational employment composition for each sector in the determination of the aggregate public sector wage differential, it is straightforward to relate this literature with the growing trend (both in the empirical evidence and in the literature) of “Job Polarization”. The shrinking concentration of employment in Routine occupations and the increasing trend in the concentration of employment in Non-Routine occupations extends not only to the private sector but also to the public sector. However, the magnitudes of these variations across sectors can have very distinct effects to the public sector wage differential. Job Polarization implies that the Routine employment is decreasing over time in the entire economy. Figure 7 shows that it is actually the case for the occupational employment composition for each sector in this analysis.

We observe a decrease in the employment share for Routine occupations in both sectors. There is a larger decrease in the Routine Manual occupations in the private sector, passing from roughly 40% of the employment in this sector in 1980 to around 24% in 2013. In the public sector this reduction is not as expressive, since there is only a decrease from an employment share in this sector of 11.5% in 1980 to an employment share of 8.4% in 2013. On the other hand, there is a larger variation in the employment share for Routine Cognitive occupations in the public sector, decreasing from an employment share of 25% in 1980 to 16.5% in 2013. In the private sector, there is essentially no change in the employment share of routine cognitive occupations between 1992 and 2013, being around 26% for both time periods. In fact, there was an upward swing in the Routine Cognitive occupations from 1980 to 1992, with a maximum of an employment share of 30%, and a downward swing from 1992 to 2013. Therefore, we can argue that the shrinking of Routine occupation employment affected each sector in a different way. The share of workers in Routine Manual occupations has decreased considerably in the private, while in the public sector the largest reduction was in the Routine Cognitive workers.

This immediately implies that the Non-Routine employment must be increasing over time. The Routine occupations were responsible for around 66% of the total employment in the
Figure 7: Wage Differential and Labor Composition by Occupational Category.
private sector and 35.5% in the public sector in 1980. In 2013, they had in the private sector an employment share of 50% and in the public sector a share of 25%. For the Non-Routine occupations, we need to consider separately the two poles: the NRM and NRC occupations. The Non-Routine Manual employment share is increasing slightly over time for both the private and public sectors. The employment share of the NRM occupations has increased for the private sector from 9.8% in 1980 to 14.8% in 2013, and for the public sector from 16.3% in 1980 to 19.0% in 2013. The largest movements in this occupation category are in the public sector wage differential, that is increasing considerably over time from 43.4% in 1980 to 79.0% in 2013. On the other hand, for the Non-Routine Cognitive occupations we can observe a considerable increase in the employment share for both the private and public sectors. In the private sector, 24.3% of all employment in this sector in 1980 belonged to NRC occupations, while 47.4% of the total employment in the public sector was also directed to NRC occupations. In 2013 the relevance of NRC occupations increased for both sectors. In the private sector the employment share is 35.3% and in the public sector it is 56.2%.

(1) Public Sector Wage Differential: Average Worker (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>NRM</th>
<th>RM</th>
<th>RC</th>
<th>NRC</th>
</tr>
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<tr>
<td>1980</td>
<td>43.4%</td>
<td>-1.7%</td>
<td>1.9%</td>
<td>-10.9%</td>
</tr>
<tr>
<td>2013</td>
<td>79.0%</td>
<td>21.0%</td>
<td>9.4%</td>
<td>-16.2%</td>
</tr>
</tbody>
</table>

(2) Private Sector Hourly Wage: Average Worker ($ 2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>NRM</th>
<th>RM</th>
<th>RC</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>11.8</td>
<td>20.3</td>
<td>17.2</td>
<td>27.5</td>
</tr>
<tr>
<td>2013</td>
<td>11.8</td>
<td>18.4</td>
<td>18.9</td>
<td>32.3</td>
</tr>
</tbody>
</table>

(3) Occupational Employment Composition: Private Sector (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>NRM</th>
<th>RM</th>
<th>RC</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>9.8%</td>
<td>39.9%</td>
<td>26.0%</td>
<td>24.3%</td>
</tr>
<tr>
<td>2013</td>
<td>14.8%</td>
<td>23.9%</td>
<td>26.0%</td>
<td>35.3%</td>
</tr>
</tbody>
</table>

(4) Occupational Employment Composition: Public Sector (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>NRM</th>
<th>RM</th>
<th>RC</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>16.3%</td>
<td>11.5%</td>
<td>24.8%</td>
<td>47.4%</td>
</tr>
<tr>
<td>2013</td>
<td>18.9%</td>
<td>8.4%</td>
<td>16.5%</td>
<td>56.2%</td>
</tr>
</tbody>
</table>


Table 3 compares the aggregate public sector hourly wage differential decomposition factors described above in (6) and (6*) for the years 1980 and 2013. It also supports the evidence in
Figure 6 and 7 by providing the actual values across time periods. The evidence provided in Figure 7 and synthesized in Table 3 allow the importance of occupational composition to the determination of the aggregate public sector wage premium to be seen as an empirical fact.

