The Federal-Private Wage Differential: How Has It Evolved?

SUN-KI CHOI[*]
St.Lawrence University

JOHN GAREN[†]
University of Kentucky

AUGUST 4, 2020[‡]

Abstract

This paper is the first to document and analyze the variation of the federal-private pay differential over time. We estimate the evolution of the federal-private pay differential from 1995 to 2017 using Current Population Survey data, enabling us to examine the current pay gap and how it has changed. To do so, wage regressions are estimated by year and used to calculate the yearly federal-private wage differential. To deal with unobserved heterogeneity, we adopt control function methods. We also estimate of the probability of receiving employer-provided health insurance and a pension plan each year for each sector. The findings imply that the federal pay differential is invariably positive, but has varied substantially. We examine the reasons for this variation and find that the most robust result is the positive effect of federal spending as a share of GDP, implying that a 1 percentage point increase in federal spending as a share of GDP raises the federal pay differential by 1.3 to 1.75 percentage points.

---

[*]Contact Information: Sun-Ki Choi (Corresponding author), Department of Economics, St. Lawrence University, 204 Hepburn, 23 Romoda Dr., Canton, NY 13617; Email: schoi@stlawu.edu, Phone: (315) 229-1874, ORCID: 0000-0001-7665-5722

[†]Contact Information: John Garen, 223P Gotton College of Business and Economics, University of Kentucky, Lexington, KY 40506; Email: jgaren@uky.edu

1 Introduction

There is long-standing interest in labor economics about the compensation of government workers relative to their private-sector counterparts. The modern, human capital/Mincerian wage equation approach to this topic was pioneered in a series of papers by Smith (1976a, b, 1977). More currently, there has been recent revival of interest in the issue with recent examinations of government wage differentials.[1]

Though the current wage and compensation difference of public and private employees is of interest, our paper focuses on federal and private-sector workers and we produce and examine an over two-decade time series of the this pay differential. This long-term look at variations in the federal-private wage differential has never been done before and we find substantial changes over time. Moreover, we endeavor to explain this variation. Though we find that the federal pay advantage is invariably positive, averaging 13.2% over the sample period, it has varied a good deal from a low of 4.3% in the late-1990s to a high of 18.4% in the mid-2010s. Generally, this differential fell through the late 1990s, rose steadily in the 2000s until 2013, then tended to decrease. We also estimate the relationship of the federal wage differential to a host of economic/political factors, including the business cycle, overall economic growth, trends in the skill differential, federal spending, and political affiliation of the president. We find that the most robust factor affecting the federal wage differential is federal spending as a share of GDP. Each 1 percentage point increase in federal spending as a

---

[1]Examples are Congressional Budget Office (2012, 2017), Bradley (2012), and Biggs and Richwine (2011) who examine the federal-private compensation differential, Gittleman and Pierce (2012), Munnell (2011), and Allegretto and Keefe (2010) who study state and local government pay, and Bewerunge and Rosen (2012) who investigate all levels of government compensation.

share of GDP is associated with a 1.3 to 1.75 percentage point increase in the federal-private pay differential.

We study the time period from 1995 to 2017. For wages and salaries, we use the CPS Merged Outgoing Rotation Group (CPS MORG). Also, there are well documented differences in federal and private fringe benefits and we examine these using the March Current Population Survey (CPS). For this analysis, we estimate the probabilities that private sector and federal sector workers receive health insurance and pension benefits from their employers. In addition to the pattern of wage differentials noted above, federal workers have much higher probabilities of receiving employer-sponsored pension plans and health insurance, though time patterns in these differentials are not strong.

In our analysis of wages, we deal carefully with unobserved heterogeneity and do so by using control function methods. Naturally, systematic unobserved differences in the abilities of federal and private workers can bias estimates of the wage differentials. The control function approach we adopt allows ability to be two-dimensional rather than one-dimensional. This is consistent with a Roy model, where some workers' unobserved traits make them more suited to one sector and not another. One-dimensional ability is a special case that we test for and reject for most of the years in our data. One-dimensional unobserved ability may be dealt with by instrumental variable (IV) or fixed effects (FE) methods, but because this is frequently rejected in the data, we do not use these methods.[2] Moreover, though the selectivity bias we find is statistically significant in many cases, its magnitude is very small and estimates are nearly identical to those from OLS.

---

[2]Our approach is consistent with the work of Heckman, Urzua, and Vytlacil (2006) and, more recently, Eisenhauer, Heckman, and Vytlacil (2015) on Roy models of heterogeneous treatment effects.

The remainder of this paper proceeds as follows. Section 2.1 briefly reviews the past literature on public-private wage differentials and relates it to our work. Section 2.2 provides an overview of federal rules on compensation. Section 3 describes the main dataset, the CPS MORG, and presents summary statistics for the main variables. Section 4 presents the results from the OLS wage equations. The handling of the unobservables and the findings are discussed in Section 5. Section 6 examines how the probability of pension plan and health insurance coverage differ between federal and private workers. In Section 7, we examine how the time path of the federal-private wage differential depends on federal spending, the business cycle, economic growth, the skill differential, and presidential party. Lastly, Section 8 concludes.

2   Background

2.1   Past Literature[3]

Wage differentials between public and private sector employees have been well documented starting with Smith's seminal series of papers (1976a, 1976b, 1977). Smith (1976a) found that in 1960, federal workers were paid more than comparable private sector workers and this wage advantage continued in 1970. Smith (1977) also found that the government wage differential varied by level of government - federal, state, or local - and by gender. This work was revisited by Moulton (1990), who found that accounting for better occupational controls and differences in local labor market conditions, the federal wage advantage was

---

[3]A more extensive review is in Choi (2016).

reduced but did not eliminated.

These and similar issues have been addressed in more recent work. Bewerunge and Rosen (2012) examine federal, state, and local compensation differentials for 2004 and 2006 and find a substantial wage premium for federal workers, very little wage differences for state and local workers, but workers at all levels of government attain higher fringe benefit compensation. Biggs and Richwine (2011) investigate federal wage and fringe benefit differentials for 2005 to 2010, while Congressional Budget Office (2012, 2017) do so for 2005 to 2010 and 2011 to 2015, respectively. Each finds a higher wages and more fringe benefits for federal workers, though these advantages are smaller at higher levels of education. Bradley (2012) summarizes some of this recent work as well as noting methodological issues.

Other work has investigated public-private wage differentials in other countries, especially for the European Union. See Bargain and Melly (2008), Giordano, et al. (2011), and Castro, et al. (2013). They find positive pay differentials in favor of the public sector. Other recent studies have focused solely on state and local government workers, including Munnell et al. (2011), Allegretto and Keefe (2010), and Gittleman and Pierce (2012). As with related studies, they find no consistent wage differential for state or local government workers, but both groups of government workers are have greater fringe benefit compensation.

While the literature is fairly thorough regarding wage and benefit differentials for government workers at a point in time, little has been done to determine how they may have changed over time and what explains those changes. However, several studies have dealt with closely related issues.

A number of papers consider the growing skill differential in the private sector, as well

as the responsiveness of government pay to market conditions, and how they may affect the public-private wage gap. A growing skill differential in the private sector, combined with a slow or muted adjustment in public sector wages, can lead to a shrinking federal pay advantage. Katz and Krueger (1991) note that during the 1980s growth in the private-sector skill differential, there was not much change in federal wages in this regard. They indicate, though, that state and local government wages seemed more responsive to local economic conditions.

Related to this, Borjas (2003) examines the skill differential and wage dispersion from 1960 to 2000 in the public and private sectors. The greater growth of wages at higher skill levels in the private sector is verified and he shows that this growth was not matched in the public sector, resulting in relatively less wage dispersion. Borjas (2003), however does not consider that time path of government compensation differentials.

In a similar vein, Freeman (1987) also considers the sensitivity of government pay to economic conditions. Business cycle downturns may lead to slower private wage growth as well as tighter government budgets. Both can affects the government wage differential. Freeman's (1987) empirical work finds that state and local government wages and employment respond to their respective government budgets, but with no clear patterns regarding federal workers.

In our analysis below, we flesh out these issues more thoroughly and examine the sensitivity of the federal wage differential to the business cycle as well as to changes in the growing skill premium in the economy.

Borjas (1980) discusses political influences on government worker wages. In particular,

he examines wage differentials across similar individuals in different federal agencies. He finds that agencies with small and well-organized constituencies have higher wages, as do those that have more homogeneous interests. These findings are in keeping with models of political and interest group influence.

In the analysis of our paper, we do not have cross-agency variation in pay among federal workers, but rather cross-time variation in federal pay relative to private-sector pay. Nevertheless, political influence over the average level of federal pay is possible. We explore this in our empirical work below.

An econometric issue that we analyze with care is the role of unobserved productivity. For example, suppose federal workers are better on unmeasured dimensions and earn higher compensation as a result. This generates an ability bias, where the positive federal pay gap may, in part, reflect higher ability rather than a true pay premium. It is important that we handle this issue appropriately so that our wage differential estimates are not subject to the ability bias or related biases. A handful of papers in the literature on government pay differentials have dealt with this issue.

Some authors have utilized fixed effect estimation to do so. Krueger (1988) does so with two data sets. One is Current Population Survey (CPS) matched data from the mid- to late-1970s. The other is CPS supplements on displaced workers from the mid-1980s. The former data show a small and insignificant effect of federal employment with the fixed effects estimator, compared to a large, positive and significant effect in the cross-sectional analysis. The latter show little difference between estimation methods: a 10.7 percent federal wage premium with fixed effects and a 12.6 percent gap with OLS. Biggs and Richwine (2011)

6

find a 9 percent federal wage gap from a sample of individuals from 2004 to 2008 in the Survey of Income and Program Participation. This compares to their OLS estimate of a 14 percent pay gap using CPS data.

Gyourko and Tracy (1988) deal with unobservables via control function methods. Using data from the 1977 CPS, they estimate the union-nonunion wage differential for the private and public sectors and the government wage differential for union and nonunion workers. They find a substantial wage differential for federal workers, but quite small differentials for state and local government employees. Interestingly, they find positive selection for private, nonunion workers and negative selection for public, union workers. This suggests that the ability bias may go in direction of underestimating the government wage differential. Also, their approach enables unobservables to affect wages in the different sectors in different ways, i.e., that ability may be multidimensional where someone may good in one sector but not in another.[4]

In our data analysis, we consider these issues carefully. In particular, we allow the more flexible unobserved heterogeneity as in Gyourko and Tracy (1988) and as developed more thoroughly in Heckman, Urzua, and Vytlacil (2006).

