The Defense Acquisition Workforce Growth Initiative

Changing Workforce Characteristics and the Implications for Workforce Retention

Michael H. Powell

RAND PARDEE RAND GRADUATE SCHOOL

Abstract

The U.S. defense acquisition workforce (DAW) experienced significant personnel reductions in the 1990s, leading to concerns regarding the size of and age distribution within the workforce in the early 2000s. Defense officials responded to these concerns, instituting a DAW "growth initiative." The growth initiative was successful in increasing the size of the DAW, but little is known about how the hiring surge changed who the DAW hired into its ranks, and how this might influence workforce outcomes, such as retention. This dissertation examines this issue by focusing on the civilian portion of the DAW (civilian DAW) and on entrants' prior work experience.

This dissertation utilizes DoD personnel data to (1) describe civilian DAW cohorts in terms of past work experience and illustrate how the hiring surge has changed cohort past-work-experience characteristics; (2) evaluate how prior work experience relates to retention in the civilian DAW; and (3) estimate how the growth initiative has influenced overall cohort-level retention rates.

The analyses reveal that the growth initiative was fueled mainly by outside hires with no prior DoD experience, and some evidence suggests that these DoD newcomers—in general—tend to have the highest retention in the civilian DAW. Additionally, the analyses reveal that internal hires are more attached to the DoD civilian workforce than are external hires. In line with these conclusions, the synthetic-cohort analysis finds that the hiring surge likely produced cohorts with greater civilian DAW retention.

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Abbreviations

AD	Active Duty
ADMF	Active Duty Master File
APF	Appropriated Fund
CSRS	Civil Service Retirement System
DAW	Defense Acquisition Workforce
DAWDF	Defense Acquisition Workforce Development Fund
DAWIA	Defense Acquisition Workforce Improvement Act
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDD	Department of Defense Directive
FY	Fiscal Year
NDAA	National Defense Authorization Act
NDRI	National Defense Research Institute
NSPS	National Security Personnel System
OSD	Office of the Secretary of Defense
PH	Proportional Hazard
SES	Senior Executive Service
TWANG	Toolkit for Weighting and Analysis of Nonequivalent Groups (RAND)
USD (AT&L)	Under Secretary of Defense for Acquisition, Technology and Logistics
USD (P&R)	Under Secretary of Defense for Personnel and Readiness

Chapter 1. Introduction

The U.S. Department of Defense (DoD) relies on its acquisition process, and the workforce that supports that process, to provide the weapon systems and services it needs to execute its ultimate job—ensuring the security of the American people (Gates et al., 2013). This is a significant task, as defense acquisition professionals are responsible for allocating hundreds of billions of federal dollars annually (Office of the Under Secretary of Defense, 2015) and for equipping U.S. military members in the field with the tools they require to survive and complete their missions. Given the significant financial and security responsibilities, the defense acquisition workforce (DAW) has been closely scrutinized for years and has undergone various "rightsizing"[1] and professionalization initiatives.

Most recently, the DAW underwent an ambitious growth initiative. In the early 2000s, there were concerns about the state of the DAW. First, the workforce was aging (U.S. Department of Defense, 2000; Testimony by Dr. Diane M. Disney, 2000), and reports warned that the DAW could experience significant attrition in the subsequent years (Office of the Inspector General, 2000; U.S. Department of Defense, 2000; Office of the Secretary of Defense, 2000). Additionally, a report from the Office of the Inspector General stated that the personnel reductions that took place throughout the 1990s made it difficult for acquisition professionals to meet the demands for their services (Office of the Inspector General, 2000). In response to these concerns, legislators established the Defense Acquisition Workforce Development Fund (DAWDF) in the FY 2008 National Defense Authorization Act (NDAA) (Public Law 110-181, National Defense Authorization Act for Fiscal Year 2008) and granted Expedited Hiring Authority in the FY 2009 NDAA for a number of acquisition positions (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009). The DAWDF created a pool of protected resources that officials could use only for growing and developing the DAW (Public Law 110-181, National Defense Authorization Act for Fiscal Year 2008; Title 10 U.S.C. Ch. 87 Section 1705), and the Expedited Hiring Authority helped streamline the actual hiring process (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009; Title 10 U.S.C. Ch. 87 Section 1705(g); Title 5 U.S.C. Ch. 33 Section 3304; Title 5 U.S.C. Ch. 53 Section 5333; Title 5 U.S.C. Ch. 57 Section 5753).[2] In April of 2009, Defense

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[1] Gates et al. (2008) write, "A popular term used in discussing the management of government agencies is 'rightsizing'—having the optimal or appropriate number of employees to accomplish the required tasks" (p. 3). This study also uses the term "rightsizing."

[2] The FY 2009 NDAA ends the Expedited Hiring Authority for the DAW at the end of FY 2012 (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009). However, the Authorization has since been extended to the end of FY 2017 (Public Law 112-239, National Defense Authorization Act for Fiscal Year 2013).

Secretary Robert Gates announced a plan to increase the size of the DAW by 20,000 by FY 2015 (Gates, 2009a).

Personnel managers and the DAW as a whole responded quickly, with help from the DAWDF and the Expedited Hiring Authority. In fact, the DAW neared its growth initiative goals more quickly than expected. From the end of FY 2009 to the end of FY 2011, the DAW grew from approximately 133,000 personnel to just under 152,000—an increase of over 18,000, or around fourteen percent (see Figure 1.1) (Office of the Under Secretary of Defense for Acquisition, 2015).

Figure 1.1. Total Size of the DAW Increased Quickly Between End-of-FY 2008 and End-of-FY 2011
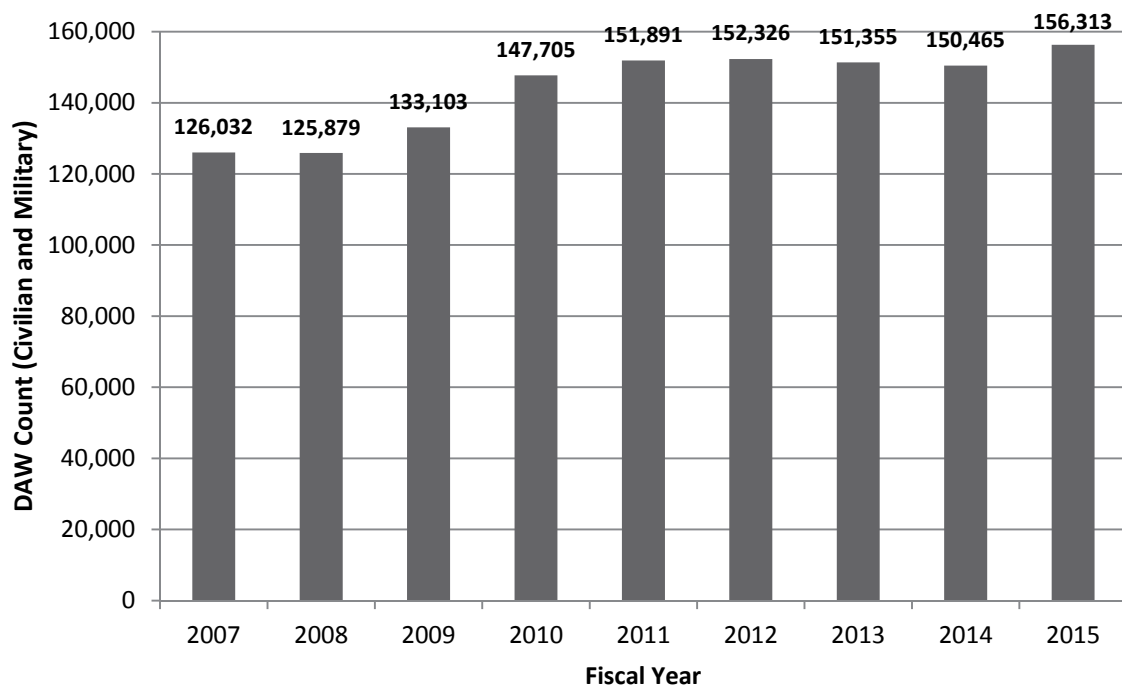
SOURCE: (Office of Human Capital Initiatives)

Figure 1.1 shows that the growth initiative was effective in quickly growing the overall size of the DAW, but it also raises the following questions regarding what type of individuals were brought into the workforce during the initiative and what implications these changes have on longer-term retention.

1. What are the characteristics of the individuals who were brought into the DAW during the hiring surge?

2. How are they different from those who were hired in the years prior to the growth initiative?

3. How might any differences in these cohort groups affect workforce outcomes, such as retention?

This study addresses these questions by focusing on the civilian DAW and examining entrants' prior work experience. "Organizational socialization" theory suggests that prior experiences influence how an individual assimilates into a new work environment (Bauer et al., 2007, p. 7; Saks and Ashforth, 1997, p. 234; Adkins, 1995, p. 839; Carr et al., 2006, p. 343; Van Maanen and Shein, 1977, p. 1). Also, this is a natural place to start because prior work experience heavily influences the employee selection process (Dokko, Wilk and Rothbard, 2009; Adkins, 1995). Past work experience is a large part of each applicant's resume or job application—it signals what "skills" and "habits" each applicant has (Dokko, Wilk and Rothbard, 2009, p. 52).

The official DAW is made up of DoD civil servants, active-duty military members, and contractors. Data on the contractor workforce, however, are limited (Gates, 2009b, pp. 14-15), so empirical examinations of the DAW tend to be confined to the acquisition personnel who are employed and tracked by the DoD—the DoD civilian employees and the active-duty military members. These personnel make up what is called the "organic" DAW (Gates et al., 2013, pp. xi, 1). In this document, the term DAW refers strictly to these organic defense acquisition employees (see Figure 1.2).

Figure 1.2. The Organic DAW Consists of Active-Duty Military and DoD Civilian Acquisition Professionals
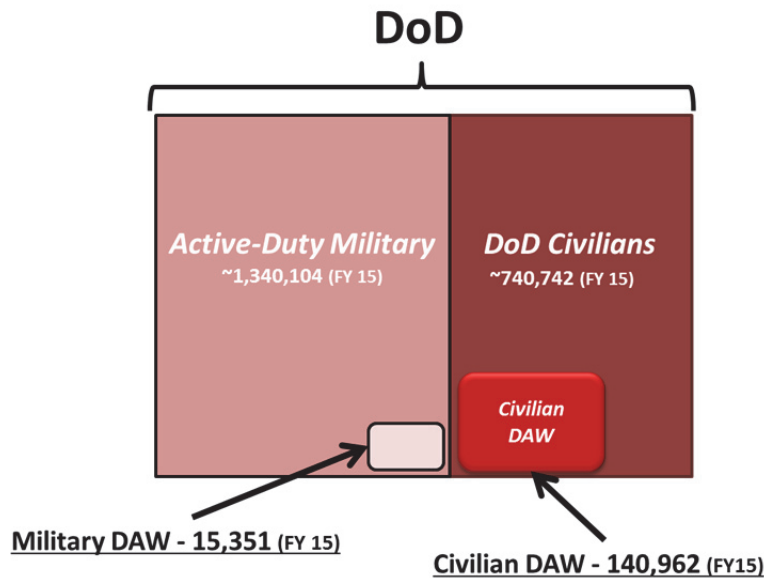
SOURCES: DAW numbers come from the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics - Human Capital Initiatives (Office of Human Capital Initiatives). The active-duty military count comes from the end-of-FY Active Duty Master File, and the DoD civilian count comes from the end-of-FY DoD Civilian Personnel Inventory File. RAND receives these files from the Defense Manpower Data Center. More detail on the personnel included in these files can be found in Chapter 6. Data and Definitions.