**Fact 3 (Occupational Composition and Job Polarization).** The occupational composition across sectors has an important effect on the aggregate public sector hourly wage premium. The private sector is more concentrated towards middle wage jobs, with the Routine jobs employment share being 65.9% in 1980 and 49.9% in 2013. On the other hand, the public sector is more concentrated towards Non-Routine jobs, with the NRC jobs employment share being 47.4% in 1980 and 56.2% in 2013, and with the NRM jobs employment share being 16.3% in 1980 and 18.9% in 2013.

The different occupational compositions across sectors are important to differentiate what is the contribution of the public sector wage differential for the average workers in each occupation category, and what is the contribution of the simple fact that one sector may be more concentrated to high wage, high skills occupations than the other. In particular, for the NRC occupations, we observe a public sector wage penalty, implying that for the same employment share in each sector, the NRC occupation workers are driving the aggregate public sector wage differential downwards. However, since the public sector has a higher employment share of workers in these occupations and since the NRC occupations are characterized by having a high wage, this will create an upward pressure in the aggregate public sector wage differential since the additional NRC workers in the public sectors would have been compared with workers in other lower wage occupation categories in the private sector. The opposite result occurs for the NRM occupations. If the employment shares in both sectors were the same, there would be an upward pressure in the aggregate public sector wage differential due to the fact that for the average worker in these occupations, the public sector worker earns 79.0% more than his private sector counterpart. However, since NRM occupations are low wage occupations, the higher concentration in the public sector of workers in these occupations would create a downward pressure in the public sector wage differential, since these workers would need to be compared with middle wage occupation workers in the private sector. The occupational composition of employment in each sector has therefore a major role in determining the aggregate public sector wage differential and should be considered alongside with the public sector wage differential for the average worker in each occupation category. Therefore, one cannot disregard the effects of Job Polarization in determining the aggregate public sector wage differential.

The descriptive analysis executed in this section accomplished one important objective. The public sector wage differential for the average workers in each sector can not be viewed as an informative statistic for policy analysis. When analyzing the differential in wages across sectors, the policy makers should look in particular to the occupational composition of both sectors. Three facts have been advanced here. Fact 1 argues that the public sector wage differential for the average worker in a given occupation category is decreasing across occupations in the hourly
wage of the average private sector worker for those occupations. Fact 2 there is a polarization of the public sector wage differentials. In particular, there is a high wage premium for low-skill, low-wage occupations and a wage penalty for high-skill, high-wage occupations. For the middle wage occupations the difference between the hourly wages for the average worker in each sector is moderate. This polarization in the public sector wage differential opens the path to assess the relevance of occupational composition and job polarization to the determination of the average public sector wage differential. Finally, Fact 3 alleges that this occupational composition is an important channel that is creating a bias in the aggregate public sector wage differential. This implies that one of the possible reasons for the existence of an aggregate public sector wage premium is the fact that the public sector employment is more concentrated in Non-Routine occupations. For the low-wage NRM occupations, the difference in the wages of both sectors are the main channel creating an upward pressure in the public sector wage differential. For the high-wage NRC occupations, there is a public sector wage penalty for the average workers in these occupations but since it is a high-wage occupation category, the higher employment share for the public sector creates an upward pressure to the aggregate public sector wage premium.

Interestingly enough, not much relevance has been given to the importance of considering the aggregate effects of occupational composition to the determination of the public sector wage premium. Up to my knowledge, this work is the first presenting the results described in Facts 1-3. For Fact 3, I am the first to reinforce the relationship between the public sector wage differential and the Job Polarization and to use the occupational classification for (Non-)Routine Manual/Cognitive occupations popularized in this to study the public sector wage differential. In the next section, I will make use of the full micro-level detail contained in the CPS dataset to understand what are the relative effects of demographics, occupational composition and propensities in the determination of the average public sector wage differential.

**IV. Oaxaca-Blinder Counterfactual Decomposition**

The connection between the public sector wage differential for a worker in a given occupation and the private sector hourly wage valuation of that occupation that defined Facts 1-2 can only be established under some aggregation procedure. In the previous section I have employed an aggregation procedure that uses the information about the occupation category the individuals belong to. The usage of these occupation categories as an exogenous instrument to study the public sector wage differential is not something new in the literature. As surveyed in Gregory and Borland (1999), public sector employment tends to be concentrated in professional and clerical jobs, and to require workers with relatively high levels of educational attainment. It is therefore surprising that not much relevance has been given to the aggregate implications that the occupational composition and job polarization can have on the aggregate public sector wage premium observed in the data.