2.2 Federal Rules on Compensation

The private sector and federal government are potential competitors as employers in the labor market. In light of this, the federal government has devised compensation rules in order to pay comparably to the private sector with both its basic pay system and its

---

[4]Van der Gaag and Vijverberg (1988) apply similar methods in their analysis of public and private wages in the Ivory Coast.

adoption of special rates.[5] Here, we give an overview of those systems. According to U.S. Office of Personnel Management (OPM), the basic pay rules are also divided into two parts, General Schedule (GS) and the Federal Wage System (FWS). The GS classification and pay system covers the majority of the civilian white-collar federal employees in professional, technical, administrative, and clerical positions. The GS has 15 grades from GS-1 (lowest) to GS-15 (highest). Each grade is classified by job based on the responsibility, level of difficulty, and qualifications required. Each grade has 10 within-grade steps that are each worth approximately a 3 percent increase in the wage. The FWS was established for Federal blue-collar workers comparable to prevailing private sector rates in each local wage area. The FWS covers Federal trade, craft, and laboring employees. There are two basic principles for FWS: 1) wages are set according to local prevailing rates, and 2) there will be equal pay for equal work and pay distinctions in keeping with work distinctions. For each wage area, OPM identifies a lead agency that is responsible for conducting wage surveys, analyzing data, and issuing wage schedules under the two principals above. Employees are paid the full prevailing rate at step 2 in each grade. The highest step in FWS, step 5, the wage of employees is 12 percent above the prevailing rate of pay.

OPM establishes a higher rate of basic pay for a group or category of GS positions in one or more geographic areas to address existing or likely significant handicaps in recruiting or retaining well-qualified employees. The special rates address staffing problems caused by significantly higher non-federal pay rates than those payable by the federal government within

---

[5]A special rate is higher rate of basic pay for a group or category of General Schedule (GS) positions in one or more geographic areas to address existing or likely significant handicaps in recruiting or retaining well-qualified employees.

the area, location, or occupational group involved. This includes the remoteness of the area or location involved, the undesirability of the working conditions or nature of the work involved, or any other circumstances OPM considers appropriate. Most of GS employees are entitled to locality pay, which is a geographic-based percentage rate that reflects pay levels for non-federal workers in certain geographic areas as determined by surveys conducted by the U.S. Bureau of Labor Statistics (BLS). There are currently 34 locality pay areas, which cover the lower 48 States and Washington D.C., plus Alaska, Hawaii, and the U.S. territories and possessions. For extraordinarily difficult living conditions and undesirable working conditions, the federal government pays both a cost-of-living allowance (COLA) and a post differential. A post differential means an addition to basic pay that is payable in selected non-foreign areas. A post differential is a recruitment incentive based on conditions of the environment in the non-foreign area that differ significantly from conditions in the U.S. as a whole. However, post differentials plus the COLA cannot exceed 25 percent of basic pay. These are reflected in our data on compensation and our examination of federal pay relative to private pay.

In addition, there is an overall COLA that raises basic rates of pay for each pay grade. The amount of this COLA is based on the Employment Cost Index. However, the President may alter or eliminate this pay increase due to unfavorable economic conditions. In fact, for 2011, 2012, and 2013, this COLA was set to zero. This does not mean, however, that federal pay raises during this period were zero. Federal employees may still obtain raises through moving up in steps or grades, as well as through changes in the area-based or other adjustments noted above.

3 Basic Data

Our primary data source is the Current Population Survey Merged Outgoing Rotation Group (CPS MORG) from the National Bureau of Economic Research (NBER) between 1995 and 2017.[6] In recent years, each monthly CPS has included about 140,000 individuals living in approximately 70,000 households. Using the MORG data instead of the March CPS yields much larger number of observations because the MORG data is monthly. Each month's observations for a given year naturally form the pool of observations we use for that year. From the earnings and hours questions, we compute average hourly earnings and express in inflation-adjusted 2017 dollars. The usual demographic variables are utilized, as well as the sector of employment: private, federal government, or other government. We limit our sample to those who worked at least 35 hours per week and are age 18 to 70.

Table 1 summarizes the mean wages of private workers and public sector workers from 1995 to 2017.[7] Separate columns are presented for private sector workers, along with federal, state, and local government workers, with the latter two categories shown for informational purposes only. The focus of this paper is the federal-private differential. Figure 1 shows the unadjusted federal-private ratio over time. The ratio of average federal to average private sector wages is over 30 percent in each year and is over 40 percent in some years. This ratio fell during the initial years of our sample time frame, then increased over time.

---

[6]The starting period of our analysis is somewhat arbitrary. We wish to have a manageable number of years to handle, yet capture a time period with variations in business cycle conditions, federal spending, and political conditions. We judged that starting in 1995 satisfied these.

[7]We follow standard Census methods for dealing with the top-coding of earnings. Burkhauser, et.al. (2008), when comparing income distributions and trends in the public CPS data to that of a more detailed internal version, find that the top-coding does not make significant differences.

Regarding non-wage compensation, we also examine coverage of workers by employer-provided health insurance and a pension plan. We rely on the annual March supplement of the CPS for this analysis since data on these variables are only available then. The only information in this regard is whether the worker has coverage or not. Ideally, we would like to know the dollar value of these benefits, as well as other non-wage benefits.[8] This would give a more complete picture of the total compensation package. Unfortunately, data are very limited in these respects. Our justification for examination of health insurance and pension plan coverage is based on the practicality of data availability, and also recognizing the importance of these two particular fringes.

Table 2 and Figure 2 show the percent of workers covered by employer-based health insurance and pension benefits for the federal and private sectors. In each year, federal worker coverage exceeds that of the private sector for both of these fringe benefits. On average over this period, federal employees have a 12.3 percent higher coverage rate for health insurance (87.1 percent compared to 74.8 percent) and 32.3 percent higher for pension plan coverage (76 percent relative to 43.7 percent).[9]

Table 3 present the summary statistics of variables that are included in our multivariate analysis. All wages in the data are expressed in 2017 dollars. In the entire sample period, 3.2 percent of individuals were working in the federal government. On average, these workers had more schooling, were slightly older, more likely to be unionized, more likely to be black,

---

[8]These can include items such as stability of work schedules, opportunities for advancement, and equality of opportunity in the workplace.

[9]Note that there are modest downward trends in health insurance and pension plan coverage in both sectors. However, as shown in section 6 below, there is little trend in the federal-private coverage differential. Thus, while the mix of compensation seems to be changing over time (away from insurance), this has little effect on the federal compensation differential.

about equally likely to be female, and more heavily in managerial, professional, and administrative support occupations. Also shown are variables for urban-rural location, regions, and the 34 locality areas that the federal government offers locality wage differentials. Each of these are control variables in our empirical analysis.

Table 4 summarizes mean values of key variables from the CPS MORG data for both sectors over time. The average schooling level has increased in the federal and private sectors by about the same amount, as has average age. Percent female in the two sectors changed little over this time period. We also show the trends in the four occupational groups that comprise roughly 90 percent of federal workers - management, professional, service, and administrative support. The extent of managerial workers varied somewhat over time - falling then rising - among federal workers and rose slightly in the private sector. The percent of professionals rose in both sectors, as did the use of service workers. For administrative support personnel, the percent of the federal workforce in these occupations fell over time while it changed little in the private sector.

4   Baseline OLS Estimation

This section presents OLS estimation of the federal-private wage differential as a baseline for comparison to estimates that deal with unobserved heterogeneity. We estimate two separate equations, year-by-year; one for federal workers only and one for all private sector workers from 1995 to 2017. The equations that we use to estimate the OLS models are below. Here, the dummy variable d_{it} equals 1 if the worker is employed in the federal sector

and 0 otherwise:

$$ln(Y_{it}^f) = \beta_{0t}^f + \beta_{it}^f X_{it} + \epsilon_{it}^f \quad if \quad d_{it} = 1, \ where \ t = 1995, \cdots, 2017 \qquad (1.1)$$

$$ln(Y_{it}^p) = \beta_{0t}^p + \beta_{it}^p X_{it} + \epsilon_{it}^p \quad if \quad d_{it} = 0, \ where \ t = 1995, \cdots, 2017 \qquad (1.2)$$

The variable Y_{it} is average hourly earnings for workers. The term X_{it} is a vector of individual characteristics and demographics including schooling, experience, gender, union status, race, MSA, region, occupation, and locality, and ϵ_{it} is the disturbance term. Their summary statistics are as shown in Table 3 noted above. Regarding the schooling variable, we utilized five schooling categories instead measuring schooling continuously. The five categories are: high school or less; some college; bachelors' degree; masters' or professional degree; and M.D. or Ph.D. Also, we allowed for wage variation by locality-occupation, where locality wage differences vary by occupation.[10] After obtaining estimated coefficients, the predicted federal-private wage differential is computed, evaluated at sample means.

Table 5 and Figure 3 summarize the estimated wage gap between two sectors. Calculating the wage differentials, year by year, using two separate equations from each sector, we find that federal government workers received between 4.5 percent and 18.4 percent more than their counterparts in private sector. Each of these differentials is statistically significant, except the lowest value which occurred in 1999. The mean differential is 13.2% and the standard deviation is 3.6%, so the variation is substantial. These findings suggest that the

---

[10]Not all localities had respondents in every occupation. To deal with this, we aggregated some occupations into broader categories and some localities into a broader region. When comparing the findings with the locality-occupation interactions to those without, the overall federal-private wage differentials estimated each year are very similar.

federal pay differential is invariably positive and, as can be seen, it fell during the 1990s, began to rise in the early 2000s, and generally continued to rise until 2013. Then it began to decrease to the end of the sample period.

5   Dealing with Unobservables

The OLS model assumes that the 'public' variable is uncorrelated with disturbance term, implying that sectoral differences in unobserved characteristics do not affect the estimated wage differential. Here, we relax this assumption.