Figure 1.3. The Vast Majority of the Organic DAW Consists of Civilian Personnel[3]

"Organic" DAW by Personnel Type, FY 2015
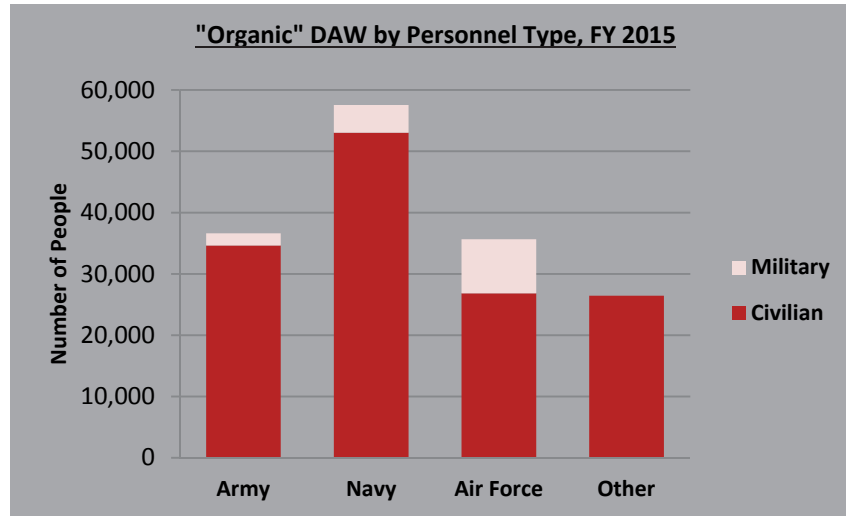
NOTE: Navy includes Marine Corps
SOURCE: Office of Human Capital Initiatives (2015)

This analysis focuses on the civilian DAW. Civil servants make up approximately 90 percent of the organic DAW (Office of Human Capital Initiatives, 2015) (see Figure 1.3 and Table 1.1), and the hiring and management of this segment of the acquisition workforce is of critical importance. Because civilian defense acquisition employees can have a diverse set of prior workforce experiences upon entry into the DAW, analysis can contribute to a better understanding of the relationship between those prior experiences and workforce outcomes. In contrast, military members typically join the military as a junior officer or enlisted member and work their way up through the ranks. Therefore, many individuals in the military DAW likely have experience in only one DoD workforce—the wider active duty military.

Table 1.1. This Study Focuses on Analyzing Entrants into the Civilian DAW

Total DAW	"Organic" DAW	Analysis Population
Civilian DAW	Civilian DAW	Civilian DAW
Military DAW	Military DAW	-
Gov't Contractors	-	-

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[3] Other RAND documents have used a similar chart to describe the DAW. See, for example, Gates et al. (2008) and Gates et al. (2013).

Looking at the civilian DAW cohorts from FY 2000 to FY 2014, one notes a large increase in the number of entrants during FYs 2008-2011 (see Figure 1.4, below). These cohorts are referred to as the "growth initiative cohorts" or the "hiring surge cohorts."

Figure 1.4. Civilian DAW Cohort Size Increased Significantly in FYs 2008-2011
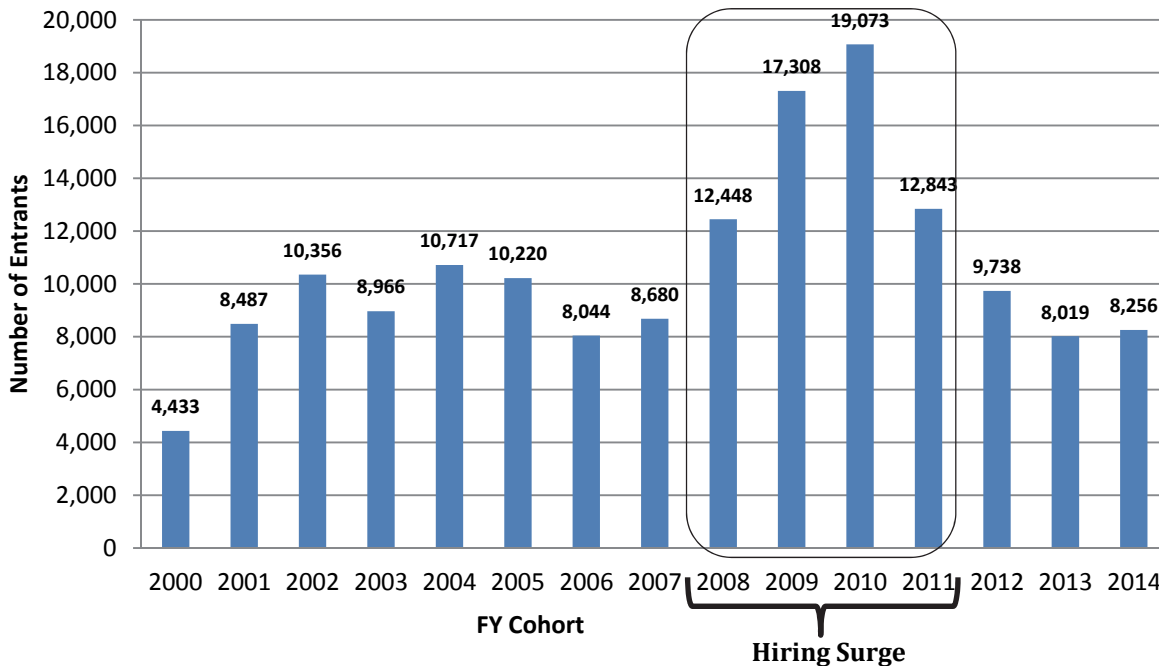
In order to (1) examine how the growth initiative changed workforce characteristics and (2) evaluate how these changes might influence overall retention trends, this study examines the civilian DAW and the growth initiative policies through the lens of prior work experience and addresses the following research questions:

1. How did the growth initiative change whom the civilian DAW hired into its ranks, in terms of prior work experience?

2. How does entrants' past work experience relate to civilian DAW retention?

3. What does this suggest in terms of how the growth initiative may have influenced overall cohort-level retention in the civilian DAW?

Past analyses provide acquisition officials insight into the makeup of the DAW,[4] and a recent study examines—more broadly—the relationship between various personnel factors and workforce outcomes.[5] But relatively little is known about the past-work-experience

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[4] These past analyses (Gates et al., 2008; Gates et al., 2009; Gates et al., 2013) are reviewed in "Chapter 3. Prior DAW-Related Studies."

[5] This study (Guo, Hall-Partyka and Gates, 2014) is also reviewed in "Chapter 3. Prior DAW-Related Studies."

characteristics of DAW entrants and how different past work experiences relate to DAW outcomes, such as retention. Understanding how the hiring surge changed cohorts' prior-work-experience characteristics and how this shift may influence workforce outcomes would provide defense officials with the knowledge to appreciate how "rightsizing" initiatives, such as the most recent growth initiative, have secondary implications. With this knowledge, decision makers can build more effective workforce management policies and plan for outcome shifts as a result of these policies.

This study utilizes DoD personnel data to (1) describe civilian DAW cohorts, in terms of past work experience, and illustrate how the hiring surge has changed cohort past-work-experience characteristics; (2) evaluate how prior work experience relates to retention in the civilian DAW; and (3) estimate how the growth initiative has influenced overall cohort-level retention rates.

Chapter 2. Background: The DAW and the Growth Initiative

The DAW is a large and broad group of professionals. This chapter describes the workforce, reviews how it was established and how it is tracked, and outlines the events leading up to and the policies involved in the growth initiative.

Establishing, Professionalizing, and Tracking the DAW

The Defense Acquisition Workforce Improvement Act (DAWIA) created and shaped the official DAW that exists today (Layton, 2007; Gates, 2009b). The legislation orders the DoD to track its acquisition employees and create and enforce professionalization standards. However, given the size of the DoD and the variety of roles acquisition professionals play in the acquisition process, counting and tracking the DAW has not been straightforward. In fact, there have been multiple different methods used for tracking these acquisition employees. The DAWIA and these various counting methods are explained in more detail, below.

The Packard Commission and the Defense Acquisition Workforce Improvement Act (DAWIA)

DAWIA was largely a response to the controversies that surrounded defense acquisition throughout the 1980s (Gates, 2009b). Allegations of "fraud, waste, and mismanagement" (Fox et al., 2011, p. 120) surfaced in the early- to mid-1980s, prompting an official review: The Packard Commission review (Layton, 2007; Gates, 2009b). The final Packard Commission report makes recommendations for many parts of the DoD, including defense acquisition (U.S. President's Blue Ribbon Commission on Defense Management, 1986). In regard to the DAW, the report recommended that the DoD "establish flexible personnel management policies" and "establish business-related education and experience criteria for civilian contracting personnel, which will provide a basis for the professionalization of their career paths" (U.S. President's Blue Ribbon Commission on Defense Management, 1986, p. 880 (pdf)).

DAWIA became law in 1990 (Title 10 U.S.C. Ch. 87), and the legislation includes mandates that resemble the recommendations made by the Packard Commission report. DAWIA mandated standardized acquisition workforce policy across the DoD (Title 10 U.S.C. Ch. 87 Section 1701). In particular, among other things, DAWIA:

- Mandated the "Designation of acquisition positions" (Title 10 U.S.C. Ch. 87 Section 1721) and the creation of an "Acquisition Corps" (Title 10 U.S.C. Ch. 87 Section 1731)

- Directed defense officials to "establish education, training, and experience requirements for each acquisition position, based on the level of complexity of duties carried out in the position" (Title 10 U.S.C. Ch. 87 Section 1723)

- Required the DoD to "ensure that appropriate career paths" exist for acquisition professionals (Title 10 U.S.C. Ch. 87 Section 1722)

- Mandated the establishment of a "Defense Acquisition University" (Title 10 U.S.C. Ch. 87 Section 1746)

- "Requir[ed] th[e] DoD [to] count and track the size of the [D]AW" (Gates, 2009b, pp. 7-8; Title 10 U.S.C. Ch. 87)

Counting and Tracking the DAW

Tracking the size of the acquisition workforce is no straightforward task as acquisition professionals are spread throughout the DoD and play a variety of different roles. Officials have been attempting to gauge the size of the DAW for decades (Defense Acquisition University, 2007; Grasso, 1999). During that time, several counting methodologies have been used. This study uses what is called the "DAWIA Count." This counting methodology, along with two others that have been used, is described below.[6]

First, the Packard Commission, in its review of the DoD in the 1980s, developed the "Packard Count" or the "Acquisition Organization Count" (Defense Acquisition University, 2007, p. 3-5; United States Department of Defense Office of Inspector General, 2006; Gates et al., 2008; Gates et al., 2013). The acquisition organization count simply includes all individuals who work in one of the official acquisition organizations (Defense Acquisition University, 2007; United States Department of Defense Office of Inspector General, 2006; Gates et al., 2008; Gates et al., 2013).[7] This counting method is simple but inaccurate if officials are attempting to track the number of personnel who are "directly involved" in the acquisition process: It includes support personnel who work in acquisition organizations but do not have acquisition responsibilities and does not include acquisition professionals who fall outside of the official acquisition organizations (Defense Acquisition University, 2007, p. 3-5).

The "DAWIA Count" (Defense Acquisition University, 2007, p. 3-6), which started in FY 1992 (Defense Acquisition University, 2007), stems from DAWIA's mandate to track and count all acquisition personnel and create official defense acquisition career fields (U.S. Department of Defense, 2010). The count is position based: Officials designate certain positions to be acquisition positions—based on the amount of acquisition work that position does (Defense Acquisition University, 2007; U.S. Department of Defense, 2010; Gates et al., 2008). And each acquisition position is assigned to an acquisition career field based on the nature of the acquisition work (Defense Acquisition University, 2007; U.S. Department of Defense, 2010). Under the DAWIA Count, the individuals who work in these acquisition-designated positons are counted in the DAW (Defense Acquisition University, 2007; U.S. Department of Defense, 2010;

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[6] The following summary of the various DAW counts is based on descriptions from previous reports (Defense Acquisition University, 2007; United States Department of Defense Office of Inspector General, 2006; U.S. Department of Defense, 2010; Grasso, 1999; Gates et al., 2013; Gates et al., 2008).