In this section, I complement the findings described in the three facts above by performing
some exploratory Oaxaca-Blinder Counterfactual Decompositions (OB). I assess the effect of occupational composition in the determination of the average public sector wage differential and in the likelihood of belonging to the public sector, after accounting for counterfactual variations in the demographics and propensities. Since the OB decomposition is performed using individual level data, it is impossible to establish a relationship between the public sector wage differential for a given category with the private sector hourly wage valuation of that category. Instead, I identify the effects in the determination of the average public sector wage differential that are due to changes in the occupational and demographic composition, and the effects that are due to unexplained variations in the labor market equilibrium determination of the average public sector wage differential or in the workers’ propensities to make the decision to belong to the private or public sector. The identification of these mutually exclusive effects allows me to discuss the job polarization effect and the consequent importance of occupational composition to the determination of the public sector wage differential and to the likelihood of a worker to belong to the private or public sectors.

The Oaxaca-Blinder counterfactual decomposition for the mean and has been widely applied to both the public sector wage differential literature and the general labor economics literature that relies on counterfactual decompositions across different groups.\footnote{I refer the interested reader to section 4 from Gregory and Borland (1999). For additional examples of counterfactual decompositions to study the changes in the distribution of wages see Machado and Mata (2005) and Blundell et al. (2007). For a recent and very thorough survey on decomposition methods in economics, see Fortin et al. (2011).} The methodology in this section follows closely the specification recently proposed in Cortes et al. (2014), although for a completely different application. In particular, let $y_{i,j}$ to be defined as the natural logarithm of the hourly wages for individual $i$ that belongs to group $j \in \{A, B\}$. The existence of just two groups is a necessary condition. In particular, suppose for the moment we consider group A to be given by the private sector workers and group B to be given by the public sector workers. Additional specifications can be considered. To study the effects of job polarization, one can also consider group A to be the pre-polarization time period and group B to be the polarization period. According to Cortes et al. (2014), I will define as the cutoff between the pre-polarization and the polarization period the year of 1990. This implies that in my specifications the pre-polarization period is defined as the 1980-1989 period and the polarization period is defined as the 1990-2013 period. To model the behavior of $y_{i,j}$ in the labor market consider the following linear model

$$y_{i,j} = X_{i,j}' \cdot \beta + \epsilon_{i,j}$$

(7)

notice that for the case where $y_{i,j}$ is a dummy variable, this is just a linear probability model. In this specification, $X_{i,j}$ is a vector of regressors that includes a set of demographic variables available in the CPS dataset such as a categorical variable to characterize the individuals’ age for six different age bins (16-24, 25-34, 35-44, 45-54, 55-64 and +65 years old), a categorical variable that identifies the education level of the individual (high school graduate or lower,
college graduate or some college, and higher education than a college graduate), a dummy variable for gender, a dummy variable for race (white vs. other races), and a categorical variable that describes the occupation category that the worker belongs to (NRM, RM, RC or NRC occupations). For the baseline group I use the 45-54 years old, high school graduates or lower, white females as the omitted group in my specification. When the occupation category is not specified, I consider the routine cognitive occupations as the baseline. The OB decomposition then works with the estimated coefficients $\hat{\beta}$ in the linear model \((7)\) to decompose variations in the average value for the dependent variable across groups A and B according to

$$\bar{y}_B - \bar{y}_A = \left(\bar{X}'_B - \bar{X}'_A\right) \cdot \hat{\beta}_B + \bar{X}'_A \cdot \left(\hat{\beta}_B - \hat{\beta}_A\right)$$  \((\text{OB})\)

where $\bar{y}_j$ represents the sample average of variable $y$ for the workers in group $j$. The difference in the average values can be thought as the average public sector wage differential or the average likelihood gap for belonging to the public sector, depending whether I use the hourly wages or a public sector dummy variable as the variable of interest. It can be decomposed in two different components. The first term, given by $\left(\bar{X}'_B - \bar{X}'_A\right) \cdot \hat{\beta}_B$, is the component that can be attributed to changes in the demographic and occupational composition across the different groups. The second term, given by $\bar{X}'_A \cdot \left(\hat{\beta}_B - \hat{\beta}_A\right)$, represents the changes in the estimated coefficients $\hat{\beta}$ across the different groups. This term reflects the intrinsic labor market characteristics each sector has and cannot be explained by the different demographic and occupational compositions across groups.