Let

$$ln(Y_{it}^f) = \beta_{0t}^f + \beta_{it}^f X_{it} + \phi_i + \theta_i^f + \epsilon_{it}^f \quad if \quad d_{it} = 1 \tag{2}$$

$$ln(Y_{it}^p) = \beta_{0t}^p + \beta_{it}^p X_{it} + \phi_i + \theta_i^p + \epsilon_{it}^p \quad if \quad d_{it} = 0 \tag{3}$$

where ϕ_i indicates the worker's absolute advantage in both the federal and private sectors, reflecting 'ability' such that a worker with a higher ϕ_i can earn a higher wage in both sectors. This is the usual person-specific fixed effect. We generalize this by including the terms θ^f and θ^p, which are relative/comparative advantages indicating how well-matched an individual is to each sector. These are as in a Roy model. For example, a person can be well-suited to government work and not for the private sector, implying a large θ^f and a low θ^p. Naturally, other cases are possible. If $\theta^f = \theta^p$ then this collapses to the special case of absolute advantage with only ϕ_i. Note that the formulation of (2) and (3) allows 'ability' to be two-dimensional rather than uni-dimensional. The ϵ_{it}^j terms are white noise for each sector. These equations can be re-written as

$$ln(Y_{it}^f) = \beta_{0t}^f + \beta_{it}^f X_{it} + \epsilon_1 \quad if \quad d_{it} = 1 \tag{4}$$

$$ln(Y_{it}^p) = \beta_{0t}^p + \beta_{it}^p X_{it} + \epsilon_0 \quad if \quad d_{it} = 0 \tag{5}$$

where $\epsilon_1 = \phi_i + \theta_i^f + \epsilon_{it}^f$ and $\epsilon_0 = \phi_i + \theta_i^p + \epsilon_{it}^p$. A common way to deal a model like this with two dimensional unobservables is use of the Heckman-Lee method. Other methods such as instrumental variable (IV) and fixed effect (FE) models deal only with unidimensional ability. As shown below, using a control function approach, we can test whether the unobservable ability is one-dimensional or two-dimensional.[11] To do so, we start with original Heckman-Lee assumption of joint normality. We later relax this assumption in our robustness checks.

The probability of a worker choosing the federal sector may depend on a host of factors, including the wage differential s/he obtains, other differences in working conditions of federal and private jobs, exogenous factors such as the ease finding federal relative to private employment, as well as pure chance (e.g., white noise). The more poorly informed workers are about the two sectors and the jobs involved, the more will be determined by chance. Our approach is agnostic in this regard, but allows for the wage differential to matter. Thus, we estimate the probability of working in the federal sector as depending on the following: any item (observed or unobserved) that affects wages: any factor representing the ease of finding a federal job, represented by the vector Z_i, and pure chance or white noise, represented by u_i. Then the probability of $d_{it} = 1$ is :

---

[11]Our approach aligns with that of Heckman, Urzua, and Vytlical (2006), who consider "essential heterogeneity," where effects differ across individuals and choice are made based on those differences.

$$Pr(d_i = 1) = X_i\delta + Z_i\gamma + \alpha\phi_i + \tau(\theta_i^f - \theta_i^p) + u_i \tag{6}$$

Equation (6) can be written as

$$d_i = V_i\psi + \epsilon_2 \tag{7}$$

$$d_i = \begin{cases} 1 \ if \ \epsilon_2 > -V_i\psi \\[2mm] 0 \ if \ \epsilon_2 \le -V_i\psi \end{cases}$$

where $\epsilon_2 = \alpha\phi_i + \tau(\theta_i^f - \theta_i^p) + u_i$ and $V_i = f(X_i, Z_i)$. Note that equation (6) estimates the probability of being a federal government employee, thus we expect the term τ to be positive. That is, the better the match to federal employment, $(\theta_i^f - \theta_i^p)$, the more likely the person is a federal worker. The expectation of the disturbance terms for federal workers and private sector workers from equations (4) and (5) are

$$E(\epsilon_1|d_i = 1) = E(\epsilon_1|\epsilon_2 > -V_i\psi) = \frac{\sigma_{12}}{\sigma_2}[\frac{f(V_i\psi)}{1 - F(V_i\psi)}] \tag{8}$$

$$E(\epsilon_0|d_i = 0) = E(\epsilon_0|\epsilon_2 \le -V_i\psi) = \frac{\sigma_{02}}{\sigma_2}[\frac{-f(V_i\psi)}{1 - F(V_i\psi)}] \tag{9}$$

where σ_{12} is the covariance of ϵ_1 and ϵ_2 and σ_{02} is the covariance of ϵ_0 and ϵ_2, f is the standard normal density function and F is the cumulative normal density function. It is these two expression that are the control function, or selection, variables.

Note that

$$\sigma_{12} = Cov(\epsilon_1, \epsilon_2)$$

$$= Cov(\phi_i + \theta_i^f + \epsilon_i^f, \alpha\phi_i + \tau(\theta_i^f - \theta_i^p) + u_i) \tag{10}$$

$$= \alpha\sigma_\phi^2 + \tau(\sigma_f^2 - \sigma_{fp})$$

and

$$\sigma_{02} = Cov(\epsilon_0, \epsilon_2)$$

$$= Cov(\phi_i + \theta_i^p + \epsilon_i^p, \alpha\phi_i + \tau(\theta_i^f - \theta_i^p) + u_i) \tag{11}$$

$$= \alpha\sigma_\phi^2 + \tau(\sigma_{fp} - \sigma_p^2)$$

where σ_{fp} is covariance between θ^f and θ^p, σ_f^2 and σ_p^2 are the variances of θ^f and θ^p, respectively.[12]

If there is only absolute advantage, $\phi_i \neq 0$ and $\theta_i^f \equiv \theta_i^p \equiv 0$, then from equation (10) and (11) :

$$\sigma_{12} = \alpha\sigma_\phi^2 \tag{12}$$

$$\sigma_{02} = \alpha\sigma_\phi^2 \tag{13}$$

In this case, we have a standard one-diminsional, fixed-effect that can be dealt with via IV or FE estimation. In the Heckman-Lee framework, the coefficients on the selectivity variables are identical. If higher ability employees are more likely to be federal government worker $(\alpha > 0)$,, then $\sigma_{02} = \sigma_{12} > 0$. On the contrary, if higher ability employees are more likely to be private sector worker$(\alpha < 0)$, then $\sigma_{02} = \sigma_{12} < 0$.

---

[12]The formulations in (10) and (11) assumes that ϕ is uncorrelated with the two match parameters, θ^f and θ^p. Dropping this assumption changes little in our discussion.

With both absolute advantage and comparative advantages, $\phi_i \neq 0$ and $\theta_i^f \neq 0 \neq \theta_i^p$, then depending on the size of each variance and covariance, σ_{12} and σ_{02} can be either sign. Positive values of σ_f^2, σ_p^2, and τ tend to make $\sigma_{12}{>}0$ and $\sigma_{02}{<}0$, though the other terms in (10) and (11) can generate different outcomes. The nature of the cross-equation correlation is readily tested with the Heckman-Lee methodology; it is a test of the equality of the coefficients on the two selectivity terms.[13]

To estimate the wage equations, we follow the standard Heckman-Lee procedure. We first estimate (7) with probit. For the vector of Z_i variables, we use variables intended to capture the ease and likelihood of obtaining a federal job relative to a private sector job. The first set of variables relates to veteran status.

Veterans are given preference for federal jobs, thus are more likely to attain federal employment. However, we do not use veteran status in the probit equation. The reason is that it is well established that veteran status stands in for unobservables that are correlated with earnings. Thus, we seek exogenous variables that are correlated with veteran status but not with earnings. One such variable is whether the individual was ever subject to a military draft. Naturally, those who were subject to a draft are more likely to be veterans. The variable we construct is based on draft rules and age eligibilities in place throughout each person's adult life. A second variable that is expected to be correlated with veteran status but not earnings is the number of military personnel relative to the U.S. labor force at the time the individual was 18 years old. A larger military provides more opportunities

---

[13]See Garen (1987) for a closely related discussion. Also, this is a special case of the more general model of Heckman , Urzua, and Vytlacil (2006), where they show that nonlinearity (i.e., non-identical) effects of the control function is a test of the heterogeneous effects model.

for military service, thus raises the likelihood of being a veteran.[14]

Another set of variables we use that relate the ease of finding a federal jobs relates to the local demand for private sector versus federal jobs. Since size of the government sector in each local labor market is related to the probability of obtaining a job there, we include the ratio of federal government workers to all employees in the worker's state.[15] We also use other variables that may affect the local demand for federal workers relative to the private sector jobs including the worker's state unemployment rate, the state GDP growth rate, and the state employment growth rate.

The wage equations we estimate can be written as:

$$ln(Y_{it}^f) = \beta_{0t}^f + \beta_{it}^f X_{it} + \frac{\sigma_{12}}{\sigma_2}\Big[\frac{f(V_i\psi)}{1 - F(V_i\psi)}\Big] + \nu_1 \quad if \quad d_{it} = 1 \tag{14}$$

$$ln(Y_{it}^p) = \beta_{0t}^p + \beta_{it}^p X_{it} + \frac{\sigma_{02}}{\sigma_2}\Big[\frac{-f(V_i\psi)}{1 - F(V_i\psi)}\Big] + \nu_0 \quad if \quad d_{it} = 0 \tag{15}$$

where estimated values of the selectivity terms from the probit are substituted in above and ν_1 and ν_0 are the applicable disturbance terms. Here, we can see that this formulation enables a simple test of whether the Roy model is appropriate relative to a unidimensional ability model by testing the equality of the coefficients on the two selectivity term. If they are equal, then IV or FE estimation also may be applied. If they are not equal, then the latter two methods are not appropriate.

Table 6 shows the coefficients on the two selectivity coefficients for each year. The

---

[14]Our probit results show that, for most years, these two variables have positive effects on the probability of being a federal worker.

[15]Note that we also include the locality dummy variables, so this variable does not simply stand in for the locality effects.

coefficients for the private sector are consistently positive and significant. However, the coefficients for the federal sector workers are unstable and tend to be insignificant. The final column of Table 6 shows the t-statistics for the tests of equality of the coefficients. For more than half of the years, we reject the hypothesis of equal coefficients. For much of the sample period, the message is that the selectivity coefficients differ.