[7] The original acquisition organizations are outlined in DoDI 5000.55 (U.S. Department of Defense, 1991, pp. 19-20; United States Department of Defense Office of Inspector General, 2006, pp. 25-26).

Gates et al., 2008). The DAWIA legislation states that the DAWIA Count should "be implemented uniformly" across the DoD (Defense Acquisition University, 2007, p. 3-7),[8] but the ultimate implementation was and is left up to the individual DoD components (U.S. Department of Defense, 2010).[9]

A third counting methodology, referred to as the "Refined Packard [C]ount" was developed in the late 1990s (Defense Acquisition University, 2007, pp. 3-9, xii; Burman, Cavallini and Harris, 1999; United States Department of Defense Office of Inspector General, 2006). Under this methodology, there are three categories included in the DAW count: Category I consists of individuals in certain occupations, "such as contracting" that are acquisition in nature (Defense Acquisition University, 2007, p. 3-6; Burman, Cavallini and Harris, 1999; United States Department of Defense Office of Inspector General, 2006, p. 8; Gates et al., 2008). Category II includes individuals in certain occupations only if the individuals work in an acquisition organization (Defense Acquisition University, 2007; Burman, Cavallini and Harris, 1999; United States Department of Defense Office of Inspector General, 2006; Gates et al., 2008). And the third category (Category III) is the adjustment category. Under this category, components can add personnel to or remove them from the DAW count if they believe these individuals should or should not be counted (Defense Acquisition University, 2007; Burman, Cavallini and Harris, 1999; United States Department of Defense Office of Inspector General, 2006; Gates et al., 2008).

The Refined Packard Count began in FY 1998, and the DAWIA Count continued as a parallel counting method (Defense Acquisition University, 2007; U.S. Department of Defense, 2010; Gates et al., 2013). The two counts "converged" over the next several years "through a process called...'assimilation'," which involved improving the "consistency" with which positions were included in the DAW (Defense Acquisition University, 2007, p. 3-7; U.S. Department of Defense, 2010; Under Secretary of Defense for Acquisition, 2001; Gates et al., 2013). By FY 2005, only the DAWIA Count remained (in its revised form) (Defense Acquisition University, 2007; U.S. Department of Defense, 2010; Gates et al., 2008; Gates et al., 2013).

There is no perfect way to count and track the DAW. This study uses the DAWIA Count data going back to FY 1992. It is important to recognize that the implementation of this count has changed over the years, as described above.

An Overview of the Current DAW

The DAW represents a significant portion of DoD personnel and includes a diverse range of careers. The vast majority of the DAW positions are filled by DoD civilians, although military personnel also play a significant role. As of the end of fiscal year (FY) 2015, there were 140,962

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[8] See sections 1701 and 1721 in DAWIA (Title 10 U.S.C. Ch. 87 Section 1701; Title 10 U.S.C. Ch. 87 Section 1721).

[9] See DoDI 5000.58 (U.S. Department of Defense, 1992) and DoDD 5000.52 (U.S. Department of Defense, 2005).

civilian DAW personnel and 15,351 military DAW personnel (Office of Human Capital Initiatives, 2015). The majority of these acquisition employees work under one of the three major military service organizations: the Department of the Army, the Department of the Navy (which includes the Marine Corps), and the Department of the Air Force. However, there is also a significant portion of DAW civilians that work for other organizations within the DoD, i.e. the defense agencies (Office of Human Capital Initiatives, 2015; Gates et al., 2013). Figure 2.1, below, illustrates the distribution of the acquisition workforce among the defense organizations.

Figure 2.1. The DAW Distribution by DoD Organization, FY 2015[10]
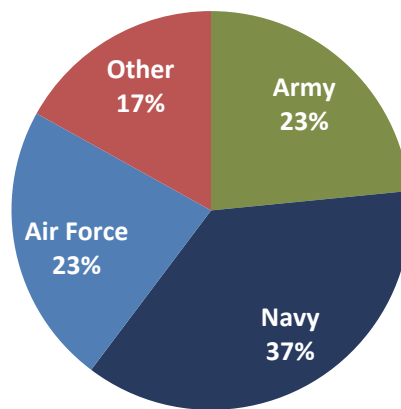
NOTE: The Department of the Navy includes the Marine Corps
SOURCE: Office of Human Capital Initiatives (2015)

Because of the range of responsibilities for the DAW, the acquisition community is composed of a diverse set of career fields. They have varied throughout the years (Gates et al., 2013; Guo, Hall-Partyka and Gates, 2014), but at the end of FY 2015 there were 14 career fields in the DAW (Office of Human Capital Initiatives, 2015; Gates et al., 2013; Guo, Hall-Partyka and Gates, 2014):[11]

- Auditing
- Business - Cost Estimating
- Business - Financial Management
- Contracting
- Engineering
- Facilities Engineering
- Industrial/Contract Property Management

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[10] This illustration includes both military and civilian personnel. Other RAND documents have used a similar chart to describe just the civilian DAW in earlier FYs. See, for example, Gates et al. (2008) and Gates et al. (2013).

[11] Gates et al. (2013), pages 1-2, and Guo, Hall-Partyka and Gates (2014), page 1, show a very similar list of career fields for FY 2011.

- Information Technology
- Life Cycle Logistics
- Program Management
- Production, Quality and Manufacturing
- Purchasing
- Science and Technology Management
- Test and Evaluation

The distribution of the DAW among these career fields differs between the civilian and military acquisition communities. These distributions are illustrated in Figures 2.2 and 2.3, below.

Figure 2.2. Civilian DAW by Career Field, FY 2015[12]

SOURCE: Office of Human Capital Initiatives (2015)

Figure 2.3. Military DAW by Career Field, FY 2015[13]
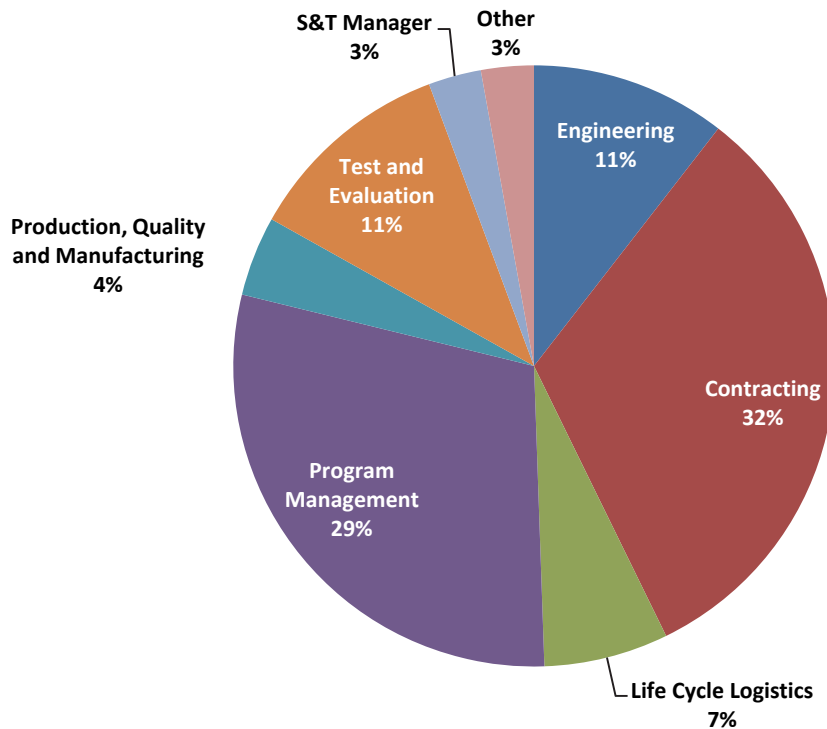
SOURCE: Office of Human Capital Initiatives (2015)

Approximately two thirds of civilian acquisition professionals are in one of the top four career fields: engineering, contracting, lifecycle logistics, or program management. In the military DAW, approximately 60 percent of acquisition professionals are in either the contracting or program management career fields.

Workforce Reductions throughout the 1990s

The entire federal government experienced personnel reductions throughout the last decade of the 20th century (Executive Office of the President Office of Management and Budget, 2002), and the DoD and DAW were no exceptions (U.S. Department of Defense, 2000; Gill, 2001; Office of the Inspector General, 2000). During the 1990s, the DoD decreased the number of its civilian personnel by approximately 37 percent, and—aligning with recommendations from the Packard Commission—the number of defense acquisition employees decreased even more (U.S. Department of Defense, 2000; Gill, 2001; U.S. President's Blue Ribbon Commission on Defense Management, 1986). These stark reductions created "imbalances in both skills and experience levels in many parts of the DoD" (Gates, Eibner and Keating, 2006, pp. xiii, 1; U.S. Department of Defense, 2000; Office of the Inspector General, 2000).

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[13] Other RAND documents have used a similar chart to describe the military portion of the DAW in earlier FYs. See, for example, Gates et al. (2008), Gates (2009b), and Gates et al. (2013).

The DAWDF and the Growth Initiative

In the early 2000s, there were some concerns about the state of the DAW. The DoD civilian workforce and the acquisition professionals within that workforce were aging (U.S. Department of Defense, 2000; Testimony by Dr. Diane M. Disney, 2000). A major report made for the Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&L)) and the Under Secretary of Defense for Personnel and Readiness (USD (P&R)) in 2000 predicted "a retirement-driven talent drain" in the DoD (U.S. Department of Defense, 2000, p. ES-1). And, according to the report, "the Office of the Secretary of Defense (OSD) project[ed] . . . losses approaching 50 percent in some key acquisition occupations primarily due to retirement over the next 5 to 6 years" (U.S. Department of Defense, 2000, p. 2).[14] Additionally, another 2000 report, from the Office of the Inspector General, projected significant losses from the DAW between the time of the report and FY 2005 (Office of the Inspector General, 2000).

There was also concern that the DAW was too small and would have difficulty meeting the demand for its services. The report from the Office of the Inspector General writes, "concern is warranted because staffing reductions have clearly outpaced productivity increases and the acquisition workforce's capacity to handle its still formidable workload" (Office of the Inspector General, 2000, p. ii).

Additionally, the demand placed on the defense acquisition personnel began to grow. The "DoD Procurement Budget" began to increase starting in the late 1990s (Gansler, Lucyshyn and Arendt, 2010, p. 2). And, according to one article, the acquisition "workload," measured by contract dollars, began to grow significantly starting in 2001 (Anderson, 2009, pp. 2-3). This, according to Anderson (2009), "strained" the DAW (p.3).

Just before the passage of the DAWDF, the then-Chairman of the Senate Committee on Armed Services, Senator Carl Levin, stated,

> Senior DoD officials have recognized the deficiencies in the defense acquisition workforce, but they have been unable to obtain significant funds that are needed to remedy the problem. ... Our bill [DAWDF] will address this issue by establishing an acquisition workforce development fund to enable the Department of Defense to increase the size and quality of its acquisition workforce (Levin, 2007, p. S12367; Anderson, 2009, p. 2).

The DAWDF was part of the FY 2008 NDAA (Public Law 110-181, National Defense Authorization Act for Fiscal Year 2008) and is codified as 10 U.S.C. Chapter 87 Section 1705 (Title 10 U.S.C. Ch. 87 Section 1705). According to the legislation, the DoD may use the money in the DAWDF "for the recruitment, training, and retention of acquisition personnel" (Public

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[14] U.S. Department of Defense (2000) cites the following: "DoD 113 Report, June 2000, adjusted for seasonal employment; source ODASD (CPP)" (p. 2).

A report from the Office of the Secretary of Defense (2000) states that "Between 1999 and 2005, as a result of separations and retirements, the job series that make the primary contribution to the acquisition process are projected to experience cumulative losses ranging from 35% to 50%" (Office of the Secretary of Defense, 2000, p. 2-3).