I conduct first a battery of OB decompositions on the natural logarithm of the hourly wage for each worker in the sample, dividing the workers accordingly to whether they work in the public or in the private sector. The results are presented in Table 4. In this specification, group B represents the public sector workers and group A the private sector workers. Column (1) presents the decomposition for the entire sample, defined by the inclusion of all occupation categories for 1980-2013. Column (2) shows the results for the pre-polarization period (1980-1989) and Column (3) for the polarization period (1990-2013), again considering all occupation categories. In columns (4)-(7) I disregard the categorical variable for the occupation categories and I run the OB decomposition for each occupation category. Finally, Columns (8)-(11) display the results for each occupation category the results for the pre-polarization period, and Columns (12)-(15) for the polarization period\(^{12}\).

\(^{12}\)I run the Oaxaca-Blinder decomposing making use of the Stata command “oaxaca”, created by Ben Jann. For further reference, please refer to \texttt{http://www.stata-journal.com/sjpdf.html?articlenum=st0151}. Table 4 presents the decomposition in detail for some selected variables in the explained composition effects and leaves the unexplained effect undetailed. Since the dependent variable is in natural logarithm terms, the coefficients should be interpreted after multiplication by 100%. In all OB decompositions presented in this work I define the levels of significance as follows - * : $p < 0.05$, ** : $p < 0.01$. In parenthesis I present also the standard errors.
### Panel A: Total Sample, Pre-Polarization vs. Polarization, and by Occupation Category.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>2.964**</td>
<td>2.902**</td>
<td>2.983**</td>
<td>3.119**</td>
<td>2.770**</td>
<td>2.894**</td>
<td>2.775**</td>
</tr>
<tr>
<td>Private</td>
<td>2.815**</td>
<td>2.791**</td>
<td>2.822**</td>
<td>3.188**</td>
<td>2.696**</td>
<td>2.758**</td>
<td>2.313**</td>
</tr>
<tr>
<td>Difference:</td>
<td>0.149**</td>
<td>0.112**</td>
<td>0.161**</td>
<td>-0.068**</td>
<td>0.074**</td>
<td>0.136**</td>
<td>0.462**</td>
</tr>
<tr>
<td>Composition</td>
<td>0.149**</td>
<td>0.114**</td>
<td>0.159**</td>
<td>0.074**</td>
<td>0.035**</td>
<td>0.080**</td>
<td>0.157**</td>
</tr>
<tr>
<td>Male</td>
<td>-0.029**</td>
<td>-0.029**</td>
<td>-0.029**</td>
<td>-0.033**</td>
<td>-0.027**</td>
<td>0.007**</td>
<td>0.052**</td>
</tr>
<tr>
<td>Education</td>
<td>0.075**</td>
<td>0.059**</td>
<td>0.080**</td>
<td>0.070**</td>
<td>0.005**</td>
<td>0.018**</td>
<td>0.042**</td>
</tr>
<tr>
<td>Occupation</td>
<td>0.047**</td>
<td>0.027**</td>
<td>0.052**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexplained</td>
<td>0.0001</td>
<td>-0.0022</td>
<td>0.0015</td>
<td>-0.143**</td>
<td>0.039**</td>
<td>0.056**</td>
<td>0.305**</td>
</tr>
</tbody>
</table>

### Panel B: Pre-Polarization vs. Polarization by Occupation Category.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
<th>(12)</th>
<th>(13)</th>
<th>(14)</th>
<th>(15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>3.077**</td>
<td>2.716**</td>
<td>2.862**</td>
<td>2.683**</td>
<td>3.131**</td>
<td>2.790**</td>
<td>2.906**</td>
<td>2.802**</td>
</tr>
<tr>
<td>Private</td>
<td>3.111**</td>
<td>2.677**</td>
<td>2.807**</td>
<td>2.271**</td>
<td>3.201**</td>
<td>2.702**</td>
<td>2.740**</td>
<td>2.323**</td>
</tr>
<tr>
<td>Difference:</td>
<td>-0.034**</td>
<td>0.039**</td>
<td>0.055**</td>
<td>0.412**</td>
<td>-0.074**</td>
<td>0.089**</td>
<td>0.166**</td>
<td>0.479**</td>
</tr>
<tr>
<td>Composition</td>
<td>0.068**</td>
<td>0.026**</td>
<td>0.094**</td>
<td>0.163**</td>
<td>0.073**</td>
<td>0.044**</td>
<td>0.082**</td>
<td>0.159**</td>
</tr>
<tr>
<td>Male</td>
<td>-0.041**</td>
<td>-0.025**</td>
<td>0.026**</td>
<td>0.072**</td>
<td>-0.033**</td>
<td>-0.028**</td>
<td>0.009*</td>
<td>0.048**</td>
</tr>
<tr>
<td>Education</td>
<td>0.064**</td>
<td>0.002*</td>
<td>0.010**</td>
<td>0.025**</td>
<td>0.070**</td>
<td>0.008**</td>
<td>0.023**</td>
<td>0.048**</td>
</tr>
<tr>
<td>Occupation</td>
<td>NRC</td>
<td>RC</td>
<td>RM</td>
<td>NRM</td>
<td>NRC</td>
<td>RC</td>
<td>RM</td>
<td>NRM</td>
</tr>
<tr>
<td>Unexplained</td>
<td>-0.102**</td>
<td>0.014**</td>
<td>-0.039**</td>
<td>0.248**</td>
<td>-0.147**</td>
<td>0.045**</td>
<td>0.084**</td>
<td>0.321**</td>
</tr>
</tbody>
</table>