As is well known, the Heckman-Lee procedure rests on strong functional form assumptions. Thus, we proceeded with a more general control function approach and estimated a variety of models with many functional forms to determine the robustness of our results.[16] In particular, we estimated equation (7) that determines the worker's sector by linear probability and logit, as well as by probit. From each of these, we formed an estimate of $\mathrm{E}(\epsilon_{2i} \mid d_i)$. These were entered linearly, as quadratics, and as cubics in each wage equation. The findings are consistent with the above. There tends to be a positive and significant association of private sector wages and $\mathrm{E}(\epsilon_{2i} \mid d_i = 0)$. The association of federal sector wages and $\mathrm{E}(\epsilon_{2i} \mid d_i = 1)$ is unstable and generally not statistically significant. Tests of equality of the two effects on wages are mostly rejected. Moreover, when we calculate the federal-private wage differential using estimates with the various control functions, we find nearly identical results. Note that we frequently reject the one-dimensional model of ability. Because IV and FE estimation methods assume one-dimensional ability, it is not generally appropriate to use these methods and we pursue these alternatives no further.[17] Additionally, as describe below, we find that unobserved heterogeneity has little effect on the magnitude of the wage differentials.

---

[16]These procedures are in line with the guidance of Imbens and Wooldridge (2007).

[17]Heckman, Urzua, and Vytlacil (2006) show the bias of IV in this setting.

The federal-private wage differential is calculated with the Heckman-Lee estimation and the results shown in Table 7. The findings are nearly identical to those of OLS. Figure 4 plots the coefficients from Table 7 against the coefficients for the corresponding OLS wage equation of Table 5. Visually, they nearly overlay one another. The average gap from Heckman-Lee model 0.086 percent. At most, it is 1.5 percent larger and is, at minimum, 0.7 percent smaller than that from OLS. Therefore, though selectivity bias generally is statistically significant, especially for private sector wages, its economic magnitude is so small as to make little difference in the wage differential computation.

Moreover, this indicates that our conclusions from the OLS analysis above continue to hold: the federal wage differential has been positive throughout this period; it fell in the late 1990s and rose fairly steadily though the 2000s until 2013 and then decreased to the end of the sample period. Moreover, the federal-private wage differential varied substantially during this period, from a low of 4.3 percent and a high of 18.4 percent. The mean differential is 13.2% with a standard deviation of 3.7%. Over half of the years had differentials over 16% or below 11%, implying differentials at least 20 percent above or below the mean.

6   Fringe Benefit Analysis

While it is desirable to analyze total compensation differences between federal and private workers, data limitations prevent us from doing this in a complete way. However, our data from the March CPS has two indicators of fringe benefits that workers receive. They are two dummy variables, one indicating whether or not the worker has an employer-provided health insurance plan, and the other whether or not s/he has an employer-sponsored retirement

plan. We do not know the dollar value of these plans. However, they are the largest fringe benefits that employers offer and seem worth analyzing.

From these data, we estimate the effect of federal sector employment on the probability of attaining each of these fringe benefits, holding constant a host of covariates. In particular, we estimate the probability of receipt of each of these fringe benefits by probit as:

$$P(Y_{it} = 1) = \Phi(X'_{it}\rho + d_{it}\lambda) \tag{16}$$

where i indexes the individual, and t indexes time. In this estimation, Y_{it} is a dummy variable indicating whether the worker has a health insurance plan or a retirement pension plan from his/her current employer, $\Phi(\cdot)$ is the cumulative distribution function for the standard normal. The vector of observable characteristics X_{it} and d_{it} are the same as in the OLS wage equation model. We run separate probit equations by year for health insurance and pension plan provision.

Table 8 shows the marginal effects of federal sector employment on the probability of obtaining each fringe benefit. Federal government workers enjoy a much higher probability of receiving an employer-provided retirement pension. Figure 5 shows the plot of these differentials over time. There is some variation in the differences but, other that the drop in the late 1990s, there is not a clear time path. The second column in Table 8 shows the findings for employer-provided health insurance. The results for health insurance are less sizable than for pensions. Federal workers generally have a higher probability of receiving health insurance, though by how much varies from year to year. These effects are plotted in Figure 6 and show the somewhat irregular pattern just noted. This analysis reinforces

earlier findings in the literature that federal workers are compensated with greater fringe benefits.

7   Analyzing the Time Path of Wage Differentials

In this section, we conduct an empirical analysis to examine and explain the over-time variation in the federal-private wage differential that we document above. Essentially, each year's federal wage differential becomes the dependent variable to be explained. For this analysis, we use the estimated coefficients from Table 7 that utilize the control function methodology. As noted above, the variation in these coefficients is quite substantial. Our literature review considers a number of papers that discuss why government wage differentials may vary over time. Here, we flesh out this discussion and examine the data in this light.

A good deal of the literature implicitly or explicit presumes that government entities are less flexible in adjusting their wages to changing economic conditions. Assuming so, this entails that changing conditions that cause private sector wages to adjust will not be as readily reflected in public sector earnings, or at least not as quickly. Thus, conditions that bolster private wages will cause the government wage differential to be smaller, and the reverse for events that trim private wages.

This idea enters the discussions of Katz and Krueger (1991) and Borjas (2003). Both note the growing skill differential in the U.S. economy and suggest that government wages may have had difficulty keeping up. This implies a shrinking federal wage premium as the skill differential grows. Thus, one explanatory variable that we use is a measure of this

differential. We use CPS weekly earnings data and form the ratio of the median earnings of full-time workers over 25 with at least a college decree to the median earnings of full-timers over 25 with only a high school degree. We expect that a wider skill gap is associated with a smaller federal wage differential.

More generally, as discussed in Freeman (1987), in a business cycle downturn, private sector wages may lag while those in the public sector remain stable due to bureaucratic stickiness. Conversely, upturns and faster economic growth tend to increase private wages, with public sector wages remaining relatively stable. With government wages adjusting more slowly, the former is expected to lead to a larger federal wage differential and the latter to a smaller one. To measure business cycles, we use the unemployment rate of those 25 to 54 years old. A higher unemployment rate is expected to lead to a greater federal wage differential. Regarding economic upturns, to measure general economic growth, we use annual real GDP growth. Higher growth is expected to reduce the federal differential.

Another related consideration, also noted in Freeman (1987), is that government wages may be sensitive to government budgets. Budgets tend to be tighter in downturns and higher in upturns, so this would lead to a pro-cyclical government wage differential in contrast to the implications of the previous paragraphs. However, this may be less of a factor for federal workers since the federal government has greater powers to borrow and offset budget shortfalls. As an overall measure of federal funds that might be partly used for federal pay, we use federal spending as a share of GDP.

The latter measure may also capture political considerations regarding federal pay. One dimension in which political outcomes vary is in favorability to larger government and/or

more government spending. Outcomes that are more inclined toward larger government are likely to lead to more government employment and pay. Thus, federal spending as a share of GDP proxies for political favorability of government. Additionally, it is typically thought that Democratic Party leaders are more sympathetic to larger government and the converse for Republican Party leaders. Thus, we expect that with greater Democratic Party control of the federal government, federal wages would be higher. To measure this, we include three dummy variables. One indicates if the president is Democratic; a second indicates if the House of Representatives is majority Democratic; and the third indicates if the Senate is majority Democratic.

We include each of the above variables in a regression analysis of the federal-private wage differential. The correlation matrix of these variable shows a good deal of consistency with the above hypotheses. The correlation of the federal wage differential and federal spending as a share of GDP is 0.660. The counter-cyclicality of the federal differential is suggested by its positive correlation with the unemployment rate (0.570) and its negative correlation with real GDP growth (-0.527). The correlation with the median earnings of college to high schools is positive (0.486), contrary to expectations, though. The federal pay differential has a slight negatively relationship to a Democratic presidency (-0.037), and is positively correlated with Democratic majorities in the House (0.405) and Senate (0.404). The latter two are consistent with expectations, but the former is not.

Also, it is important to note, though, that there is a good deal of collinearity in the data, which makes it difficult to parse out the effects of individual variables. For example, federal spending as a share of GDP has a correlation of 0.894 with the unemployment rate

and a correlation of -0.591 with real GDP growth. Not surprisingly, spending is higher in recessions and less in growth periods.

Table 9 shows the findings of the regression analysis.[18] In column (1), the findings show a substantial association of the federal wage differential to the federal spending measure. The magnitude is substantial, and reaches statistical significance at the 8% level. The results indicate that a 1 percentage point increase in federal spending as share of GDP raises the federal pay differential by 1.3 percentage points. The coefficients on the unemployment rate, median college to high school earnings, and real GDP growth are small in magnitude statistically insignificant.

In this and other specifications, we also included lagged values of each of these variables. This is to capture the possibility that federal wages are more likely to lag in response to economic conditions, thus show a stronger response over time. However, none of the lagged variables showed any substantial effects, so these specifications are not reported. Of course, using lagged variables introduces a lot of collinearity, making interpretation more difficult.

Column (2) of Table 9 adds the Democratic presidency dummy. We also tried including the dummy variables for Democratic House and Senate majorities, but their coefficient were very small and insignificant, so those specifications are not reported. The inclusion of the presidency dummy increases the size of the federal spending coefficient but reduces its level of significance to 10%. The Democratic presidency coefficient itself has a negative sign, but is significant only at the 16% level. The sign of this coefficient is not as expected. However, a good deal of the data is during the period of the Democratic presidency that experienced a

---

[18]Because the wage differentials are estimated, we correct for potential problems with standard errors by using Huber/White robust standard errors.

declining federal wage differential (Clinton) and a Republican presidency that experienced a rising federal differential (Bush). We suspect that this is what is driving this finding, though the two presidencies experienced different amounts of federal spending and varying mixes of Democratic and Republican majorities in Congress.

Columns (3) and (4) of Table 9 display some simpler specifications. Column (3) drops the median earnings ratio variable. The finding are very similar to that of column (2), though statistical significance of the federal spending variable improves to the 7% level. Column (4) also drops the real GDP growth variable. Here, the federal spending coefficient rises somewhat in magnitude and significance improves to the 4% level. The Democratic presidency dummy also increases in significance to the 9% level.

Overall, the most robust finding is the effect of federal spending as a share of GDP. This coefficient is consistently positive, large in magnitude, and with statistical significance at the 10% level or stronger. The results imply that an increase of federal spending as a share of GDP by one percentage point raises the federal-private wage differential by 1.3 to 1.75 percentage points. This is quite sizable since the average federal differential during this time was 13.2%.

8 Conclusion

Our empirical analysis of the federal wage differential from 1995 to 2017 reaches several robust conclusions. The differential has been positive throughout this period. It fell in the late 1990s and rose fairly steadily though the 2000s until 2013, and then tended to decrease to the end of the sample period. Our preferred estimates indicate it varied substantially,

from 4.3 percent to 18.4 percent. Results after correction for unobserved heterogeneity with use of control function methods are nearly identical to those from OLS. Additionally, the probabilities of federal workers having a pension plan and employer-sponsored health insurance are persistently higher than for private-sector workers.