Law 110-181, National Defense Authorization Act for Fiscal Year 2008, sec. 852; Title 10 U.S.C. Ch. 87 Section 1705). To respond to the workforce shortfalls, the initial emphasis was on growing the DAW, through "recruiting and hiring" initiatives (Anderson, 2009, p. 4; Office of the Under Secretary of Defense, 2010).

Less than a year after the passage of DAWDF, the FY 2009 NDAA (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009) established the Expedited Hiring Authority within the DAW. This authority allows for a streamlined hiring process, greater pay flexibility, and bonus payments for certain DAW positions recognized by the Secretary of Defense as being especially difficult to fill or undermanned.[15] Additionally, in April of 2009, the then Secretary of Defense Robert Gates announced a DoD-wide acquisition workforce growth initiative. Specifically, Secretary Gates declared a plan to increase the size of the DAW by 20,000 by FY 2015 (Gates, 2009a). Gates planned for just over half of this growth to come from "converting" "contractors" into actual DoD personnel (Gates, 2009a).

Defense acquisition personnel managers responded, with help from the DAWDF and the Expedited Hiring Authority. In fact, the DoD neared its DAW growth initiative goals more quickly than expected. From the end of FY 2009 to the end of FY 2011, the DAW grew from approximately 133,000 personnel to just under 152,000 workers—an increase of over 18,000 (Office of the Under Secretary of Defense for Acquisition, 2015). See Figure 2.4 for the total DAW workforce size for FYs 2007 through 2015. The graphic illustrates that the DAW grew most significantly during FYs 2009, 2010, and 2011.

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[15] The Expedited Hiring Authority for the DAW was originally established in the FY 2009 NDAA (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, sec. 833) but has changed slightly as a result of the FY 2010 NDAA (Public Law 111-84, National Defense Authorization Act for Fiscal Year 2010, sec. 831) and the FY 2013 NDAA (Public Law 112-239, National Defense Authorization Act for Fiscal Year 2013, sec. 803). The original "Termination date" was September 30, 2012 (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, sec. 833), but the Authorization has since been extended to September 30, 2017 (Public Law 112-239, National Defense Authorization Act for Fiscal Year 2013, sec. 803). The implementation of the Expedited Hiring Authority can be seen in the following official memoranda: Office of the Secretary of Defense (2008), Office of the Secretary of Defense (2010), and Office of the Secretary of Defense (2015). These memoranda from the Under Secretary of Defense for Acquisition, Technology, and Logistics and the Under Secretary of Defense for Personnel and Readiness document which parts of the DAW (i.e., which types of acquisition positions) are authorized to use the Expedited Hiring Authority. The Expedited Hiring Authority for the DAW is codified as 10 U.S.C. Chapter 87 Section 1705(g) (Title 10 U.S.C. Ch. 87 Section 1705(g)). The Authority (1) allows the hiring process to forgo the hiring preference regulations outlined in 5 U.S.C Chapter 33 Sections 3309-3318 (Title 5 U.S.C. Ch. 33 Subchapter I; Title 5 U.S.C. Ch. 33 Section 3304), (2) allows for greater pay flexibility for "new appointments" (Title 5 U.S.C. Ch. 53 Section 5333), and (3) allows for the use of "Recruitment and relocation bonuses" (Title 5 U.S.C. Ch. 57 Section 5753) for the specified defense acquisition positions.

Figure 2.4. DAW Grew Most Significantly during FYs 2009, 2010, and 2011
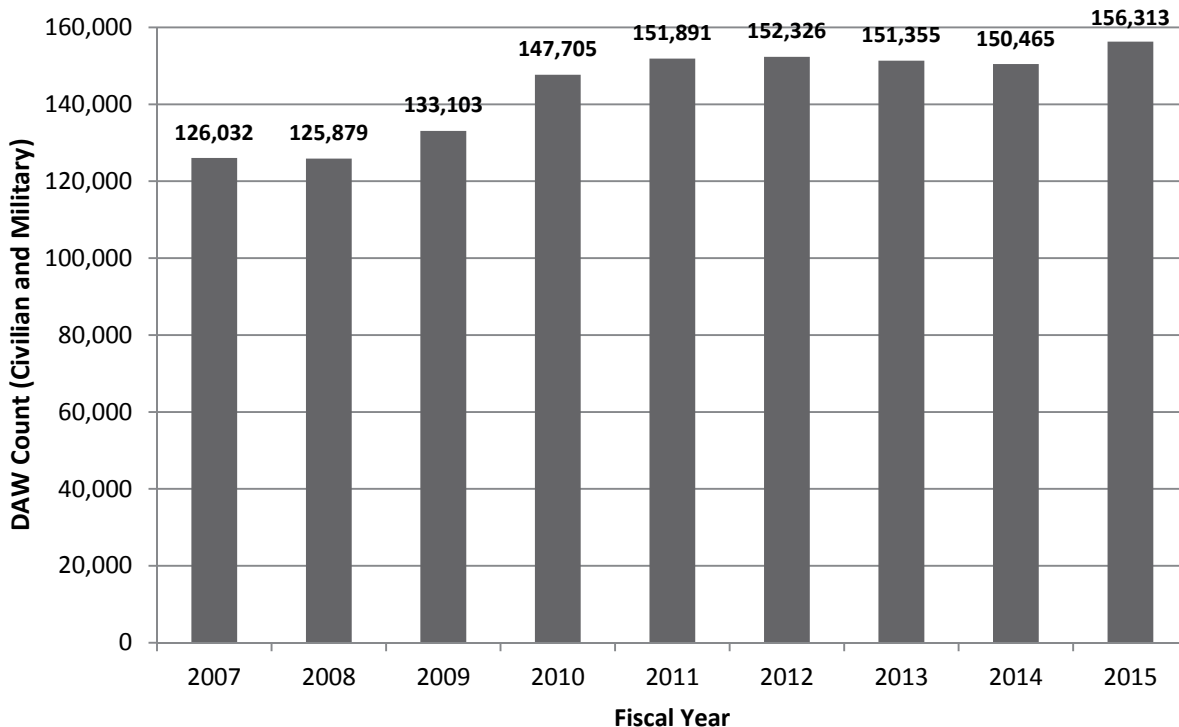
SOURCE: (Office of Human Capital Initiatives)

Although Figure 2.4 shows that the total size of the DAW began to grow in FY 2009, the cohort analysis shows that cohort sizes began to increase starting in FY 2008, the same year that the DAWDF was founded. Figure 2.5, below, illustrates the number of entrants into the civilian DAW for FYs 2000 to 2014.[16] The graphic shows that there is a significant increase in the number of entrants into the civilian DAW during FYs 2008-2011. This is a bit surprising, given that no money from the DAWDF was used to hire employees into the DAW until FY 2009 (Office of the Under Secretary of Defense, 2010) and that the DAW Expedited Hiring Authority was not established until the FY 2009 NDAA (Public Law 110-417, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009). It is also interesting to note that given the increase in cohort size from the FY 2007 cohort to the FY 2008 cohort, the total size of the DAW did not increase during FY 2008. This discrepancy may stem from the fact that the civilian DAW experienced a greater number of losses in FY 2008 than in FY 2007.[17]

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[16] The methodology used to create these cohort numbers is defined in "Chapter 6. Data and Definitions."

[17] Gates et al. (2013) find in their analysis that there are both more gains to and losses from the civilian DAW in FY 2008 than in FY 2007 (p. 20).

Additionally, another part of this difference may come from the way this study defines cohorts. Specifically, as outlined in Chapter 6, the cohort numbers only include "new hires" (Gates et al., 2013, pp. 7-8) and "substantive" transfers (Gates et al., 2013, pp. 8-12) into the civilian DAW. Gates et al. (2013) show that there is an increase in the number of "New hires" from FY 2007 to FY 2008 (p. 20), so this increase is captured in this study's cohort

The total number of professionals who joined the civilian DAW during FYs 2008-2011 was 61,672, with the largest civilian DAW cohort being in FY 2010, when over 19,000 professionals joined the civilian DAW. In contrast, a total of 95,916 professionals joined the civilian DAW during FYs 2000-2007 or FYs 2012-2014, with the largest of these cohorts having just over 10,700 entrants.[18]

In general, besides the fact that the increased cohort size predates the full implementation of these policy initiatives, these findings are consistent with the aims of the DAW growth initiative, and with the DAWDF and Expedited Hiring Authority legislation, and suggest that DoD organizations responded to these efforts by bringing more professionals into the civilian DAW.

The Expedited Hiring Authority was not established until the passage of the FY 2009 NDAA; money from the DAWDF was not used to hire individuals until FY 2009; and then-Secretary Gates first announced the DAW growth initiative in April of 2009. However, cohort numbers show an increase (based on the methodology used in this study) starting with the cohort in FY 2008, the same year in which the DAWDF was founded. The FY 2008-2011 cohorts are hereafter referred to as the "DAW hiring surge" or the "DAW growth initiative" cohorts.

Figure 2.5. Larger Cohort Sizes During DAW Growth Initiative, FY2008-FY2011

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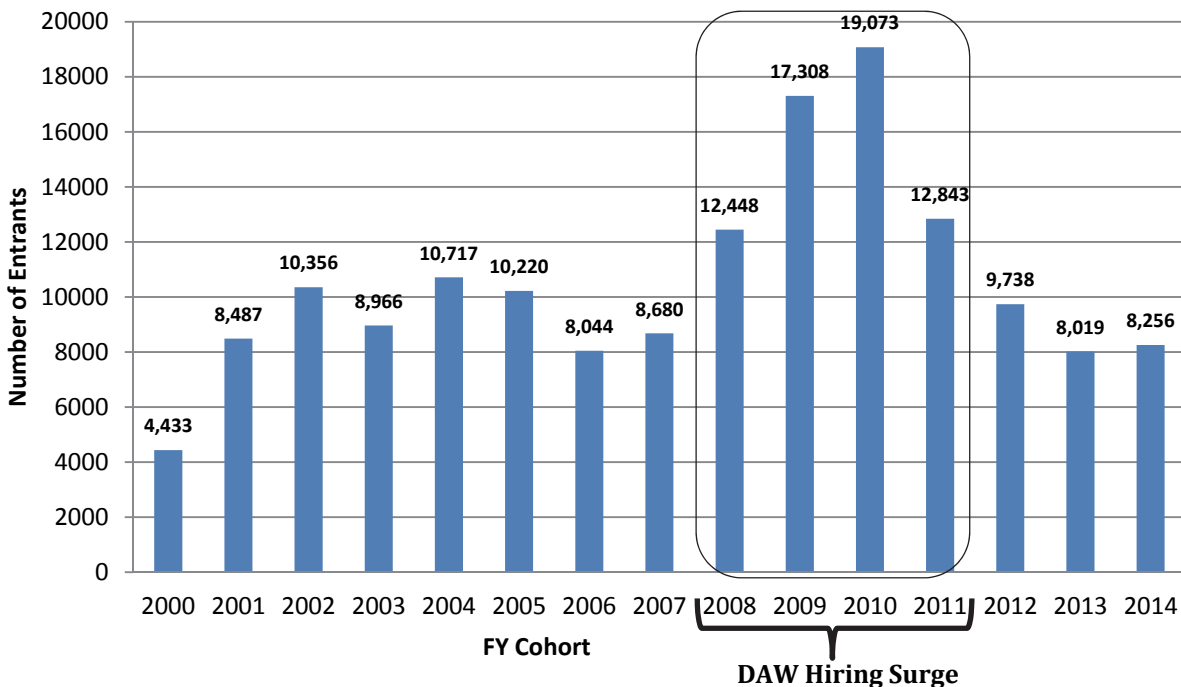
numbers. Chapter 6 explains in more detail this study's definition of the civilian DAW cohorts and explains "new hires" (Gates et al., 2013, pp. 7-8) and "substantive" and "administrative" transfers (Gates et al., 2013, pp. 8-12).