Table 4: Oaxaca-Blinder Decomposition for ln (Hourly Wage): Public vs. Private Sector.
I present in each panel the average values for the natural logarithm of the hourly wage for both the public and private sectors, and the difference between both sectors as defined in (OB). I exhibit the contribution of the explained composition factors to this wage gap between the public and private sectors, as well as the contribution of the unexplained variations in the coefficients. I highlight the effects of composition changes in gender, education and occupation. I do not report the effects of the age categorical variable because it indicates for all the empirical specifications followed that the public sectors are older than the private sector workers. This creates an upward pressure in the public sector wage differential. Additionally, for the specifications that consider solely one occupation category, the occupation categorical variable is dropped and the category considered is reported instead. Panel A exhibits the general results for the total sample and all time periods, for the total sample defining the differences between the pre-polarization and polarization time periods, and finally for each occupation category separately.

In Column (1) it is shown the existence of a significant public sector wage premium. The public sector workers earn on average a hourly wage premium of 14.9% in relation to the average private sector workers. This premium is due entirely to the “explained” factors. In particular, there is a large demographic contribution from education (7.5%) and from age (5.8%). The fact is that the public sector workers are on average more educated and older than the private sector workers, driving their wages upwards. This is a very common finding in the literature and can be reviewed in Gregory and Borland (1999). Interestingly enough, the contribution of the occupation composition is extremely significant as well to the public sector wage premium, explaining around 30% of the total wage gap, with an absolute contribution of 4.7% out of the total 14.9% wage premium. The unexplained facts seem to be irrelevant in explaining the public sector wage premium. We can also consider what were the structural changes that were brought by job polarization to the determination of the public sector wage differential across sectors.

Columns (2) and (3) allow us to analyze this specific case. Both in the pre-polarization and polarization periods there is a public sector hourly wage premium. This premium has increased with polarization, passing from 11.2% in the pre-polarization period to 16.1% in the polarization period. Again, the wage gap across sectors seems to be fully explained by the demographic and occupational composition. Interestingly enough, the polarization period coincides with a large increase in the explanatory power of both education and occupation to the determination of the public sector wage differential. In the pre-polarization, the differences in educational composition explained 5.9% and occupational composition explained an absolute 2.7% out of the public sector wage premium of 11.2%. After polarization, the public sector wage premium increased to 16.1%. This coincided with an increase in the contribution of this difference from the education and occupational compositions. In summary, the main message for the more general analysis argues that there is a significant public sector hourly wage premium. Interestingly enough, the public sector workers are more educated, older and belong to higher
paid occupations than the public sector workers. In addition, there is a consistent decrease of male workers in the public sector in relation to the private sector. The demographic and occupational composition effects are therefore of extreme importance in explaining the public sector wage premium, as it has been emphasized throughout this text.

The importance of occupational composition in the determination of the public sector wage premium even after controlling for the gender, age and education of the individuals in each sector suggest a very different labor market equilibrium outcome across distinct occupation categories. This should not be surprising after the evidence exhibited in Section III. To develop this idea I consider in columns (4)-(7) an OB decomposition for the public sector hourly wage premium for each of the occupation categories separately and for the time period comprising all years in the sample. In addition, columns (8)-(11) perform the same decomposition for the pre-polarization period, and columns (12)-(15) for the polarization period. By doing so, we can see how polarization has affected the contributions of both the demographic composition factors and the unexplained factors that derives from different labor market equilibrium behaviors across sectors for each occupation. There is a public sector wage penalty for the NRC occupations that is more accentuated in the polarization period than in the pre-polarization, relatively mild wage premiums for the Routine occupations and a large public sector wage premium for the NRM occupations. The effect of polarization in the premium for the routine occupations is astonishing, with routine cognitive occupations passing from a public sector wage premium of 3.9% to a wage premium of 8.9%, and with routine manual occupations increasing their public sector wage premium of 5.5% to 16.6%. The polarization in the public sector wage differential seems to be a consequence of job polarization, with structural variations in the public sector wage differential across occupation categories.

