

Data Appendix - Not for Publication

Closing the Gender Pay Gap in the US Federal Service: The Role of New Managers

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I. *OPM Payroll Data:*

The data used in this paper come from the US Office of Personnel Management’s (OPM) longitudinal administrative payroll data for the US federal workforce. The data are public information under the Freedom of Information Act (FOIA). The data are an extract of OPM’s Enterprise Human Resources Integration-Statistical Data Mart (EHRI-SDM). Key features of that data are highlighted below. Comprehensive information on the the construction of the EHRI-SDM data and its contents are described in OPM (2014).

The data cover the majority of non-sensitive civilians employed by the federal executive branch between 1973 and 2016.¹ OPM’s data is provided in quarterly snapshots of employees (herein static files) from the third quarter of 1973 up through 2016. OPM also provided data on each quarter’s employee transitions and personnel actions (herein transition files). The transition files are only available beginning in 1982 and end in the third quarter of 2016. These files are essential for our analysis and we therefore restrict our sample to the years for which these data are available. Furthermore, a variable identifying duty stations – employees’ physical offices, is not available in the files starting the third quarter of 2014. Thus, we focus on the data starting in the first quarter of 1982 until the second quarter of 2014. These data cover 5,296,254 unique employees spread over 232 agencies.

A. Key variables in the OPM data:

Below we discuss salient features and key data processing decisions for our key variables (listed using the OPM variable names). Complete documentation for the OPM data is available at:

¹The following executive branch employees are excluded: Board of Governors of the Federal Reserve, Central Intelligence Agency, Defense Intelligence Agency, Foreign Service personnel at the State Department (included until March 2006), National Geospatial-Intelligence Agency, National Security Agency, Office of the Director of National Intelligence, Office of the Vice President, Postal Regulatory Commission, Tennessee Valley Authority, U.S. Postal Service, White House Office, Foreign Nationals Overseas, Public Health Service’s Commissioned Officer Corps, and Non-appropriated fund employees (OPM, 2014, p. 17). The following non-executive government employees are included: Dwight D. Eisenhower Memorial Commission, Financial Crisis Inquiry Commission, Government Printing Office, Medicare Payment Advisory Commission, Ronald Reagan Centennial Commission, U.S. - China Economic and Security Review Commission, U.S. Commission on International Religious Freedom, and U.S. Tax Court.

<https://www.opm.gov/policy-data-oversight/data-analysis-documentation/fedscope/>

NAME: The full name of the employee.

ID: A unique employee id created by OPM. It is consistent across years enabling the matching of employees over time and the linking of employees whose names were withheld for security reasons.

AGENCY: Agency identifies the federal agency, inter-agency panel, or commission (herein simply referred to as agency) where the individual is employed in each quarter. The OPM data included 232 unique agencies in the 1982-2014 sample. The average federal agency size has 126,341 unique workers and the largest agency we observe has 344,410 unique workers. The agency identifier provided is a two-letter code. When an agency is moved into another federal department, its agency code is changed. There are no missing entries for this variable.

SUBAGENCY: Subagency identifies the subagency where the employee is employed in each quarter. Many (28%) of agency-quarter observations have only one subagency. Among those with multiple subagencies the median number is 18. The median size of a subagency (for agencies with multiple subagencies) is 444 unique individuals at any given time and subagencies range in size from 1 to 308,049 employees.

Like agency above, OPM provides a two-letter code for subagencies. This variable contains missing entries in the data. We fill the missing subagency entries with non-missing subagency codes for individuals employed at the same agency and duty station in the period preceding or following the period with a missing subagency code. We then fill missing subagency codes in cases when there is only one subagency at the agency level, as well as agency-duty station level in all years in the 1982-2014 sample.²

DUTY_STATION: The duty station is the physical office where the employee works. This variable also contains missing entries. We fill the missing duty station codes with non-missing codes for individuals employed at the same agency and subagency in up to 3 periods preceding or following the period with a missing duty station code. We further fill missing duty station codes if there is only one duty station code for the agency-subagency pair in a given year and quarter.³

²We were unable to fill missing subagency code for 11 out of 16,687 observations in the 1982-2014 sample after excluding law and regulatory enforcement agencies.

³We filled all 5,939 missing duty station codes in the 1982-2014 sample after excluding law and regulatory enforcement agencies.

AGE: Each employee's age is provided in five-year age bins.