[18] Individuals can be in more than one cohort if they enter the civilian DAW on more than one occasion based on the methodology used in this study (which is outlined in Chapter 6). In total, the cohorts consist of 149,839 unique individuals; 7,439 (around five percent) of them are in more than one cohort. The sum of the non-unique observations for the FY 2000-2014 cohorts equals 157,588.

Chapter 3. Prior DAW-Related Studies

The recent literature on the DAW stems from the perceived DoD-civilian-manpower dilemma that came from the workforce drawdowns throughout the 1990s. There were concerns about the DAW in particular but also about the wider DoD civilian workforce and about the entire federal workforce (Gill, 2001; U.S. Department of Defense, 2000; Office of the Inspector General, 2000; U.S. President's Blue Ribbon Commission on Defense Management, 1986; Executive Office of the President Office of Management and Budget, 2002; Gates, Eibner and Keating, 2006). In response, the Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&L)) created a task force to develop recommended courses of action to help "reshape" the DAW (U.S. Department of Defense, 2000, p. ES-1). One of the major immediate recommendations was to "Develop and Implement Comprehensive, Needs-based Human Resource Performance Plans for the Civilian Acquisition Workforce" (U.S. Department of Defense, 2000, p. ES-2). The USD (AT&L) and the Under Secretary of Defense for Personnel and Readiness (USD (P&R)) supported the task force's recommendations and forwarded them to the DoD leaders, including the heads of the military services and defense agencies, urging them to act (U.S. Department of Defense, 2011).

At the federal level, President George W. Bush highlighted the need for "Strategic Management of Human Capital" when he issued *The President's Management Agenda* for FY 2002 (Executive Office of the President Office of Management and Budget, 2002, p. 11). In this document, President Bush said that officials poorly handled the workforce reductions in the 1990s, and that their mismanagement could create workforce issues during the following decade. Bush called for the improvement of workforce planning in the future throughout the entire federal government (Executive Office of the President Office of Management and Budget, 2002).

Defense acquisition leaders and federal officials both called for strategic workforce plans at the beginning of the 21st century, and these orders spurred the DoD into action (Gates et al., 2008). Within the Defense Department, acquisition officials were responsible for creating their own workforce-management plan specifically aimed at the DAW (Gates et al., 2008).

In general, the first group of studies published in response to the DoD's new motivation for workforce management focuses on where defense officials should start in thinking about strategic workforce management. First, studies from Emmerichs, Marcum and Robbert (2004a and 2004b) involve developing a "methodology for conducting workforce planning" (Emmerichs, Marcum and Robbert, 2004b, p. ix). A few years later, Gates, Eibner and Keating (2006) completed a defense-sponsored report that describes how specific defense organizations were managing their workforces and highlights what the Office of the Secretary of Defense (OSD) can do to assist in this planning. Additionally, this study also points out the data resources available to defense officials that will be useful for workforce planning (Gates, Eibner and Keating, 2006).

Then, defense officials, acquisition leaders, and researchers focused their attention on describing and understanding the current state of the DAW. RAND conducted several studies. One RAND study, which was published in 2009, focuses mainly on the Navy's civilian acquisition workforce (Gates et al., 2009). Gates et al. (2009) use administrative data to examine personnel trends in the Navy's civilian acquisition workforce, including changes in the number of civilians in the workforce and attrition (Gates et al., 2009). Using the same administrative data, the study also examines the Navy's internship program and the development and selection of its Senior Executives (Gates et al., 2009). The most notable conclusions yielded from this study include that members of the Navy acquisition workforce tend to stay in the workforce longer than do other Navy civilians (before retirement eligibility) and they also tend to be more highly educated (Gates et al., 2009).

At approximately the same time, a group of researchers conducted a similar study, this time concentrating on the entire DAW (Gates et al., 2008). This study focuses on many of the same factors examined by Gates et al. (2009)—the size of the workforce over time, education levels, retirement, attrition, and leadership development and selection—only this study was done from a DoD-wide perspective (Gates et al., 2008). The study also includes unique analyses. Gates et al. (2008) examine the size of and distributions within the military portion of the DAW. Additionally, Gates et al. (2008) also briefly analyze the magnitude of the military-to-civilian-DAW transition. The study finds that many of the newly hired members of the DAW have some type of prior military experience, and the authors illustrate that this number grew steadily from 1993 to 2006 (from around 23 percent in FY 1993 to approximately 40 percent in FY 2006) (Gates et al., 2008). Gates et al. (2008) show that the civilian DAW depends quite heavily on the military ranks to supply its manpower pipeline. Gates et al. (2013) complete the same analyses but included updated data (through FY 2011). Gates et al. (2013) also note that they made some subtle changes in the way they interpreted some of the data, although they report that these changes did not significantly affect the final results (Gates et al., 2013).

Using the same administrative data from the DoD, Guo, Hall-Partyka and Gates (2014) took another step forward in understanding the DAW: they uncovered relationships between various personnel factors—such as "education and performance" (pp. xi, 3,13) —and retention, and they analyzed "promotion patterns" (p. iii) within the DAW. Their analysis yielded some interesting results. First, Guo, Hall-Partyka and Gates (2014) show that acquisition professionals who complete an education upgrade tend to remain in the DAW for a longer period than those who do not. Second, Guo, Hall-Partyka and Gates (2014) find that higher performing civilian defense acquisition professionals tend to have lower retention levels than those whose performance ratings are worse, and the authors point out that this is especially true "for employees who entered the [civilian DAW] at more senior grades" (p. xi). Guo, Hall-Partyka and Gates (2014) find that individuals indicated as "Veterans" tend to have greater retention in the civilian DAW than individuals not indicated as such (pp. 14, 21). The authors also find that, all else equal, "Employees who transferred into the [civilian DAW]" from a non-DAW DoD civilian position have greater retention than employees who came from other sources (Guo, Hall-Partyka and

Gates, 2014, pp. 14, 22). Lastly, Guo, Hall-Partyka and Gates (2014) highlight that demographic factors do not have a significant relationship with promotion to the SES ranks. Rather, it is the organizational background of defense acquisition personnel that has predictive power in regard to whether someone is promoted to be a Senior Executive (Guo, Hall-Partyka and Gates, 2014).

This dissertation expands on the existing body of RAND DAW research (Gates et al., 2008; Gates et al., 2009; Gates et al., 2013; Guo, Hall-Partyka and Gates, 2014). This dissertation is unique in that it develops a methodology for reaching back into civilian DAW entrants' pasts to characterize their prior work experience and uses this characterization technique to understand how policy affects the workforce. Specifically, this analysis uses this characterization technique to (1) explore how the recent growth initiative has changed who the civilian DAW has brought into its ranks, (2) understand how different past work experiences relate to retention outcomes, and (3) estimate how the growth initiative has influenced overall cohort-level retention rates.

Chapter 4. Prior Work Experience, Workforce Socialization, and Retention

One way to characterize workforce entrants is by their prior work experience. There are two main reasons why it makes sense to start by examining prior work experience. First, the workforce socialization theory and empirical analyses argue that prior experiences play an important role in an individual's assimilation into a new organization and that the assimilation process influences retention. Secondly, this is a natural place to start given the important role prior work experience plays in the employee selection process. Usually, past work experience is a large part of each applicant's resume or job application (Dokko, Wilk and Rothbard, 2009; Adkins, 1995). These prior experiences signal what "skills" and "habits" each applicant has (Dokko, Wilk and Rothbard, 2009, p. 52).

The literature refers to an individual's process of assimilating into a new organization or workforce as "organizational socialization" (Bauer et al., 2007, p. 7; Saks and Ashforth, 1997, p. 234; Adkins, 1995, p. 839; Carr et al., 2006, p. 343; Van Maanen and Shein, 1977, p. 1). Bauer et al. (2007) define organizational socialization as "the process by which newcomers make the transition from being organizational outsiders to being insiders" (p. 707). Van Maanen and Shein (1977) write,

> At heart, organizational socialization is a jejune phrase used by social scientists to refer to the process by which one is taught and learns "the ropes" of a particular organizational role. In its most general sense, organizational socialization is then the process by which an individual acquires the social knowledge and skills necessary to assume an organizational role (p. 3).

In the past, researchers thought about and modeled the socialization process in a number of ways (Saks and Ashforth, 1997). In 1997, Saks and Ashforth (1997) integrated the separate theories into an all-inclusive organizational-socialization model, which they call the "Multi-Level Process Model of Organizational Socialization" (pp. 238-241). Other researchers have used similar versions of this integrated approach to guide analyses aimed at understanding what affects individuals' assimilation into a new organization or workforce and what influences all of this may have on workforce outcomes (Bauer et al., 2007; Carr et al., 2006; Kammeyer-Mueller and Wanberg, 2003). A simplified version of this model is illustrated in Figure 4.1, below.

As illustrated in Figure 4.1, one can think of the entire socialization process in the logic model format, consisting of inputs, a process, outputs, and outcomes. The inputs are the newcomers (i.e., entrants) and any introductory courses that the organization provides (Saks and Ashforth, 1997; Bauer et al., 2007; Kammeyer-Mueller and Wanberg, 2003). The process is simply assimilating into the new workforce, with the goals (i.e., the outputs) being "Social integration" in the new organization, "Skill acquisition," developing "Role clarity," and understanding "Person-job/organization fit" (Saks and Ashforth, 1997, p. 239; Kammeyer-

Mueller and Wanberg, 2003; Bauer et al., 2007). Finally, the model predicts that effective workforce socialization should produce important workforce outcomes, including "Higher job satisfaction," "Higher org[anizational] commitment," "Higher performance," and "Lower absenteeism & turnover" (Saks and Ashforth, 1997, p. 239; Bauer et al., 2007; Kammeyer-Mueller and Wanberg, 2003). The Saks and Ashforth (1997) model highlights that, among other things, "individual"-specific characteristics, such as "previous work experience," "Demographic[s]," and "Personality," influence how effectively and easily an individual assimilates into his or her new environment, which—in turn—will influence outcomes such as retention (Saks and Ashforth, 1997, pp. 238-241).