The composition effect seems to create an upward pressure in the public sector wage differential for all the occupation categories individually and for both the total, pre-polarization and polarization time periods. This again is the evidence that over time the public sector workers are older and more educated than the private sector workers. It is also interesting to observe that the gender composition of both sectors drive the public sector wage differential downwards for Cognitive occupations and upwards for Manual occupations, with higher values in absolute value for Non Routine occupations than for Routine occupations. Controlling for the job polarization does not change the upward pressure influence of the composition effects in the public sector wage differential. This implies that the heterogeneity across the public sector wage premiums for different occupation categories comes not from the composition effects but from the unexplained changes in the coefficients. Interestingly enough for the high-skill, high-wage NRC occupations there is a significant downward pressure from differences in coefficients across sectors, a mild upward pressure for routine occupations, and a large upward pressure for NRC occupations. This implies that the private sector values more NRC occupations and the public sector values more NRM occupations. For the Routine occupations the composition of each sector is more relevant in determining the public sector wage differential, explaining
roughly 50% of the observed public sector wage premium, being the other 50% explained by the different variations across sectors.

The results for the contribution of the unexplained differences in the valuation of each sector for the public sector wage differential can be viewed as a statistical test related to the Fact 1 described above. The Negative Monotonicity Fact argued that the public sector wage differential for the average workers in a given occupation category is decreasing in the hourly wage valuation of the average private sector worker. This is exactly the same message translated by the unexplained effects. The private sector values more the NRC occupations (between 10.2% and 14.7% more), has a relatively similar, although in general smaller valuation for the Routine occupations (between -3.9% and 8.4% for the RM occupations and between 1.4% and 4.5% for the RC occupations), and a much lower valuation for the NRM occupations (the public sector attributes a value above 24.8% for these occupations than the private sector). The effects of job polarization are therefore clear. Not only composition matters for describing the public sector wage differentials for each occupation categories, but especially the intrinsic valuations by each sector to each occupation matter. For the Polarization period, the results of Fact 1 are clear, NRM occupations are the least valued by the private sector and have the largest unexplained differentials. NRC occupations are the mostly valued by the private sector and have a large negative unexplained differential. The Routine occupations are in the middle of the private sector wage distribution and have the smallest unexplained differentials in absolute value. This evidence goes also in line with the Public Sector Wage Differential Polarization described in Fact 2. There is indeed a public sector wage premium for low-skill, low-wage occupations (NRM) and a public sector wage penalty for high-skill, high-wage occupations (NRC). This can be seen in these unexplained differentials after controlling for the demographic composition of the sample. For the middle wage occupations (RC, RM) the public sector wage differential is mild.

The combination of results for the OB decompositions for all the occupation categories presented in Columns (1)-(3) and for each occupation category separately shown in Columns (4)-(15) allows us to argue again that occupational composition affects the determination of the public sector wage differential and that the job polarization has significant effects on the public sector wage differential for each occupation category. From the results in columns (4)-(15) we have concluded that there is a large unexplained variation in the coefficients across different sectors that affect the determination of the public sector wage differential. However, these unexplained variation is higher for the polarization period than for the pre-polarization period. This is provides some exploratory evidence for the argument that job polarization affects the public sector wage differential for each occupation category. Additionally, the inclusion of occupational composition in the empirical specifications for the average public sector wage differential immediately turn the unexplained components to be not statistically significant. The contribution of the occupation composition to the public sector wage differential is large, being around 30% of the total differential presented. Again the effects of job polariza-
tion appear in this specification. In Column (2) the occupational composition explain around 24% of the total public sector wage differential and in Column (3) around 32%. The increase in the relevance of occupational composition for the determination of the public sector wage differential in the polarization period is again evidence that Job Polarization may be affecting the wage differential across sectors.\textsuperscript{13}

The results in Table 4 have therefore confirmed the relevance of occupational composition and heterogeneity in determining the aggregate wage premium. A related and extremely important question is whether the demographic and occupational compositions have changed the likelihood of a worker to belong to the public sector. From 1980 to 2013 there was a significant decline in the public sector labor share from 19.3% to 16.8%. In order to determine whether the demographic composition, occupational composition, or changes in the unexplained propensities over time have driven the public sector labor share downwards as time goes by, I apply a bunch of OB decompositions with a dummy variable that defines the sector of each worker as the dependent variable.