EDUC: The data include the education level of the employee expressed as the maximum level of schooling attained⁴ each quarter (14% of employees increase educational attainment throughout their career).

PAY_PLAN: The OPM data list the exact pay plan the employee is covered by in each quarter of employment. In the 1982-2014 sample, starting in 1982, 71% of federal employees are paid under the GS system at some point in their careers, and 29% of employees are paid under a non-GS system at some point in their careers. Many of the alternative pay plans are associated with management responsibilities. In 42 out of 203 of the alternative pay plans at least 95% of the individuals covered under them are in management positions at some point while paid in that pay plan. Only 10% of individuals are classified as managers at some point while paid in the GS pay plan.

Alternative pay plans are not limited to high skilled workers. 44% percent of those ever paid under alternative pay plans have a Bachelor's degree or higher (40% of those ever paid under the GS plan are similarly educated). These alternative pay plans are more generous, on average, than the GS pay plan. After controlling for education, agency, and year fixed effects, those in alternative pay plans earn roughly 12% more per year than those paid under the GS plan.

GRADE: This is the exact grade (level) the employee is in within their pay plan in each quarter of employment. For example, GS grades range from 1-15 (1-18 prior to 1991), and higher GS grades are associated with greater pay. Other pay plans have a wide variety of grades. The Executive pay plan has only 5 grades and lower grades are more highly paid.

LOS: The total number of quarters of federal work experience accrued to date. This includes all previous federal employment spells. Length of service is provided in bins of years of service: <1, 1-2, 3-4, 5-9, 10-14, 15-19, 20-24, 25-39, 30-34, 35+.

PATCO: Occupation type: administrative, blue collar, clerical, other white collar, professional, or technical.

⁴Categories included are: no formal education or some elementary school - did not complete, elementary school completed - no high school, some high school - did not complete, high school graduate or certificate of equivalency, terminal occupational program - did not complete, terminal occupational program - certificate of completion, diploma or equiv, some college - less than one year, one year college, two years college, associate degree, three years college, four years college, bachelor's degree, post-bachelor's, first professional, post-first professional, master's degree, post-master's, sixth-year degree, post-sixth year, doctorate degree, post-doctorate.

BASIC_PAY: The employee’s annualized salary. It includes the employee’s base pay along with any location adjustments or special pay adjustments for law enforcement officers.

SUPERVISOR: A categorical supervisory status variable indicating whether the employee is in a supervisory position in each quarter and the type of supervisory position held: supervisor or manager; supervisor (CSRA); management official (CSRA); leader; team leader; all other positions.

TYPE: The type of appointment held by the employee in each quarter. Appointments are permanent or nonpermanent, and further classified into competitive, excepted, and senior executive service.

SCHEDULE: An indicator for whether the employee is employed as full or part-time worker.

NSTFP: An indicator for being a non-seasonal permanent full-time employee.

FED_CODE: A 4-digit occupation code that follows OPM occupation codes classification (OPM, 2018). There are a total of 1,228 occupation codes.

Key constructed variables:

Harmonized Agencies, Subagencies, Duty-Stations, and Pay Localities:

In our data, we define an office as a combination of the three variables from OPM – agency, subagency, and duty station codes. We treat duty stations that belong to multiple subagencies and agencies as distinct offices because administrative reporting lines are organized within subagencies.

When an agency or subagency is moved into another federal department, their codes change in the OPM data. For example, the Federal Emergency Management Agency (FEMA) received a new agency code when it was folded into the Department of Homeland Security in 2003. While the duty stations during similar restructurings remain the same, when identifying them in conjunction with the agency-sub-agency pairs they would appear as new offices even though they are indeed the same. To avoid this, we harmonize agency and subagency codes when possible through the longitudinal data of their employees. If agency or subagency codes change while employees remain working at the same OPM duty stations, we recode agency and subagency codes to those prior to the code change. This harmonization affected less than 1% of the sample⁵.

⁵Out of 110,165,639 person-quarter observations in the data after excluding missing offices, law enforcement and regulatory agencies, offices were harmonized for 881,377 person-quarter observations

LPA: Each duty station is matched to its locality pay areas (LPA) as defined by OPM (2014).

Tenure: OPM’s total federal service to date is a categorical variable (see LOS above). We use the longitudinal data to recover exact years of federal service and to construct the exact years of federal experience (tenure) at any point in time. For those hired with no prior federal employment (zero tenure), tenure is the length of the current spell. For those with previous federal work experience (“positive tenure” at the start of their spell), we determine the exact years of tenure through the timing of changes in the categorical tenure variable and impute years of tenure to the rest of the observations for that individual.