Our examination of factors that affect the wage differential over time considered effects of business cycles, economic growth, the skill differential, federal spending, and presidential party affiliation. The most robust result is the positive and sizable effect that federal spending as a share of GDP has on the federal wage differential, implying that a 1 percentage point increase in federal spending as a share of GDP raises the federal pay differential by 1.3 to 1.75 percentage points. Once federal spending is accounted for, the effects of other factors tend to have little effect.

References

Allegretto, Sylvia A. and Keefe, Jeffery. 2010. "The Truth about Public Employees in California: They Are Neither Overpaid Nor Overcompensated," Institute for Research on Labor and Employment, University of California, Berkeley.

Bargain, Olivier and Melly, Blaise. 2008 "Public Sector Pay Gap in France: New Evidence using Panel Data." *IZA Discussion Paper*, No. 3427

Bewerunge, Philipp and Rosen, Harvey S. 2012 "Wage, Pensions, and Public-Private Sector Com- pensation Differentials". *Griswold Center for Economic Policy Studies Working Paper*, 227: 1-45

Biggs, Andrew and Richwine, Jason. 2011 "Comparing Federal and Private Sector Compensation,"*American Enterprise Institute Economic Policy Working Paper.*

Borjas, George, 1980. "Wage Determination in the Federal Government: The Role of Constituents and Bureaucrats". *Journal of Political Economy*, 90(2), April, pp.1110-1147.

Borjas, George, 2003. "The Wage Structure and the Sorting of Workers into the Public Sector," in Donahue, John and Nye, Joseph (eds), *For the People: Can We Fix Public Service?*, edited by John D. Donahue and Joseph S. Nye, Brookings Institution Press, pp. 29-54.

Bradley, David H. 2012 "Comparing Compensation for Federal and Private-Sector Workers: An Overview". *CRS Report for Congress*, RA2636

Burkhauser, Richard V. et al. 2008 "Estimating Trends in US Income Inequality Using the Current Population Survey: The Importance of Controlling for Censoring." IZA Discussion Paper No. 3690

Castro, Francisco et al. 2013 "The Gap between Public and Private Wages: New Evidence for the EU". *European Commission, Economic Paper*, No.508

Choi, Sun Ki, *The Determinants and Trends in Public-Private Wage Differentials*," Ph. D. dissertation, University of Kentucky, July 2016.

Congressional Budget Office. 2012. "Comparing the Compensation of Federal and Private-Sector Employees," Congress of the United States.

Congressional Budget Office. 2017. "Comparing the Compensation of Federal and Private-Sector Employees, 2011-2015," Congress of the United States.

Eisenhauer, Philipp; Heckman, James; and Vytacit, "The Generalized Roy Model and the Cost-Benefit Analysis of Social Programs," Journal of Political Economy, 123(2), April 2015, pp 313-433.

Freeman, Richard B., 1987. "How Do Public Sector Wages and Employment Respond to Economic Conditions?," in David A. Wise, ed., *Public Sector Payrolls*, Chicago: University of Chicago Press, pp. 183-216.

Garen, John. 1987 "Relationships Among Estimators of Triangular Econometric Models". *Economics Letter*, 25: 39-41.

Giordano, Raffaela et al. 2011 "The Public Sector Pay Gap in a Selection of Euro Area Countries".*European Central Bank Working Paper*, No. 1460

Gittleman, Maury and Pierce, Brooks Pierce, 2012. "Compensation for State and Local Government Workers," *Journal of Economic Perspectives*, 26(1), Winter, pp. 217-242.

Gyourko, Joseph, and Tracy, Joseph. "An Analysis of Public- and Private- Sector Wages Allowing for Endogenous Choices of Both Government and Union Status." *Journal of Labor Economics,* 6(2), April 1988, pp. 229-53.

Heckman, James; Urzua, Sergio; and Vytlacil, Edward, "Understanding Instrumental Variables in Models with Essential Heterogeneity," *Review of Economics and Statistics,* 88(3), August 2006, pp. 389-432.

Imbens, Guido and Wooldridge, Jeff, "What's New in Econometrics? Control Function and Related Models, Lecture Notes 6," National Bureau of Economic Research, Summer 2007.

Katz, Lawrence F. and Krueger, Alan B. 1991 "Changes in the Structure of Wages in the Public and Private Sectors". *Research in Labor Economics*, 12: 137-172

Krueger, Alan B., 1988. "Are Public Sector Workers Paid More Than Their Alternative Wage? Evidence from Longitudinal Data and Job Queues," in Richard B. Freeman and Casey Ichniowski, eds., *When Public Sector Workers Unionize*, University of Chicago Press, pp. 217-242.

Moulton, Brent R. 1990 "A Reexamination of the Federal-Private Wage Differential in the United States". *Journal of Labor Economics*, 8: 270-293

Munnell, Alicia H. 2011 "Comparing Compensation: State-Local versus Private Sector workers".*Center for Retirement Research at Boston University*

Smith, Sharon P. 1976a "Pay Differential between Federal Government and Private-Sector Workers".*Industrial and Labor Relations Review*, 29: 179-197.

Smith, Sharon P. 1976b "Government Wage Differentials by Sex". *The Journal of Human Resources*. 11: 185-199.

Smith, Sharon P. 1977, "Government Wage Differentials." *Journal of Urban Economics*. 4(3), July, pp. 248-271.

Van der Gaag, Jacques and Vijverberg, Wim, 1988. "A Switching Regression Model for Wage Determinants in the Public and Private Sectors of a Developing Country," *Review of Economics and Statistics*, 70(2), May, pp. 244-252.

Table 1: Real Average Hourly Earnings, by Worker Category, 1995-2017 CPS MORG.

	Federal	State	Local	Privte	Federal/Private	State/Private	Local/ Private
1995	27.589	23.124	23.936	20.934	1.318	1.105	1.143
1996	27.636	22.971	23.449	20.621	1.340	1.114	1.137
1997	27.697	23.251	23.660	20.935	1.323	1.111	1.130
1998	28.435	23.969	24.126	21.860	1.301	1.096	1.104
1999	29.515	24.287	24.508	22.358	1.320	1.086	1.096
2000	29.284	24.258	24.429	22.410	1.307	1.082	1.090
2001	30.119	24.636	24.527	23.041	1.307	1.069	1.064
2002	30.701	25.354	24.875	23.370	1.314	1.085	1.064
2003	30.552	25.195	24.767	23.396	1.306	1.077	1.059
2004	31.616	25.290	25.199	23.415	1.350	1.080	1.076
2005	31.997	24.984	24.662	23.252	1.376	1.074	1.061
2006	32.307	24.928	24.692	23.155	1.395	1.077	1.066
2007	32.662	25.305	25.055	23.309	1.401	1.086	1.075
2008	31.828	25.368	25.108	23.471	1.356	1.081	1.070
2009	32.896	25.701	25.541	24.070	1.367	1.068	1.061
2010	32.662	25.927	25.692	23.850	1.370	1.087	1.077
2011	32.567	25.386	25.487	23.624	1.379	1.075	1.079
2012	33.605	25.173	25.068	23.787	1.413	1.058	1.054
2013	33.920	25.243	25.096	23.699	1.431	1.065	1.059
2014	32.837	25.294	25.075	23.705	1.385	1.067	1.058
2015	33.149	25.842	25.888	24.121	1.374	1.071	1.073
2016	33.340	25.866	25.869	24.638	1.353	1.050	1.050
2017	33.279	25.886	25.585	24.518	1.357	1.056	1.044

Source: Current Population Surveys

Figure 1: Trend of Real Wage Ratio between Federal and Private Sector.
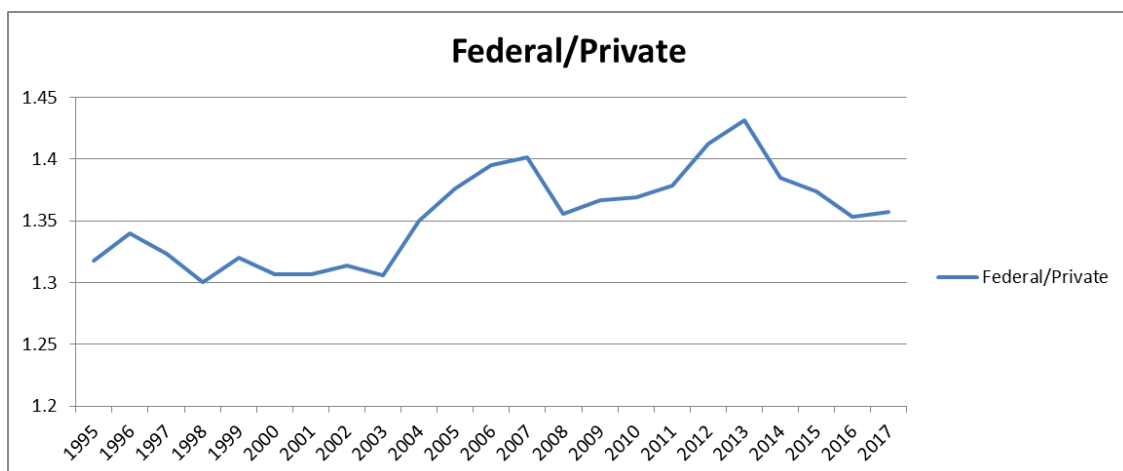
Table 2: Percentage of workers receiving fringe benefit

	Health Insurance		Pension Plan	
	Private	Federal	Private	Federal
1995	0.743	0.890	0.448	0.802
1996	0.763	0.906	0.447	0.830
1997	0.759	0.865	0.449	0.799
1998	0.762	0.881	0.454	0.759
1999	0.768	0.835	0.481	0.786
2000	0.791	0.876	0.480	0.743
2001	0.806	0.910	0.481	0.755
2002	0.810	0.923	0.480	0.760
2003	0.796	0.885	0.461	0.777
2004	0.784	0.895	0.458	0.744
2005	0.768	0.893	0.454	0.771
2006	0.750	0.866	0.449	0.741
2007	0.736	0.896	0.426	0.763
2008	0.746	0.874	0.460	0.778
2009	0.741	0.895	0.444	0.774
2010	0.707	0.881	0.427	0.763
2011	0.710	0.887	0.421	0.795
2012	0.712	0.862	0.432	0.744
2013	0.703	0.893	0.424	0.785
2014	0.706	0.805	0.423	0.762
2015	0.715	0.792	0.390	0.751
2016	0.712	0.842	0.334	0.658
2017	0.706	0.772	0.327	0.643