Figure 4.1. A Simplified Version of Saks and Ashforth's (1997) Multi-Level Process Model of Organizational Socialization
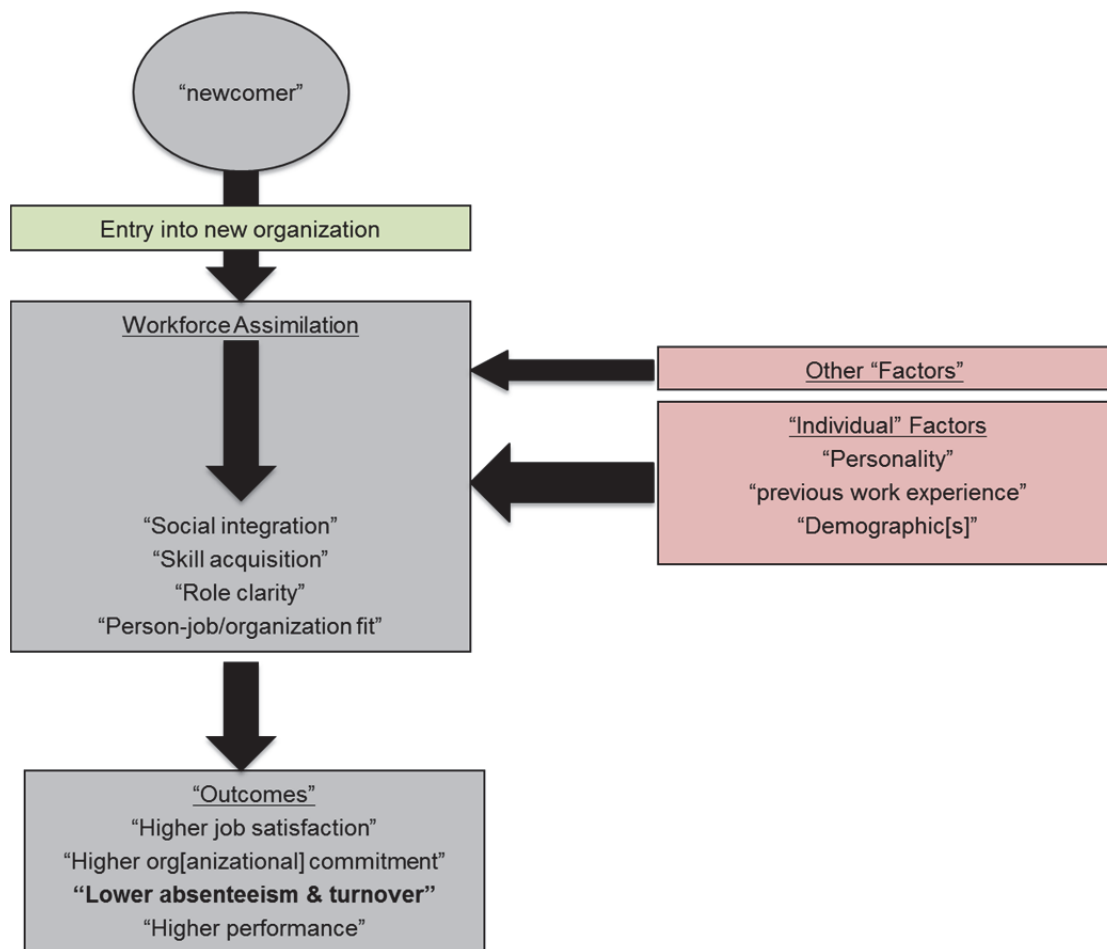
SOURCE: Saks and Ashforth (1997), pp. 238-241

A number of studies have looked into the relationship between prior work experience and workforce outcomes.

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Carr et al. (2006) examine the relationship between "prior occupational experience" and job retention (in the same general occupation) (p. 343). The authors surveyed more than 200 truck driver new hires in a company, gathering self-reported information on their prior experience as a driver. In addition, the surveys collected information on the new hires' job expectations, how closely their values fit with the values of the company, and how well they believe their skills and abilities match their new job requirements. Carr et al. (2006) found that prior occupational experience had a significant relationship with retention, but they found that other factors—such as an individual's perceived "person-job (P-J) fit" and "value congruence"—"mediated" this relationship (p. 343).

Kammeyer-Mueller and Wanberg (2003) investigate how a number of different factors, such as "Preentry knowledge," "personality," and "Socializing Influences" from "leaders" (p. 785), may relate to workforce outcomes, including retention. The authors gather self-reported survey data on "white-collar workers" (Kammeyer-Mueller and Wanberg, 2003, p. 791) from a number of different industries (Kammeyer-Mueller and Wanberg, 2003). More than 800 participants reported information regarding, among other things, "how much information [they had] about their new jobs in advance," how "proactive" their personality is, and how much influence leaders had in their assimilation into the new workforce (Kammeyer-Mueller and Wanberg, 2003, p. 785). To measure retention, Kammeyer-Mueller and Wanberg (2003) collect "employment" (p. 785) data from the participants' companies. Using a Cox Proportional Hazard model, the authors find that "Preentry knowledge" and "Leader influence" are related to higher rates of retention (Kammeyer-Mueller and Wanberg, 2003, p. 790).

Beyer and Hannah (2002) use "qualitative" methods to investigate how prior work experience may influence an individual's assimilation into a new workforce (p. 636). To do this, the authors focus on a company called SEMATECH, which is a research "consortium" that uses loaned employees from other companies in the industry (Beyer and Hannah, 2002, p. 638). Beyer and Hannah (2002) closely follow 14 individuals who are sent (i.e., loaned) to work at SEMATECH by their employer. The authors gathered information about each individual's prior work experience and conducted a number of interviews with each of the 14 employees regarding their particular socialization process. In the end, the authors found that prior work experience influenced the individuals' socialization process through three mechanisms: "through the personal identities they had developed and carried with them, through the know-how they had acquired in past jobs and how well it fit with their new jobs, and through the personal tactics they had learned for managing their work and managing change" (Beyer and Hannah, 2002, p. 636). The authors discovered that the individuals with the more "diverse"[19] professional backgrounds

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[19] Beyer and Hannah (2002) do not explicitly define what they mean by "diversity"—whether they mean job diversity, organizational diversity, or both. However, they write "The diversity of individuals' work experience is thus an indicator of the practice they have had in the past in adjusting to new settings and jobs" (Beyer and Hannah, 2002, pp. 641-642). Based on this statement, Beyer and Hannah (2002) seem to have a broad definition of "diversity" that includes both job and organizational diversity and does not distinguish between the two. The authors list examples of "Very Diverse," "Diverse," and "Narrow" "Past Work Experience" on page 641 (Beyer and Hannah, 2002, p. 641).

tended to assimilate into the new organization more successfully (Beyer and Hannah, 2002, p. 636).

A study from Dokko, Wilk and Rothbard (2009) investigates the relationship between prior work experience and a different workforce outcome—performance. The authors gather the prior career information for employees in a call center and use regression techniques to understand how this past work experience relates to performance ratings. The call center employees receive ratings on their "knowledge and skill" and on their overall performance, allowing the authors to examine how (i.e., through what mechanisms) prior experience influences performance (Dokko, Wilk and Rothbard, 2009, pp. 52-56). The results show that "prior experience" is related to higher levels of "knowledge and skill," which is related to higher performance ratings (Dokko, Wilk and Rothbard, 2009, p. 63). However, the authors discover that once they control for the differences in "knowledge and skill," prior work experience is actually negatively related to performance outcomes (Dokko, Wilk and Rothbard, 2009, p. 63).[20] One explanation for this is that prior work experience may improve an individual's performance through expertise gained during that past experience but may reduce an individual's ability to adapt to the "habits" or customs of the new organization (Dokko, Wilk and Rothbard, 2009, pp. 52, 62-64). The authors found the negative aspects of prior experience, i.e., the "habits" that experienced newcomers bring with them, to be longer lasting than the positive benefits, i.e., increased "knowledge and skill" (Dokko, Wilk and Rothbard, 2009, p. 64).

In the context of the civilian DAW, this literature outlines several mechanisms through which prior work experience may influence the socialization into and the propensity to remain in the civilian DAW. As described above, Carr et al. (2006) find that entrants with "prior occupational work experience" tend to have higher rates of retention than those without that experience (p. 343). Accordingly, one would expect entrants with prior acquisition experience to have higher levels of retention in the civilian DAW than those without. On the other hand, Dokko, Wilk and Rothbard (2009) highlight the important role that organizational "habits" play in workforce outcomes (pp. 52, 62-64). Dokko, Wilk and Rothbard (2009) focus on performance outcomes, but insofar as the workforce outcomes (performance and retention) move in the same direction,[21] one would also expect entrants with prior work experience in the DoD to more easily assimilate into the DoD civilian work environment and therefore have greater levels of civilian DAW retention. Beyer and Hannah (2002) find that the variety and "diversity" of prior work experience plays an important role in how entrants assimilate into a new workforce (p. 647). Based on this study (Beyer and Hannah, 2002), one would conclude that entrants with a wide

[20] An earlier study, Adkins (1995), examining "mental health specialists" (p. 842), also finds some evidence that "previous [related] work experience" may actually hinder workforce "socialization" (pp. 855-856).

[21] Saks and Ashforth (1997) theorize, in their "Multi-Level Process Model of Organizational Socialization," that successful workforce assimilation will lead to both higher levels of performance and retention (pp. 238-241). However, Guo, Hall-Partyka and Gates (2014) find evidence that these two workforce outcomes may move in opposite directions in the civilian DAW; they find that civilian defense acquisition professionals with higher performance ratings tend to have lower rates of retention.

variety of experiences would more easily adapt to their new work environment and remain in the civilian DAW for a longer period of time.

There is a developed literature on the socialization process, and this research shows that prior work experience may influence workforce assimilation and thereby affect workforce outcomes, such as retention. Additionally, from a practical perspective, prior work experience typically plays an important role in the recruitment, assessment, and selection of new employees. For these reasons, this study characterizes the civilian DAW entrants by their prior work experience.

Chapter 5. Approach

The goals of this study are to (1) understand how the DAW growth initiative changed workforce characteristics, focusing on prior work experience, and (2) evaluate how these changes may influence workforce retention outcomes. To do this, this study asks three research questions and uses descriptive- and retention-analysis techniques to address them (see Table 5.1). The first step involves developing a methodology for characterizing entrants' prior work experience and then using this characterization to describe cohorts before and during the growth initiative (the descriptive analysis). Subsequently, after adding retention information and other control factors to the analysis data files, survival analysis techniques are used to understand how prior work experience relates to retention in the civilian DAW and to estimate how the growth initiative has influenced overall cohort-level retention.

Table 5.1. Research Questions and Methods

Research Question	Method
1. How did the growth initiative change who the civilian DAW hired into its ranks, in terms of prior work experience?	Descriptive analysis
2. How does entrants' past work experience relate to civilian DAW retention?	Retention analysis (Part I)
3. What does this suggest in terms of how the growth initiative may have influenced overall cohort-level retention in the civilian DAW?	Retention analysis (Part II)

Descriptive Analysis: How Did the Growth Initiative Change Who the Civilian DAW Hired, in Terms of Prior Work Experience?

The descriptive analysis (1) defines the civilian DAW cohorts from FYs 2000-2014; (2) characterizes each entrant's prior work experience; and then (3) uses this characterization to examine how cohorts from before the hiring surge (prior to FY 2008) differ from those during the surge (FYs 2008-2011).

As outlined in Chapter 2, the growth initiative was an ambitious surge in hiring, and some of the surge was aimed at hiring contractors into government positions (Gates, 2009a). Therefore, given the parameters of the initiative, one would expect the hiring surge cohorts to have a greater percentage of entrants who came from positions not officially within the DoD. Moreover, one would logically hypothesize that the growth initiative cohorts would also have a higher fraction

of entrants with no prior DoD experience compared to the cohorts prior to the growth initiative years.[22] The research question addressed in the descriptive analysis and the hypothesis tested are shown in Table 5.2, below.

Table 5.2. Descriptive Analysis: Question and Hypothesis

Question	Hypothesis
Research Question 1. How did the growth initiative change who the civilian DAW hired into its ranks, in terms of prior work experience?	The growth initiative cohorts have a greater percentage of entrants who joined from outside of the DoD and a greater percentage of entrants with no prior DoD experience at all compared to the cohorts prior to the hiring surge.

Retention Analysis Part I: How Does Prior Work Experience in the DoD Relate to Retention in the Civilian DAW?

The first part of the retention analysis builds from the dataset created for the descriptive tests, adding tenure and loss-type information, along with a number of control factors, to investigate—using survival analysis techniques—how different past work experiences relate to retention trends in the civilian DAW. This analysis (Retention Analysis Part I) focuses on cohorts prior to the growth initiative (i.e., prior to the FY 2008 cohort) because this allows the survival tests to capture longer-term retention.[23]

It is not entirely clear how prior DoD work experience, as defined in this study, should relate to retention outcomes. First, this study has no explicit past-work-experience information on entrants who join the civilian DAW with no prior DoD experience. These entrants may be experienced contractors who are joining the civilian DAW with years of defense acquisition experience, or they could be new hires with no acquisition experience whatsoever. One would expect these two types of non-DoD-experienced entrants to have different retention patterns within the civilian DAW. Additionally, DoD experience is a broad term—different DoD employment histories could relate to retention differently. At the same time, as outlined in the previous chapter, prior work experience can influence workforce outcomes through a number of different mechanisms.