I define the benchmark group A to be given by the year 1980, while group B is respectively given by the years 1990, 2000, 2005, 2010 and 2013. The vector of regressors $X_{i,j}$ includes a set of variables that can account for the demographic composition over time such as the age of each worker (with a quadratic formalization), a dummy variable for gender and race (white vs. other races), a categorical variable to identify the level of education for each worker (high school graduate or lower, college graduate or some college, and higher education than the bachelor degree), and finally a categorical variable that describes the workers’ occupation. For the baseline omitted group in my specification I consider the white women that are high school graduates or lower working in Management occupations. To highlight the fact that some occupation categories are extremely concentrated in one of the sectors and to make use of the additional occupation heterogeneity that is shown in the previous section, I define the categorical variable for the occupations to match the major occupation categories from the SOC 2000. The richer occupational heterogeneity in comparison to the (Non-)Routine Manual/Cognitive classification is more prone to identify the effects that come from structural changes in the occupational composition over time and the time variations in propensities have in determining the changes over time in the likelihood of a worker to be in the public sector. The empirical results are described in Table 5.\textsuperscript{14}

I differentiate between the explained composition

\textsuperscript{13}Not shown in this text for the sake of brevity, I have run an OB decomposition similar to (1)-(3) without including the occupational composition in the set of regressors. Two things change in the analysis: (1) the unexplained component turns out to be statistically significant with a p-value of 1%, and (2) the explained contribution from the educational composition is now much higher than the results presented in Table 4. The effects of age and gender remain very similar to the ones showed in this analysis. We can take two messages from this. First, occupational composition is the factor that identifies the unexplained components in the analysis in (1)-(3). Second, the occupation categories we have constructed are very linked and even related with the educational composition. Please refer to Acemoglu and Autor (2011) for additional details on the construction of these categories and its relationship with the individuals’ education.

\textsuperscript{14}I do not present here the full details that come from the particular specification for the OB decomposition I use. The details for the remaining variables can be provided if requested. In all the columns I define the level of significance as - * : $p < 0.05$, ** : $p < 0.01$. In parenthesis I present the standard errors.
effects and unexplained time variations in propensities and I show the full details for both the
education and occupation categorical variables.

The dynamics for the public employment share are entirely due to the unexplained factors. The
demographic and occupational composition changes over time predict an accentuated increase
in the likelihood of the worker to belong to the public sector in comparison to the share ob-
erved in 1980, which is not actually a feature of the data. Specifically, the total composition
effect implies that if the propensities to go to the public sector had stayed the same as in 1980,
the public sector share would have increased over time, reaching an increase of more than 5
percentage points for 2010 and 2013. This is mainly due to the contribution of the occupational
composition, that explains almost half of the total increase predicted by the sum of all com-
position effects. The total propensity effect implies that the public sector employment share
would have decreased if the composition was the same as in 1980. Obviously this second effect
is much stronger than the first one, since the public sector employment share has decreased
over time. In particular, two propensity effects must be considered. The main driver of the
decrease in the public sector employment share seems to come from time variations of the con-
stant term. This term can be interpreted as the change in the conditional change in the public
sector employment share for the omitted group (white women, high school graduates or lower,
working in a Management occupation). This effect has decreased the public sector employment
share by more than 7 percentage points for the years 1990, 2000, 2005 and 2013. The fact
that the propensity effect for the occupation categories is positive and statistically significant
means that the heterogeneity in the occupation categories can be also seen in these unexplained
factors. The fact that the Management occupations are part of the NRC occupations implies
that there may be variations for other type of occupations such as the Routine occupations,
which have decreased their employment share in the public sector by less than the decrease
observed for the private sector and the NRM occupations that have increased their employment
share in the public sector by slightly less than in the private sector.

It is not therefore surprising to observe a statistically significant propensity effect for the oc-
cupation coefficients over time. Interestingly enough, the effect for the propensities of some
key demographic factors such as the age of the workers drives the total propensity effects, after
accounting for the contribution in the propensity changes for the omitted group and for the
differences in the propensity for the different occupations. These propensities for demographic
factors are particularly relevant for 2010, in which we do not observe a significant effect in the
propensities for the occupation categories and for the omitted group.

In summary, in this section I have performed a set of Oaxaca-Blinder counterfactual decom-
positions for the average worker to assess the importance of the occupational composition to
the determination of the public sector wage differential. As discussed in the previous section,
there are four important factors to understand this question. The first is the private sector
hourly wage valuation across occupations that allows us to understand the connection across
the two different sectors in the labor market. The second is the public sector hourly wage
Table 5: OB decomposition for a worker’s likelihood to be in the public sector over time.

differential for each occupation, that compares the public sector hourly wage with the private sector hourly wage. From the first set of OB decompositions illustrated in Table 4 I manage to establish a negative monotonicity result between the public sector wage differential and the private sector hourly wages across occupations and to signal the existence of a public sector wage differential polarization. The third and fourth important factors to be considered are the occupational employment composition for each sector. Two effects must be considered here: the impact of the occupational composition for the determination of the public sector wage differential and for the likelihood of an individual to work in the public sector. I have shown that the occupational composition creates an upward pressure in the public sector wage differential and that job polarization may be affecting the wage differential across sectors. Additionally, the occupational composition is creating an upward pressure on the public sector employment share, compensating the decrease in this share due to unexplained effects that affect all the workers in the sample.
V. Conclusions and Future Research