Birth Year (exact age): The OPM data reports age in five-year bins. We use the age recorded at hiring and separation in the dynamic data files to impute each employees’ birth year. This method is more reliable than using the age provided in the quarterly status files.⁶ To create the year of birth (exact age) variable, we first exploit changes in age bins. We assign the remaining employees the age and associated birth year implied by the middle of their age bin.

Employee Gender:

The data files provided by OPM do not include each employee’s gender. We used a probabilistic algorithm based on the employee’s name and imputed birth year to impute employee gender. Specifically, we use the Social Security Administration (SSA) baby name data to assign each first name a gender probability in each birth year. In instances where there is a first initial provided and a full middle name, we use the middle name.⁷ We code an employee as female if at least 85% of the babies born with that name in the birth year are female, and male if 15% or less of the babies born with that name in the birth year are female. We very conservatively classify names that are female in 15 to 85% of births as gender neutral names. We classify 45% of unique employees as female, 45% as male and 3% have gender neutral names. 7% of unique employees have names that cannot be matched to the SSA data and are thus unclassified.

Our gender assignments are extremely accurate. We validated our approach using a separate extract of EHRI-SDM data from Vilhuber (2018) which includes information on employee gender for 1999-2012. Vilhuber’s data does not include employee name. Using variables that are common to both datasets we are able to uniquely match roughly 80% of the employees common to both

⁶The age variable in the status files is badly behaved, with the age bins for a given employee regularly decreasing and increasing from quarter-to-quarter. The age variable in the dynamic files is more consistent. It appears that the age variable is entered in the dynamic files and then updated passively via an algorithm with a few bugs in the quarterly snapshots provided in the static files.

⁷If a name is relatively uncommon and does not appear in the SSA year files or if we do not have a reliable exact year of birth, we use the baby gender mix for that name from the imputed decade of birth.

data sets.⁸ 95.11% of the employees our algorithm identifies as male are listed as male in the Vilhuber data. Virtually all (99.24%) of the employees our algorithm identifies as female are listed as female in the Vilhuber data.

II. *Estimation Sample Construction:*

Our objective in constructing our estimation sample was to create a sample of employees with identifiable gender and longitudinal employment data. Figure I provides an overview of the sample construction process.

Our sample consists of full and part-time white-collar employees⁹ hired on or after January 1st, 1982 (the first year the dynamic data files are available), who we observe until the second quarter of 2014. We focus on the cohorts who enter adulthood in our sample period: the 1955-1960, 1960-1964, 1965-1969, 1970-1974, 1975-1979, and 1980+ birth cohorts. We restrict the sample to employees employed within the United States.

OPM redacted the names of individuals in sensitive positions, such as law enforcement and regulatory enforcement positions. Since we need names to code employee gender, the 15 agencies with a predominantly law-enforcement or regulatory mission were excluded from the sample by necessity.¹⁰ The Inspector General subagency was also dropped for all the remaining agencies as it acts as a regulatory/enforcement body within each agency. OPM withheld the names of 80% of the unique employees within these agencies.

OPM also redacted names and duty stations for occupations it deems sensitive, such as correction officers, marshals, nuclear engineers etc. The full list includes 27 occupations and can be found in OPM’s Data Release Policy. In line with limited information for these occupations, we exclude them from the sample as well.

Finally, we excluded any employee with only a first and middle initial listed, those with gender neutral names and those with names that do not appear in the SSA Baby Name files. We retain all managers whose agency-subagency-duty stations are included in the sample, even if they have unobserved genders. We also exclude observations with missing covariates.

⁸The variables used are quarter and year, agency, subagency, duty station, education level, pay plan, pay plan grade, occupation code, type of appointment, and exact salary.

⁹We exclude seasonal, intermittent, and job sharing employees

¹⁰Department of Defense, Department of the Airforce, Department of the Army, Department of Justice, Selective Service System, Office of Special Counsel, Department of the Treasury (although this is not an enforcement agency, since roughly 85% of treasury employees work for the IRS the agency acts as a law-enforcement agency in practice), Nuclear Regulatory Commission, Office of Personnel Management, Department of Homeland Security (and old FEMA), Consumer Product Safety Commission, National Transportation Safety Board, Office of National Drug Control Policy, Defense Nuclear Facilities Safety Board, and the Equal Employment Opportunity Commission.