Source: Current Population Surveys

Figure 2 : Percentage of workers receiving Fringe Benefits (Fed. Vs. Private)

Health Insurance

Pension Plan
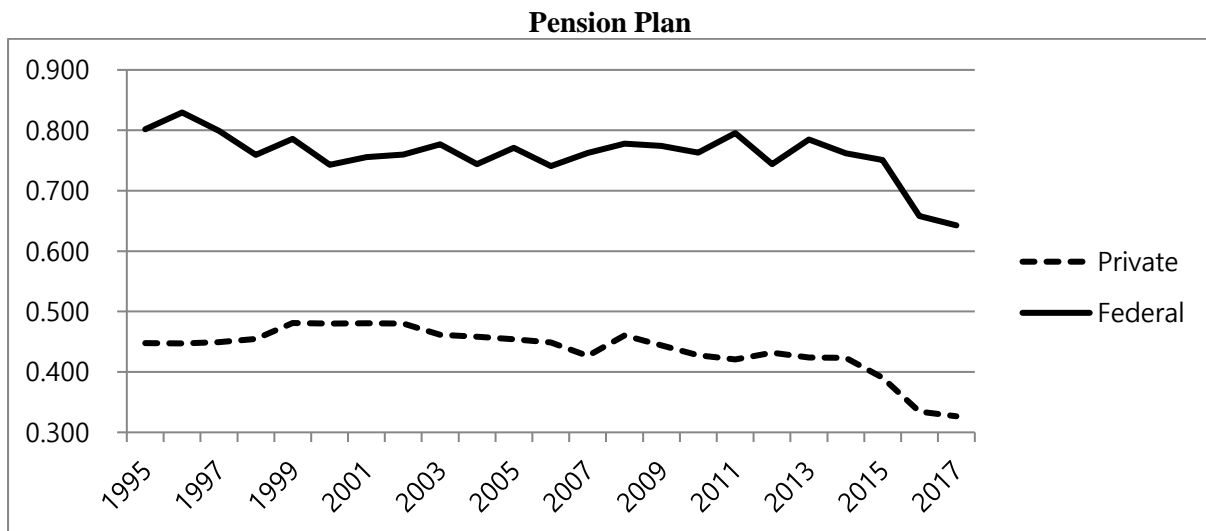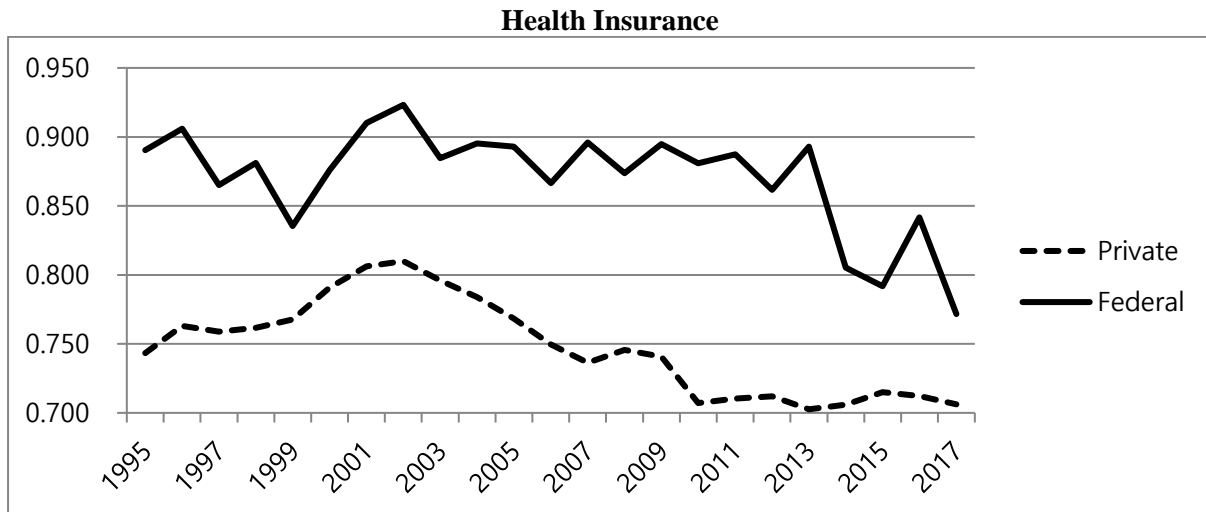
Table 3: Summary Statistics, 1995-2017 Current Population Survey Merged Outgoing Rotation Group.

Variable	Entire Sample		Federal		Private	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Wage	23.416	14.288	31.451	16.077	23.133	14.139
Health Insurance	0.757	0.429	0.873	0.333	0.753	0.431
Pension Plan	0.452	0.498	0.759	0.428	0.441	0.497
Federal Employee	0.032	0.177				
School	13.474	2.587	14.908	2.496	13.426	2.577
Age	40.492	12.179	44.360	11.234	40.362	12.188
Female	0.437	0.496	0.457	0.498	0.436	0.496
Union	0.089	0.285	0.180	0.384	0.086	0.281
Msa						
Metropolitan	0.284	0.451	0.336	0.472	0.289	0.453
Balance	0.478	0.500	0.455	0.498	0.479	0.500
Non-Metropolitan	0.231	0.422	0.209	0.407	0.232	0.422
Experience	21.018	12.321	23.452	11.507	20.936	12.339
Region						
Northeast	0.203	0.402	0.120	0.325	0.207	0.405
Midwest	0.242	0.428	0.150	0.357	0.245	0.430
South	0.316	0.465	0.455	0.498	0.311	0.463
West	0.238	0.426	0.275	0.446	0.237	0.425
Race						
White	0.730	0.444	0.673	0.469	0.727	0.445
Black	0.091	0.288	0.160	0.366	0.089	0.285
Asian	0.046	0.208	0.051	0.220	0.045	0.208
Others	0.137	0.344	0.117	0.321	0.138	0.345
Occupation						
Management	0.158	0.365	0.253	0.435	0.162	0.368
Professional	0.215	0.411	0.328	0.469	0.171	0.377
Service	0.132	0.339	0.118	0.323	0.123	0.328
Sales	0.097	0.296	0.016	0.124	0.116	0.320
Administrative support	0.139	0.346	0.164	0.371	0.138	0.345
Farming, fishing, and forestry	0.011	0.102	0.008	0.087	0.012	0.108
Construction	0.055	0.229	0.021	0.142	0.061	0.240
Installation, maintenance, and repair	0.042	0.200	0.036	0.187	0.046	0.209
Production	0.083	0.275	0.026	0.160	0.097	0.296
Transportation	0.067	0.250	0.030	0.170	0.075	0.263
Locality						
Rest of U.S.	0.606	0.489	0.527	0.499	0.600	0.490
Atlanta	0.012	0.108	0.008	0.091	0.012	0.109
Boston	0.016	0.125	0.008	0.088	0.016	0.126
Buffalo-Niagara	0.003	0.052	0.002	0.040	0.003	0.053
Chicago	0.027	0.161	0.012	0.108	0.027	0.162
Cincinnati	0.006	0.077	0.004	0.059	0.006	0.077
Cleveland	0.009	0.093	0.005	0.069	0.009	0.094
Columbus	0.005	0.069	0.003	0.057	0.005	0.070

Table 3 (cont'd)

Dallas	0.014	0.116	0.008	0.087	0.014	0.117
Dayton	0.003	0.051	0.005	0.071	0.003	0.051
Denver	0.012	0.107	0.011	0.105	0.012	0.107
Detroit	0.015	0.121	0.006	0.080	0.015	0.122
Hartford	0.005	0.072	0.001	0.037	0.005	0.073
Houston	0.012	0.108	0.004	0.064	0.012	0.109
Huntsville	0.002	0.043	0.005	0.070	0.002	0.042
Indianapolis	0.005	0.069	0.004	0.060	0.005	0.070
Los Angeles	0.033	0.180	0.017	0.128	0.034	0.181
Miami	0.012	0.108	0.006	0.079	0.012	0.109
Milwaukee	0.006	0.079	0.002	0.047	0.006	0.080
Minneapolis	0.013	0.114	0.005	0.071	0.014	0.115
New York	0.045	0.208	0.022	0.145	0.046	0.210
Philadelphia	0.021	0.145	0.016	0.124	0.022	0.145
Phoenix	0.010	0.097	0.005	0.069	0.010	0.098
Pittsburgh	0.007	0.084	0.003	0.058	0.007	0.084
Portland	0.008	0.088	0.004	0.065	0.008	0.089
Raleigh	0.004	0.067	0.003	0.051	0.005	0.067
Richmond	0.003	0.056	0.004	0.061	0.003	0.055
Sacramento	0.004	0.061	0.003	0.051	0.004	0.061
San Diego	0.006	0.077	0.010	0.098	0.006	0.076
San Jose	0.014	0.119	0.009	0.094	0.014	0.120
Seattle	0.010	0.098	0.008	0.088	0.010	0.098
Washington	0.039	0.194	0.213	0.409	0.033	0.180
State of Alaska	0.011	0.103	0.031	0.174	0.010	0.099
State of Hawaii	0.012	0.110	0.029	0.167	0.012	0.107

Source: Current Population Surveys

Note: Definitions of Variables: **Hourly Wage**: The wage rate is used, if reported. Otherwise, this is reported earning divided by reported usual hours over that time span. **Public:** This variable is created from the 'Class of Job' survey question. State and local government workers are dropped from sample. As a result, federal government workers have value for this variable equal to 1 and 0 for private sector workers. **School**: This variable indicates the number of years of education the workers attained. **Experience**: Potential experience (= Age- School -6). **Female**: If a worker who interviewed is female, then the value for this variable is 1 and 0. **Union**: equal 1 for union members, 0 otherwise. **Race**: There are four race dummy variables one each for White, Black, Asian, others. **Region**: There are four region dummy variables, one each Northeast, Midwest, South, and West. **MSA**: This variable defines the 'Metropolitan Statistical Area' status. Separate dummies are created in the city of an MSA, the balance of the MSA, and non-metropolitan location. **Occupation**: Dummies variables are created for ten major occupations. **Locality**: This variable indicates 33 separate metropolitan locality pay areas and one variable for "Rest of U.S.". Federal government offers 34 different wage schedules which are depending on the location and cost of living.