Throughout this paper I have argued that the aggregate public sector wage differential for the average worker in each sector hides a large distributional heterogeneity and so, it is not a very informative statistic for policy analysis. I contribute to the literature by carefully reviewing the empirical evidence on the main drivers and on the existence of the public sector wage differential using individual-level annual data from the March Supplement of the Current Population Survey (March CPS) and providing three new empirical facts that reinforce the role of the occupational composition in the determination of the public sector wage differential. The periodical surge of nationwide headlines on the behavior of the wages in the private and public sectors put the public sector payroll under the public opinion’s spotlight whenever there are some budgetary pressures for the government to reduce expenditures. Looking to the public sector wage differential at the “macro” level, one would find an expressive public sector wage premium over time.

In the current macroeconomics research, in modeling the effects of fiscal policy there is no recognition of the existence of a public sector in the labor market and the budgetary implications of the wages that are paid to these public sector workers. There are few exceptions to this simple remark but three distinct examples can be found in Ardagna (2001), Cavallo (2005), and Quadrini and Trigari (2007).

Ardagna (2001) assesses the effects of fiscal policy composition on the public debt and on the level of economic activity. In particular, she decomposes the government budget constraint in several distinct pieces: final goods bought from the private sector, transfers to the private sector, distortionary taxes on labor and capital, debt issuance and most importantly, the existence of a public sector in a competitive labor market. She shows that in her framework an increase in public employment can have a negative effect on the economy even when this increase is financed by lump-sum taxes. In her analysis the public sector wages are however perfectly matched with the private sector. This happens due to the existence of a representative worker and a perfectly competitive labor market.

Cavallo (2005) distinguishes between the goods and employment expenditures in the government budget constraint to assess the effects of fiscal shocks on the economy. Cavallo (2005) extends the analysis pioneered in Burnside et al. (2004) by including the public sector hours in the set of exogenous fiscal policy variables, including at the same time distortionary taxation on labor and capital income. His results confirm the intuition advanced in Burnside et al. (2004) that the private sector consumption does not decrease much after a large investment in national defense. The application of the public sector employment in this work has a magnification effect. In particular, Cavallo (2005) argues that the neoclassical growth model does not have a very good performance on accounting for the effects of fiscal policy shocks because it considers the government expenditures to be only on goods.
Finally, Quadrini and Trigari (2007) study the business cycle fluctuations introducing a public sector for employment. They model their economy as a two-sector search and matching model with exogenous policy rules that can be latter calibrated to the US economy. In particular, the existence of a public sector in their work implies an increase in the volatility of total employment and output, which are important empirical facts that the standard neoclassical growth model and the standard search and matching model fail to account for. However, in their analysis, Quadrini and Trigari (2007) calibrate their fiscal policy rules to account for a low cyclicality of public wages and employment and for a premium paid on average to the public sector workers.

I contribute to this literature by providing three new robust empirical facts relating the occupational heterogeneity with the determination of the public sector wage differential. The first reflects a negative monotonic relationship between the public sector wage differential and the private sector hourly wages across occupations. The second signals the existence of a public sector wage differential polarization, in which low-skill and low-wage occupations have very high wage premiums, high-skill and high-wage occupations have wage penalties, and the occupations in the middle of the distribution have smaller differentials across sectors. Lastly, the third fact argues that the public sector wage differential is affected by the occupational employment composition across sectors and therefore it is affected by the job polarization structural trend that is occurring in the labor market since 1990. To test the robustness of these results I execute a battery of Oaxaca-Blinder counterfactual decompositions for the average worker. The main conclusion is that the occupational composition is important both for the determination of the average public sector wage differential and for the determination of the public sector labor market share over time.

As it is argued in this paper, the occupational heterogeneity across workers is crucial in determining the public sector wage differential, since some occupations have public sector wage penalties (NRC), some occupations have large public sector wage premiums (NRM), and some occupations have mild public sector wage penalties and premiums (RC, RM). This implies that the main challenge for future research comes from modeling the evidence provided here in a dynamic general equilibrium framework. The macroeconomics literature that search for a theoretical workhorse to model the public sector employment is still limited and to my knowledge only Albrecht et al. (2014) tries to account for the effects of heterogeneity across workers in the determination for the public sector employment. They assume the workers are heterogeneous in terms of their human capital and that productivity is match specific, being the distribution of this productivity more favorable as we consider more highly skilled workers in terms of their human capital accumulation. Two key characteristics differentiate the evidence provided here and in their work. First, they focus on human capital accumulation (Education) instead of focusing on the workers’ occupational choice. Second, they focus their conclusions on the public sector employment and not on the public sector wage differential. In my opinion, given the lack of a workhorse for the determination of the public sector wage differential and employment this is an exciting field to be working on.
VI. References


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