III. Managers

Identification of Managers and New Managers:

The OPM data include a 6 value categorical supervisory status variable indicating whether each worker has supervisory duties and the level of any such duties, as discussed above. Our work focuses on estimating the effect of direct supervisors. We define a manager as any person who has any managerial or leadership responsibility. This includes supervisory status codes corresponding to supervisor or manager; supervisor (CSRA); management official (CSRA); leader; and team leader.

We observe every employee at each office in each quarter, including those whose names are withheld. We code an individual a “new manager” in the first quarter we observe them with a managerial role in a particular office. “New Managers” therefore include individuals who are taking a managerial role for the first time and those with prior managerial service who are a manager in a particular office for the first time (new to the office). New managerial appointments are spread throughout the year (Figure III) and do not cluster at the start of the calendar or federal fiscal (October) year.

Manager Characteristics:

After identifying all of the managers who appear in our data we once again impute manager gender using the same algorithm described above. However, unlike with employees, we retain **all** managers regardless of our ability to impute gender. We then match the managers back to the employee data at the office-quarter-year level. Thus, the only reason a manager would be excluded is if the office they work in is excluded in the employee data due, for example, to office size or OPM’s withholding of employee names. We identify 259,135 unique white collar managers in the event-study sample¹¹ (85,253 women, 127,380 men, and 46,502 unidentified managers). Among these managers, we observe 165,184 new managerial appointments (59,354 women, 82,622 men, and 23,208 unidentified managers). Nearly all (91%) of the newly appointed managers we observe were already employed by the federal government at the time of the appointment. More than half (64%) had previously worked at the office they were appointed to.

¹¹The event-study sample is restricted to workers who were employed by the US Federal service for at least 5 years, work in offices with at least 10 employees and at most 5 managers, were born in the year starting 1955, and experienced an appointment of a first new manager.

References

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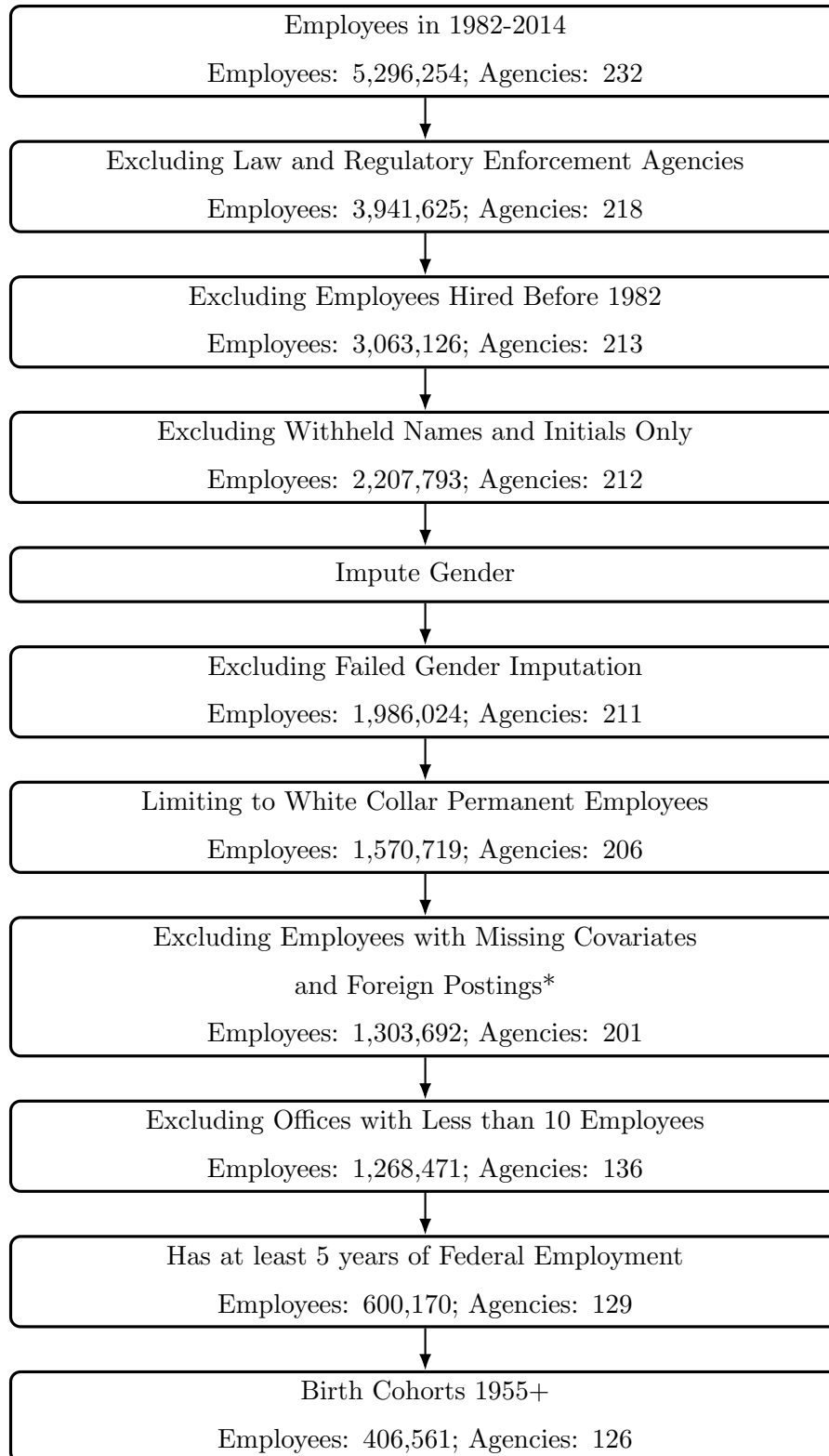