This analysis uses Cox Proportional Hazard models to test for differences in retention trends across different past-work-experience groups and uses control techniques to account for confounding factors. The analyses control for demographic factors and factors regarding the entrants' civilian DAW entry positions, among other things. Career level and compensation are

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[22] "Chapter 6. Data and Definitions" outlines how this study defines prior DoD experience. In short, individuals who appear in an end-of-FY ADMF or DoD civilian personnel file (starting with FY 1980) are indicated as having prior DoD experience. Only official DoD employees are included in the personnel files; defense contractors are not included.

[23] This analysis creates and utilizes retention data through FY 2014.

two of the important factors included as controls in the Cox Proportional Hazard models. Assuming that civilian DAW entrants with prior acquisition experience are more likely to join the civilian DAW at higher career levels and have higher levels of compensation, these factors are effective proxies for pre-entry acquisition "knowledge and skill."[24] With this assumption, the models used in this analysis test for differences in retention trends across past-work-experience groups, controlling for "knowledge and skill" (among other things). Therefore, although it is not entirely clear, one logical hypothesis given the findings of Dokko, Wilk and Rothbard (2009) is that entrants with prior work experience in a DoD organization would more easily assimilate into the civilian DAW and, therefore, tend to stay for a longer period of time, all else equal. Using this same logic, one would hypothesize that entrants with prior experience in the civilian DAW or in the wider DoD civilian workforce would most easily fit into their civilian DAW work environment and therefore have greater retention than entrants without prior experience in the DoD. Table 5.3, below, lists the specific question asked in this analysis and outlines the proposed hypothesis.

Table 5.3. Retention Analysis Part I: Question and Hypothesis

Question	Hypothesis
Research Question 2. How does entrants' past work experience relate to civilian DAW retention?	Entrants with prior DoD experience have higher retention in the civilian DAW than those with no prior DoD experience. Entrants with prior experience in the civilian DAW or in the wider DoD civilian workforce have higher civilian DAW retention than entrants with no prior DoD experience.

Retention Analysis Part II: How Did the Growth Initiative Influence Retention in the Civilian DAW?

Part II of the retention analysis examines how the shift in cohort characteristics brought about by the growth initiative relates to retention trends and investigates what role the shift in past-work-experience characteristics, specifically, plays in this relationship. This analysis asks two specific questions to explore these issues. First, it asks what retention trends would have been for those hired *during* the growth initiative (the "policy cohorts") if their characteristics (including prior-work-experience characteristics) had resembled those who were hired *before* the growth initiative (the "pre-policy cohorts"). Second, for the sake of robustness, the analysis also asks what retention trends would have been for those who were hired *before* the growth initiative if their characteristics had more closely resembled those who were hired *during* the growth initiative.

Assuming that the hypotheses for the descriptive analysis and Part I of the retention analysis hold—that the growth initiative cohorts have a greater percentage of non-DoD-experienced

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[24] The phrase "knowledge and skill" comes from Dokko, Wilk and Rothbard (2009). See, for example, pages 52-56, 63, and 64 in Dokko, Wilk and Rothbard (2009).

entrants, and that these entrants tend to have lower retention rates relative to entrants with DoD experience—one would hypothesize that the growth initiative would produce cohorts with lower overall rates of retention (compared to what would have happened if pre-growth initiative trends had continued) and that the shift in past-work-experience characteristics would play an important role in this difference. Table 5.4, below, outlines the specific test questions addressed in Part II of the retention analysis and lists their respective hypotheses.

Table 5.4. Retention Analysis Part II: Questions and Hypotheses

Question	Hypothesis
Research Question 3. How did the growth initiative influence retention in the civilian DAW?	The growth initiative produced cohorts with lower civilian DAW retention.
(a) What would retention trends have been for the policy cohorts if the individuals in these cohorts had looked more like those in the pre-policy cohorts?	(a) If the policy cohorts had looked more like pre-policy cohorts, retention would have been higher.
(b) What would retention trends have been for the pre-policy cohorts if the individuals in these cohorts had looked more like those in the policy cohorts?	(b) If the pre-policy cohorts had looked more like the policy cohorts, retention would have been lower.

In order to address the questions listed in Table 5.4, this analysis uses a synthetic-cohort-comparison technique. This technique involves using propensity score weighting to create a synthetic cohort, i.e., a counterfactual, to estimate what the retention trends would have been if the cohort characteristics had been different. Specifically, to address question (a) in Table 5.4, this study weights a policy cohort group to look like the pre-policy cohorts, creating a synthetic pre-policy cohort group, and compares the retention trends for this synthetic pre-policy cohort group to the retention trends for the unweighted policy cohort group. This study uses the same technique but in the other direction to address question (b) in Table 5.4: It weights a pre-policy cohort group to look more like the policy cohorts, creating a synthetic policy cohort group, and compares the retention trends for this synthetic policy cohort group to the retention trends for the unweighted pre-policy cohort group. This analysis uses Cox Proportional Hazard models to compare retention trends.

One major advantage of the synthetic-cohort technique, which compares weighted and unweighted versions of the same dataset, is that it effectively controls for any global time-specific confounding factors, such as the strength of the national economy and labor market.

Chapter 6. Data and Definitions

In order to address the questions described above, this study utilizes annual defense personnel data files maintained by the Defense Manpower Data Center (DMDC). First, the analysis uses these data to define and create the civilian DAW cohorts (FY cohorts 2000-2014) and characterize each entrant's prior work experience for the descriptive analysis. After that, additional information, including retention data and control factors, are added to the data file for the pre-policy and policy cohorts, and these comprehensive files are used in the retention analyses. These data and definitions are described below.

Raw Data Files

The datasets used for the descriptive and retention analyses are a combination and distillation of the DoD civilian, active-duty military, and acquisition workforce data maintained by the DMDC. When linked together, these administrative files show which individuals enter the civilian DAW and provide the information necessary to characterize each entrant's past DoD work experience, including their prior acquisition workforce experience. Past DAW analyses use similar data files (see Gates et al. (2008), Gates et al. (2013), and Guo, Hall-Partyka and Gates (2014)). The specific data files used in this research and the information contained in each of them are described below.

- Annual DoD Civilian Personnel Inventory Files

  The DoD civilian personnel files that are maintained at DMDC are snapshots of the DoD civilian personnel inventory. These files contain all Appropriated Fund (APF) Civilians—or all "APF direct hire civilians paid exclusively from DoD APFs" (U.S. Department of Defense, 2013, p. 1), except for certain intelligence personnel as outlined in DoDI 1444.02 (U.S. Department of Defense, 2013).[25] The records include a vast number of variables for each individual included in the data files, including person and workforce-position descriptors.[26]

  This study only uses the annual end-of-FY files and has been granted access to a number of these variables, including both position and person descriptors. For example, the available position information describes each individual's position within the DoD,

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[25] The DoD civilian files contain all types of workers, including full-time, part-time, and intermittent employees. This includes both non-seasonal and seasonal employees. Intermittent employees are those individuals who do not have a regular set work schedule ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010). However, for some reason, the end-of-FY 1980 and end-of-FY 1981 files report no seasonal employees. It is not known if the 1980 and 1981 files contain no seasonal employees or if seasonal employees in these files were not properly recorded.

[26] See DoDI 1444.02 *Data Submission Requirements for DoD Civilian Personnel: Appropriated Fund (APF) Civilians* (U.S. Department of Defense, 2013). DoDI 1444.02 outlines which individuals are included in the DoD civilian personnel files that are used in this analysis and defines what other information is included for these individuals (U.S. Department of Defense, 2013).

including which defense organization the individual works in and which specific job and grade he or she holds. The available data also provide individual-level demographic information, including—among other things—age and gender descriptors. Additionally, these files contain supervisor performance ratings for each individual. This research uses DoD Civilian files starting in FY 1980.

- Annual Active Duty Master Files (ADMF)[27]

  DMDC maintains "a centralized database of active duty uniformed personnel" (U.S. Department of Defense, 2015b, p. 1). This database includes information on individuals from all of the military services, the Coast Guard,[28] and the other uniformed services, including Public Health Services and the National Oceanic and Atmospheric Administration. These active duty personnel files from DMDC provide snapshots of the inventory of all of these active duty uniformed personnel. The data contain a number of variables, including personal demographic and workforce position descriptors.[29]

  This study uses subsections of the larger uniformed personnel data files that are maintained by DMDC and only uses the annual end-of-FY records. Specifically, the data files used in this analysis consist only of active-duty military (Army, Navy, Marine Corps, Air Force) and Coast Guard[30] personnel who are included in the Active Component End Strength calculations, per DoDI 1120.11 (U.S. Department of Defense, 2015a). However, Cadets and Midshipmen are excluded. This study has been given access to a handful of variables from these files, including personal descriptors, such as education level and gender, and position information, such as occupation codes. This research uses ADMFs starting in FY 1980.

- Annual DAWIA Data Files

  The DAWIA data files were created as a response to the DAWIA, which mandated the DoD to track its acquisition workforce. Hence, the earliest version of these data files is from 1992. The DAWIA data maintained at DMDC provide snapshots of official defense acquisition positions and personnel. Specifically, they record which DoD positions and personnel are a part of the DAW and mark which acquisition career field each falls under. Additionally, these data files include a number of other variables that describe these individuals and positions.[31]

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[27] The previous DAW analyses (Gates et al. (2008), Gates et al. (2013), and Guo, Hall-Partyka and Gates (2014)) have used what is called the Work Experience Files (WEX) for their active duty information. The WEX is the active duty military personnel transaction file. It is derived from the ADMFs and captures changes in the individuals' records. This analysis uses the ADMFs, which provide personnel inventory "snapshots" rather than just transaction records.

[28] Coast Guard personnel are included starting in 1989.

[29] Enclosure 3 in DoDI 1336.05 *Automated Extract of Active Duty Military Personnel Records* (U.S. Department of Defense, 2015b) and DoDI 1120.11 *Programming and Accounting for Active Component (AC) Military Manpower* (U.S. Department of Defense, 2015a) list the information recorded on the active duty military and active duty Coast Guard personnel who are included in the data file.

[30] Coast Guard personnel are included starting in 1989.

[31] See DAWIA (Title 10 U.S.C. Ch. 87) and DoDI 5000.55 *Reporting Management Information on DoD Military and Civilian Acquisition Personnel and Positions* (U.S. Department of Defense, 1991). DoDI 5000.55 (U.S. Department of Defense, 1991) outlines the specific reporting requirements for the DAW.

This study uses the annual end-of-FY DAWIA records and has been granted access to many of these variables, including—among other things—information on the acquisition certification level each individual has achieved and the defense acquisition organization and career field each position falls under. This research uses DAWIA data files starting in FY 1992.

All of these data files use the same personal identifier to identify specific individuals. This shared personal identifier among the data files allows the files to be "linked" so that individuals can be followed "across files" and "over time" (Gates et al., 2008, p. 6; Gates et al., 2013, p. 3; Guo, Hall-Partyka and Gates, 2014, p. 2).

Defining a Cohort

This study defines a civilian DAW cohort as the group of individuals that enters the civilian DAW in a given FY. A merged dataset consisting of annual (end-of-FY) DoD civilian personnel inventory files and DAWIA files is used to determine who enters the civilian DAW and in which FY he or she enters. The DoD civilian inventory files show which individuals are a part of the DoD civilian workforce at the end of each FY, and the DAWIA data indicate which individuals are in acquisition positions. This analysis defines and examines cohorts from FY 2000 to FY 2014.

An individual is included in a FY cohort under two circumstances: (1) if he or she is a "transfer" or (2) if he or she is a "new hire." These two terms and the conditions that define them are described below.[32]

- "transfers"[33]

  An individual is considered a "transfer" into the civilian DAW in year t if he or she is (1) in the larger DoD civilian workforce in year $t-1$ (in a non-acquisition position) and (2) is in an acquisition position in the DoD civilian workforce in year t. This individual is counted as a civilian DAW entrant in year t (i.e., he or she is included in that FY's cohort).