Table 4 : Detailed Summary of Key Variables in Federal Government and Private Sector Workers, Year-by-Year, 1995-2017 CPS MORG

	School		Age		Female		Union		White		Management		Professional		Sevice		Administation	
	Federal	Private	Federal	Private	Federal	Private	Federal	Private	Federal	Private	Federal	Private	Federal	Private	Federal	Private	Federal	Private
1995	14.3520	13.1231	42.4799	38.1402	0.4721	0.4291	0.1915	0.1153	0.7019	0.7849	0.2809	0.1464	0.2937	0.1449	0.0840	0.1014	0.2059	0.1472
1996	14.3688	13.1070	43.0279	38.3341	0.4679	0.4309	0.1890	0.1114	0.7076	0.7789	0.2771	0.1477	0.2940	0.1448	0.0838	0.1034	0.1976	0.1453
1997	14.4591	13.1132	42.8133	38.4340	0.4667	0.4328	0.1779	0.1070	0.7200	0.7689	0.2695	0.1506	0.2990	0.1488	0.0938	0.1022	0.1985	0.1416
1998	14.4598	13.1454	43.3043	38.6617	0.4695	0.4326	0.1893	0.1054	0.7098	0.7631	0.2780	0.1526	0.2947	0.1520	0.0938	0.1037	0.1957	0.1420
1999	14.5862	13.1630	43.9659	38.8884	0.4572	0.4308	0.1873	0.1049	0.7039	0.7564	0.2945	0.1557	0.2993	0.1546	0.0916	0.1044	0.1803	0.1378
2000	14.5201	13.1698	43.9679	38.9645	0.4402	0.4314	0.1761	0.0998	0.7013	0.7412	0.2705	0.1560	0.3102	0.1552	0.0857	0.1035	0.1906	0.1394
2001	14.6314	13.2293	44.1584	39.3028	0.4558	0.4328	0.1921	0.0983	0.7020	0.7436	0.2753	0.1603	0.3173	0.1601	0.0901	0.1057	0.1699	0.1366
2002	14.6452	13.2728	44.3165	39.6607	0.4746	0.4348	0.1849	0.0945	0.6835	0.7515	0.2768	0.1638	0.3129	0.1622	0.1056	0.1073	0.1745	0.1339
2003	14.6188	13.2896	44.3450	39.9761	0.4790	0.4379	0.1840	0.0895	0.6788	0.7451	0.2368	0.1505	0.3164	0.1624	0.1211	0.1251	0.1822	0.1509
2004	14.6744	13.3073	44.6819	40.1246	0.4604	0.4355	0.1735	0.0866	0.6773	0.7375	0.2322	0.1509	0.3248	0.1635	0.1345	0.1289	0.1615	0.1467
2005	14.7823	13.3197	44.7881	40.2127	0.4494	0.4349	0.1699	0.0845	0.6800	0.7313	0.2319	0.1510	0.3158	0.1647	0.1330	0.1277	0.1725	0.1460
2006	14.8534	13.3316	45.0279	40.3514	0.4515	0.4338	0.1719	0.0804	0.6737	0.7183	0.2285	0.1528	0.3276	0.1644	0.1268	0.1302	0.1797	0.1446
2007	14.9815	13.3927	44.7131	40.5955	0.4449	0.4372	0.1559	0.0803	0.6592	0.7136	0.2399	0.1573	0.3355	0.1676	0.1239	0.1289	0.1622	0.1424
2008	14.9397	13.4673	44.7791	40.8612	0.4634	0.4377	0.1768	0.0826	0.6614	0.7164	0.2352	0.1611	0.3384	0.1737	0.1180	0.1308	0.1619	0.1409
2009	14.9973	13.5470	44.8439	41.3024	0.4676	0.4424	0.1793	0.0774	0.6686	0.7188	0.2473	0.1678	0.3208	0.1823	0.1334	0.1364	0.1556	0.1390
2010	15.0283	13.5974	44.2943	41.4373	0.4512	0.4442	0.1750	0.0758	0.6533	0.7142	0.2282	0.1656	0.3322	0.1870	0.1419	0.1381	0.1601	0.1397
2011	15.1276	13.6381	44.6907	41.6339	0.4502	0.4418	0.1800	0.0750	0.6678	0.7113	0.2422	0.1684	0.3447	0.1873	0.1281	0.1362	0.1495	0.1375
2012	15.2929	13.6938	44.6459	41.7773	0.4527	0.4363	0.1675	0.0713	0.6668	0.7067	0.2505	0.1755	0.3602	0.1876	0.1267	0.1359	0.1416	0.1319
2013	15.3905	13.7482	44.9923	41.8899	0.4501	0.4383	0.1796	0.0724	0.6449	0.7033	0.2557	0.1760	0.3489	0.1909	0.1347	0.1338	0.1404	0.1311
2014	15.4022	13.7482	44.8234	41.9066	0.4590	0.4369	0.1858	0.0717	0.6324	0.6954	0.2497	0.1746	0.3526	0.1918	0.1320	0.1334	0.1401	0.1298
2015	15.4354	13.7598	44.9279	41.8763	0.4666	0.4380	0.1846	0.0702	0.6402	0.6839	0.2363	0.1757	0.3595	0.1952	0.1376	0.1332	0.1391	0.1277
2016	15.4070	13.7987	44.7671	41.8243	0.4353	0.4375	0.1799	0.0675	0.6453	0.6764	0.2622	0.1783	0.3547	0.1965	0.1338	0.1358	0.1241	0.1252
2017	15.4471	13.8502	45.0219	41.9834	0.4379	0.4393	0.1826	0.0685	0.6310	0.6753	0.2495	0.1800	0.3604	0.2007	0.1376	0.1331	0.1300	0.1203

Source: Current Population Surveys

Table 5: Wage Differential, OLS, Year-by-Year, 1995-2017 CPS MORG

	OLS Wage Differential
1995	0.136***
	(0.016)
1996	0.138***
	(0.019)
1997	0.107***
	(0.019)
1998	0.057**
	(0.022)
1999	0.045
	(0.030)
2000	0.097***
	(0.015)
2001	0.101***
	(0.014)
2002	0.094***
	(0.015)
2003	0.130***
	(0.018)
2004	0.111***
	(0.017)
2005	0.143***
	(0.016)
2006	0.164***
	(0.016)
2007	0.172***
	(0.015)
2008	0.163***
	(0.014)
2009	0.168***
	(0.014)
2010	0.165***
	(0.015)
2011	0.156***
	(0.017)
2012	0.164***
	(0.022)
2013	0.184***
	(0.018)
2014	0.123*
	(0.069)
2015	0.137***
	(0.017)
2016	0.146***
	(0.017)
2017	0.128***
	(0.022)

Note: standard errors in parentheses*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Current Population Surveys

Table 6: Differences in Coefficients of inverse Mills ratio, Year-by-Year, Each Sector

	Public IMR Coefficient	Private IMR Coefficient	Difference
1995	0.193**	0.187***	0.006
	(0.094)	(0.046)	(0.109)
1996	0.080	0.252***	-0.173
	(0.109)	(0.042)	(0.121)
1997	0.228**	0.380***	-0.152
	(0.105)	(0.043)	(0.116)
1998	0.079	0.369***	-0.290**
	(0.149)	(0.047)	(0.151)
1999	0.073	0.222***	-0.149
	(0.163)	(0.045)	(0.209)
2000	-0.179*	0.414***	-0.593***
	(0.106)	(0.045)	(0.129)
2001	0.136*	0.542***	-0.406***
	(0.077)	(0.046)	(0.101)
2002	0.043	0.290***	-0.247***
	(0.077)	(0.041)	(0.083)
2003	0.206**	0.321***	-0.115
	(0.094)	(0.048)	(0.120)
2004	0.306***	0.345***	-0.038
	(0.097)	(0.045)	(0.121)
2005	0.119	0.310***	-0.191
	(0.124)	(0.045)	(0.124)
2006	0.056	0.253***	-0.197*
	(0.110)	(0.045)	(0.121)
2007	0.078	0.255***	-0.177*
	(0.096)	(0.049)	(0.096)
2008	-0.053	0.235***	-0.288***
	(0.079)	(0.047)	(0.094)
2009	-0.107	0.278***	-0.385***
	(0.104)	(0.050)	(0.109)
2010	0.013	0.458***	-0.445***
	(0.131)	(0.052)	(0.140)
2011	0.275**	0.258***	0.017
	(0.098)	(0.048)	(0.099)
2012	0.105	0.299***	-0.194
	(0.129)	(0.048)	(0.161)
2013	-0.015	0.198***	-0.212**
	(0.104)	(0.047)	(0.105)
2014	-0.200	-0.080	-0.120
	(0.207)	(0.088)	(0.257)
2015	0.174	0.310***	-0.136
	(0.115)	(0.049)	(0.118)
2016	-0.060	0.370***	-0.430***
	(0.108)	(0.050)	(0.121)
2017	-0.020	0.223***	-0.243**
	(0.127)	(0.051)	(0.117)

Note: standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Source: Current Population Surveys

Table 7: Wage Differential using Heckman Selection Model, Year-by-Year, CPS ORG

	Wage Differential (Heckman)
1995	0.148***
	(0.019)
1996	0.140***
	(0.022)
1997	0.112***
	(0.021)
1998	0.055**
	(0.024)
1999	0.043
	(0.031)
2000	0.097***
	(0.015)
2001	0.101***
	(0.014)
2002	0.095***
	(0.013)
2003	0.129***
	(0.018)
2004	0.116***
	(0.017)
2005	0.144***
	(0.017)
2006	0.164***
	(0.017)
2007	0.173***
	(0.017)
2008	0.160***
	(0.016)
2009	0.161***
	(0.015)
2010	0.164***
	(0.017)
2011	0.171***
	(0.021)
2012	0.167***
	(0.020)
2013	0.184***
	(0.022)
2014	0.116
	(0.075)
2015	0.136***
	(0.018)
2016	0.148***
	(0.017)
2017	0.126***
	(0.024)

Note: standard errors in parentheses*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Current Population Surveys