Figure I. : Sample Construction

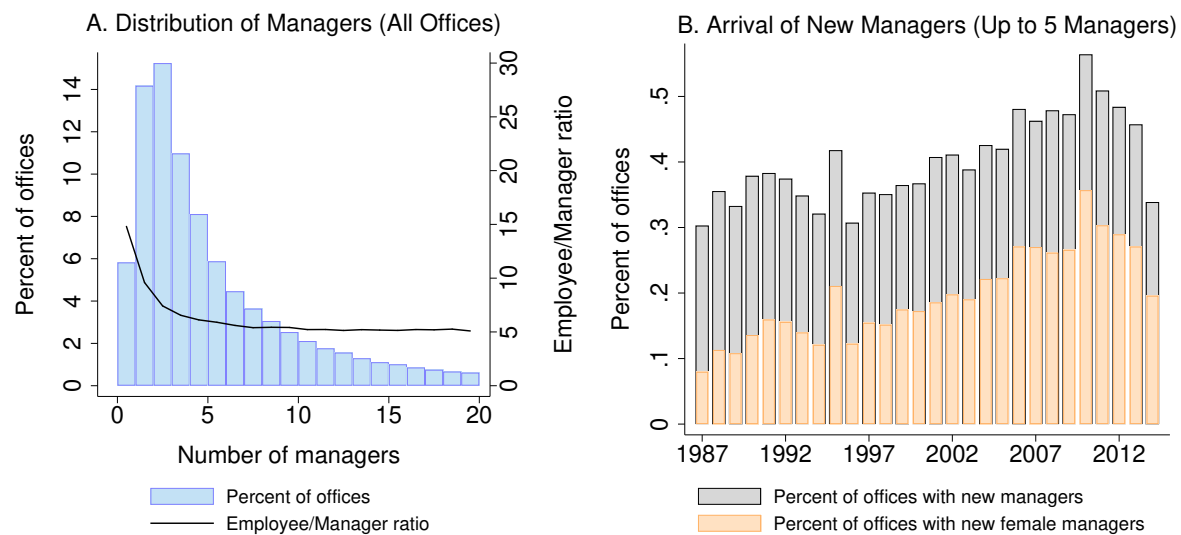


Figure II. : Managers across Offices

Note: The samples are defined as in Figure 1. The display in Panel A however omits offices with more than 20 managers. There are 11,964 offices in the “All offices” sample: 1,791 offices have more than 20 managers in at least one year while 11,177 offices have 20 managers or less in at least one year.

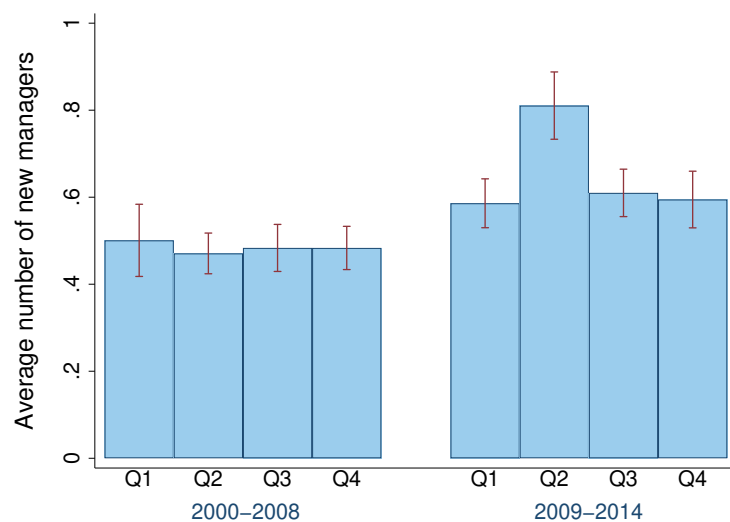


Figure III. : New Managers by Quarter

Note: The sample is restricted to offices in the “Up to 5 managers” sample as defined in Figure 1B. Bars denote the average number of new managers in quarters 1-4 for two time periods – 2000-2008 and 2009-2014. Vertical bars represent 95% confidence intervals.

IV. *O*NET Task Data*

We begin by following Acemoglu and Autor’s (2011) canonical work on measuring occupations’ task content, available under the task measure construction [<https://economics.mit.edu/people/faculty/david-h-autor/data-archive>]. Acemoglu and Autor (2011) employ a more parsimonious set of O*NET scales than Firpo, Fortin, and Lemieux (2009) and Goos, Manning, and Salomons (2014), who use O*NET task measures to construct measures of routine and abstract tasks and offshorability. Following Autor, Levy, and Murnane (2003), they focus on three broad task groups: routine cognitive and manual tasks, which can be codified to be performed by machines; abstract analytical and managerial tasks, which may require creativity, hypothesis formation, problem solving or persuasion; and non-routine manual tasks, which may require physical flexibility and adaptability, visual recognition, or non-scripted communications.

Because we consider only white-collar workers, we focus mainly on the measure of “routine cognitive” tasks, but also present results for “non-routine cognitive- analytical and interpersonal”. To further explore the role of new managers, we compare their impact across jobs that require more or less supervision using the new O*NET Work Style - Independence.

The O*NET task measures proposed in Acemoglu and Autor (2011) are composite measures of the following O*NET Work Activities (A) and Work Context (C) Importance scales:

- Non-routine cognitive: Analytical
 - 4.A.2.a.4 Analyzing data/information
 - 4.A.2.b.2 Thinking creatively
 - 4.A.4.a.1 Interpreting information for others
- Non-routine cognitive: Interpersonal
 - 4.A.4.a.4 Establishing and maintaining personal relationships
 - 4.A.4.b.4 Guiding, directing and motivating subordinates
 - 4.A.4.b.5 Coaching/developing others
- Routine cognitive
 - 4.C.3.b.7 Importance of repeating the same tasks
 - 4.C.3.b.4 Importance of being exact or accurate
 - 4.C.3.b.8 Structured v. Unstructured work (reverse)
- Routine manual
 - 4.C.3.d.3 Pace determined by speed of equipment
 - 4.A.3.a.3 Controlling machines and processes
 - 4.C.2.d.1.i Spend time making repetitive motions
- Non-routine manual physical
 - 4.A.3.a.4 Operating vehicles, mechanized devices, or equipment
 - 4.C.2.d.1.g Spend time using hands to handle, control or feel objects, tools or controls
 - 1.A.2.a.2 Manual dexterity
 - 1.A.1.f.1 Spatial orientation

- Independence
 - 1.C.6 Guiding oneself with little or no supervision and getting things done in one’s own way

The O*NET scales are available at the seven-digit O*NET classification occupation system, which Acemoglu and Autor collapse the more detailed classification into SOC occupations. Each scale is then standardized to have a mean zero and standard deviation of one, using labor supply weights from the pooled 2005/6/7 Occupational Employment Statistics (OES) Survey, one of the few large surveys that use the SOC occupational classification system. The composite task measures listed above are equal to the sum of their respective constituent scales, then standardized to mean zero and standard deviation one. As explained in Autor and Dorn (2013), the task measures are further collapsed to the Census 2000 occupational code level, using the OES Survey labor supply weights and then collapsed to the 326 consistent occupations, using Census 2000 labor supply weights.

OPM uses its own occupation classification system. Thus, we construct a custom occupational crosswalk between the 4-digit federal service and 7-digit O*NET occupation codes.

References

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