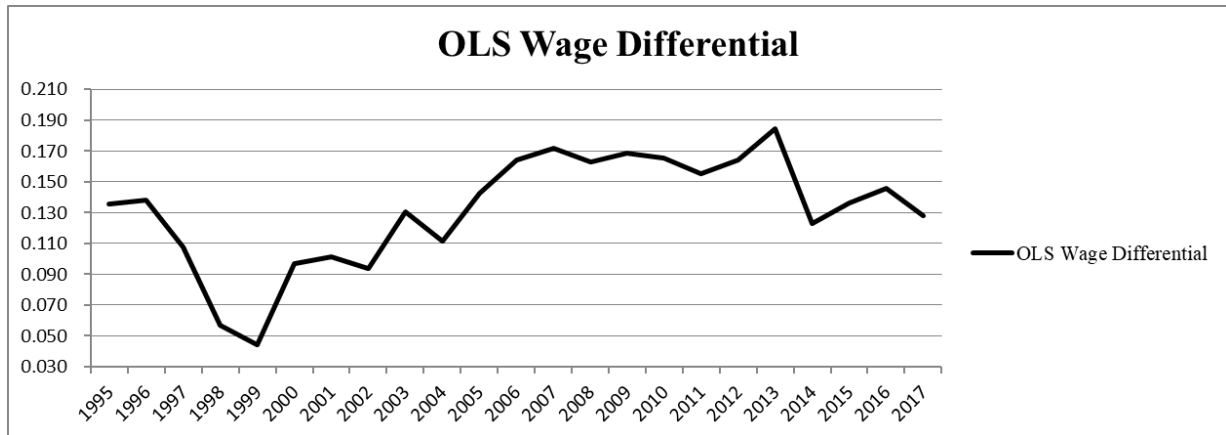**Figure 3: Wage Differential, OLS, Year-by-Year, 1995-2017 CPS MORG**
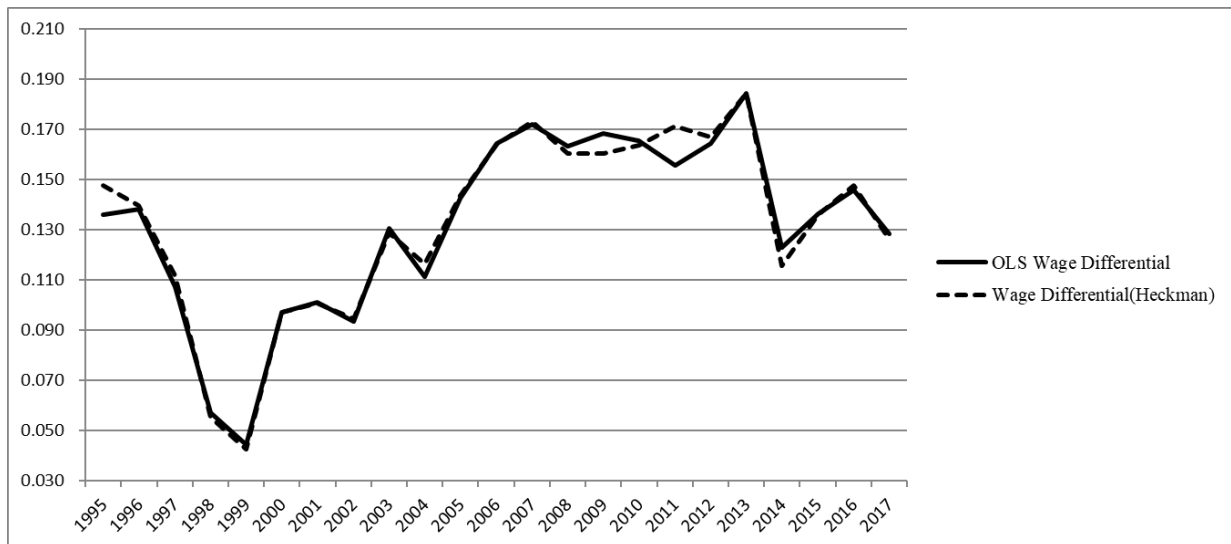

Figure 4: Comparing Wage differentials (OLS vs. Heckman)

Table 8: Fringe Benefit Differential from Probit model

	Pension Plan	Health Insurance
1995	0.252***	0.095***
	(0.032)	(0.023)
1996	0.291***	0.087***
	(0.034)	(0.024)
1997	0.263***	0.029
	(0.036)	(0.029)
1998	0.260***	0.058**
	(0.036)	(0.028)
1999	0.214***	0.002
	(0.037)	(0.031)
2000	0.134***	-0.003
	(0.036)	(0.028)
2001	0.182***	0.064***
	(0.026)	(0.016)
2002	0.193***	0.055***
	(0.026)	(0.017)
2003	0.244***	0.019
	(0.025)	(0.019)
2004	0.208***	0.047**
	(0.026)	(0.019)
2005	0.250***	0.064***
	(0.032)	(0.024)
2006	0.189***	0.034
	(0.032)	(0.026)
2007	0.233***	0.094***
	(0.032)	(0.024)
2008	0.204***	0.041
	(0.033)	(0.028)
2009	0.259***	0.057**
	(0.032)	(0.027)
2010	0.262***	0.102***
	(0.030)	(0.024)
2011	0.296***	0.109***
	(0.031)	(0.025)
2012	0.238***	0.062**
	(0.033)	(0.028)
2013	0.255***	0.099***
	(0.032)	(0.026)
2014	0.246***	-0.020
	(0.030)	(0.029)
2015	0.268***	-0.043
	(0.032)	(0.030)
2016	0.224***	0.050*
	(0.031)	(0.027)
2017	0.222***	-0.036
	(0.032)	(0.030)

Note: standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Source: Current Population Surveys

Figure 5: Trend of Pension Plan Differentials, Year-by-Year, March CPS
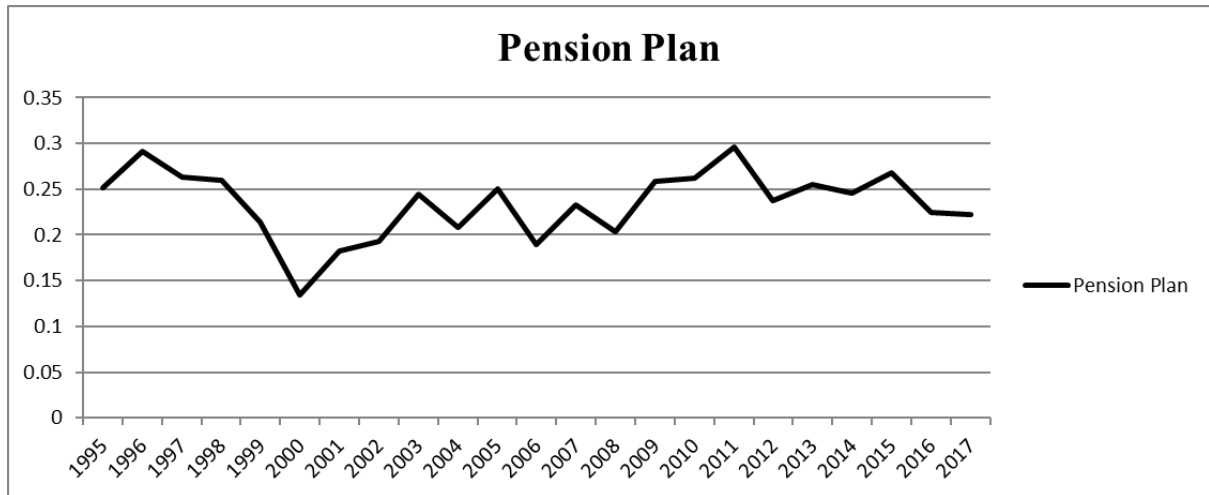

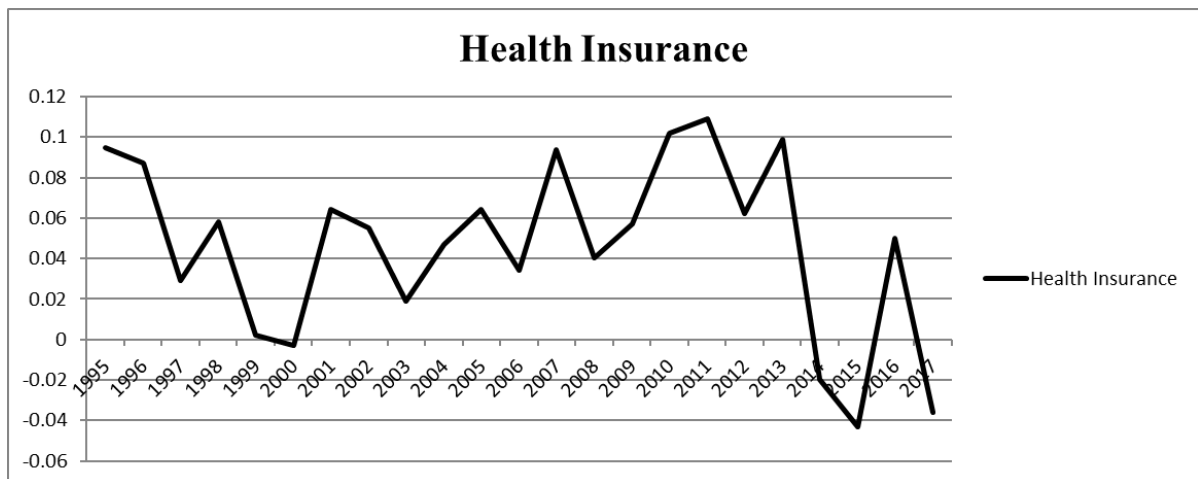**Figure 6: Trend of Health Insurance Differentials, Year-by-Year, March CPS**

Table 9 : Time series analysis of Wage Differentials

	(1)	(2)	(3)	(4)
Fed. Spending to GDP[1]	0.013*	0.017	0.017*	0.0178**
	(0.007)	(0.010)	(0.009)	(0.008)
Unemployment Rate (Age 25~54)	-0.003	-0.002	-0.003	-0.002
	(0.007)	(0.009)	(0.008)	(0.008)
Annual GDP Growth Rate	-0.005	-0.001	-0.001	
	(0.006)	(0.006)	(0.005)	
Median Earning (College/High school)[2]	-0.003	0.030		
	(0.236)	(0.246)		
Democrats[3]		-0.023	-0.023	-0.025*
		(0.016)	(0.015)	(0.014)
Constant	-0.094	-0.227	-0.179	-0.193
	(0.347)	(0.401)	(0.137)	(0.119)

Note: Huber/White robust standard errors in parentheses , *** p<0.01, ** p<0.05, * p<0.1

[1] Federal spending as a share of GDP

[2] Ratio of median earnngs of college graduates to median earnings of high school graduates

[3] 1 if the president is Democratic, 0 otherwise