  Like Gates et al. (2013), this analysis makes a distinction between professionals who substantively transfer into the civilian DAW and those who administratively transfer (Gates et al., 2013, pp. 8-12). A "substantive" transfer is when an individual actually changes position or job when he or she moves into the civilian DAW (Gates et al., 2013, pp. 8-12). On the other hand, an "administrative" transfer is when a DoD civilian remains in the same position from one year to the next but that position changes from a non-acquisition position to an acquisition position (Gates et al., 2013, pp. 8-12). In coding terms, a substantive transfer is flagged when an individual transfers to an acquisition position and this switch is accompanied by a change in agency/service, bureau, functional occupational group, or occupational series. A substantive transfer is also flagged if an

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[32] These terms and their definitions stem from Gates et al. (2013) (pp. 7-12).

[33] The below methodology for counting transfers is based on Gates et al. (2013)—see pages 8-12. Gates et al. (2013) mainly use the term "switches" (pp. 8-12), although on a few occasions, they also use the term "transfers" (pp. xiii, xv, 35). This report mainly uses "transfers."

individual who transfers into the civilian DAW comes from or goes into a Senior Executive Service (SES) position or if that individual changes pay grade while remaining in the same pay plan. In all other cases, a transfer to the civilian DAW is recorded as administrative (Gates et al., 2013).[34] Only individuals who substantively transfer into the civilian DAW are counted as entrants (i.e., members of a civilian DAW cohort) for this analysis. Administrative transfers are not counted. This distinction is made because those employees who substantively transfer into the civilian DAW actively choose to join an acquisition-related position, whereas individuals who are administrative transfers are simply in positions that are re-coded as acquisition positions—their responsibilities do not change and they have no choice in the matter. Recruiting and hiring policies can influence substantive transfers but not individuals who are administratively switched.

- "new hires" (Gates et al., 2013, pp. xii, 7-8)

    An individual is considered a "new hire" in year t if he or she was not in the DoD civilian workforce in year $t-1$ but is in the DoD civilian workforce and in an acquisition position in year t (Gates et al., 2013, pp. xii, 7-8). This individual is counted as a civilian DAW entrant in year t (i.e., he or she is included in that FY's cohort).

    There are certain cases where individuals are recorded as joining the DoD civilian workforce in a non-acquisition positions in year t and then administratively transferring into an acquisition position the following year (year $t+1$). Many of these cases may be due to a lag in reporting and recording DAWIA data. It is possible that these professionals are actually hired into a civilian DAW position in year t but are first recorded as in an acquisition position the following year (year $t+1$).[35] Therefore, in an effort to accurately describe civilian DAW cohorts, these individuals are included in the cohort of the FY in which they were brought into the DoD civilian workforce (year t). Hereafter, these instances are referred to as "lag instances."

Figures 6.1 and 6.2, below, illustrate the civilian DAW cohorts that this methodology produces for FYs 2000-2014. Figure 6.1 shows the overall cohort size,[36] and Figure 6.2 illustrates the number of lag instances included in each cohort. There are several hundred lag

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[34] See Gates et al. (2013) pp. 8-12 for a more detailed explanation on defining substantive and administrative transfers.

[35] It is impossible to be sure that this assertion holds in each instance. However, Gates et al. (2013) find other "discrepancies" between the DAWIA files and the active duty and DoD civilian files (p. 14), making this a reasonable assertion. Specifically, Gates et al. (2013) find that

> some people appear as military in the DAWIA file but match only to the end-of-year civilian inventory file (or vice versa). Our review of the cases indicates that the DAWIA file is not being updated immediately to reflect changes in status (i.e., a person separates from the military and is hired as a civilian) (p. 14).

Gates et al. (2013) hypothesize that some of these discrepancies may be due partially to the fact that the DAWIA data follow a different data-reporting process than do the ADMFs and the DoD civilian personnel files. Specifically, Gates et al. (2013) write "DoD components report [DAWIA] data on a quarterly basis, while the civilian and military personnel files are updated on a just-in-time basis, when a transaction occurs" (p. 14).

[36] Individuals can be in more than one cohort if they enter the civilian DAW on more than one occasion based on the methodology used in this study (which is outlined in Chapter 6). In total, the cohorts consist of 149,839 unique individuals; 7,439 (around five percent) of them are in more than one cohort. The sum of the non-unique observations for the FY 2000-2014 cohorts equals 157,588.

instances included in most FY cohorts, with over 750 in the FY 2001 and FY 2009 cohorts. Based on the data, one cannot determine definitively whether each particular lag instance should be included in a particular civilian DAW cohort; their inclusion simply represents a "best guess" at interpreting the data. In any case, the inclusion of the lag instances is not substantially consequential: Lag instances never make up more than 11 percent of any particular civilian DAW cohort, and most cohorts consist of no more than five percent of lag instances. Moreover, a sensitivity analysis, presented in Appendix H, finds that the overall conclusions from Parts I and II of the retention analysis (presented in Chapters 8 and 9, and in Appendix F) are not sensitive to the inclusion of the lag instances in the civilian DAW cohorts.

Figure 6.1. Civilian DAW Cohort Sizes for FY 2000-2014 Cohorts
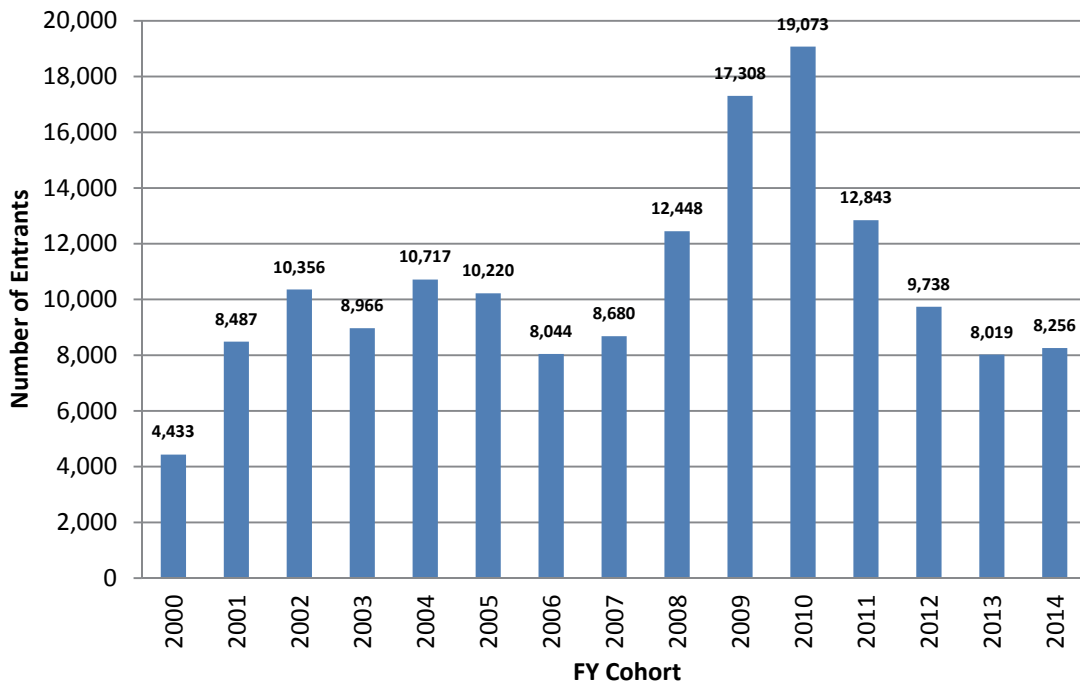
Figure 6.2. Number of Lag Instances Included in Each Civilian DAW Cohort, FYs 2000-2014
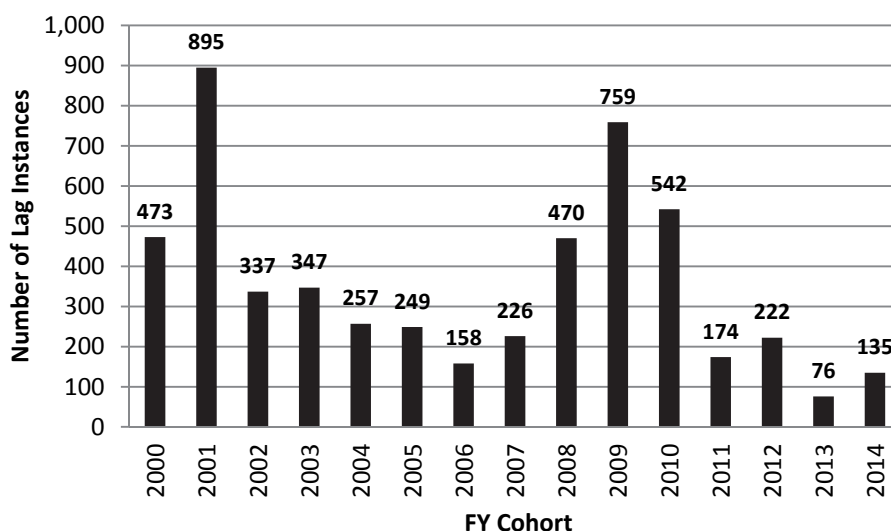
Characterizing Past Work Experience

Once all of the civilian DAW cohorts (from FY 2000 to FY 2014) have been defined, the next step is building a work history for each individual entrant. This analysis uses a merged dataset consisting of the end-of-FY active duty files, the end-of-FY DoD civilian personnel inventory files, and the end-of-FY DAWIA data to look back at each civilian DAW entrant's past work experience within the DoD.[37] Based on the data, an individual is categorized into one of three conditions in each FY, beginning with FY 1980. In each FY, an individual is in (1) the DoD civilian workforce; (2) the active-duty military; or (3) a non-DoD position (i.e., Other). Starting in FY 1992 (the first year for which data on the DAW are available), conditions 1 and 2 are divided into two mutually exclusive sub-groups to capture DAW experience: An individual who is in the DoD civilian workforce is either in the (1a) civilian DAW[38] or in (1b) another DoD civilian position. An individual in the active-duty military is either in the (2a) military DAW or in (2b) another active-duty military position. Figures 6.3 and 6.4, below, illustrate these

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[37] Starting in FY 1989, the active duty data that this study uses also include active component Coast Guard personnel. So for this study, active duty military experience includes experience in the active component of the Coast Guard starting in FY 1989.

[38] This is also adjusted for DAWIA-data lag instances, in parallel with the "lag" adjustment made when defining civilian DAW cohorts. Therefore, an individual is marked as in the civilian DAW in year t under one of two conditions:

(1) If he or she appears in the DoD civilian file and is recorded as in the DAW.

(2) If he or she is recorded as joining the DoD civilian workforce in a non-acquisition position in year t and then administratively transferring into an acquisition position the following year (year $t+1$). As explained above, many of these cases may be due to a lag in reporting and recording DAWIA data. It is possible that these professionals are actually hired into a civilian DAW position in year t but are first recorded as in an acquisition position the following year (year $t+1$). These individuals are marked as being in the civilian DAW in year t.

conditions. Figure 6.3 shows the three conditions that exist from FY 1980 to FY 1991, and Figure 6.4 illustrates how conditions 1 and 2 are divided into their mutually exclusive sub-groups starting in FY 1992.

This categorization scheme provides flexibility to analyze the workforce and prior workforce experience in different ways. One can combine categories 1a and 1b to analyze experience in the DoD civilian workforce and categories 2a and 2b to analyze active duty experience. One can also combine categories 1a and 2a to examine all individuals with experience in the DAW or combine categories 1a, 1b, 2a, and 2b to analyze all individuals with DoD experience.

Figure 6.3. Framework for Characterizing Past Work Experience, FY1980-FY1991

Figure 6.4. Framework for Characterizing Past Work Experience, FY1992-FY2014
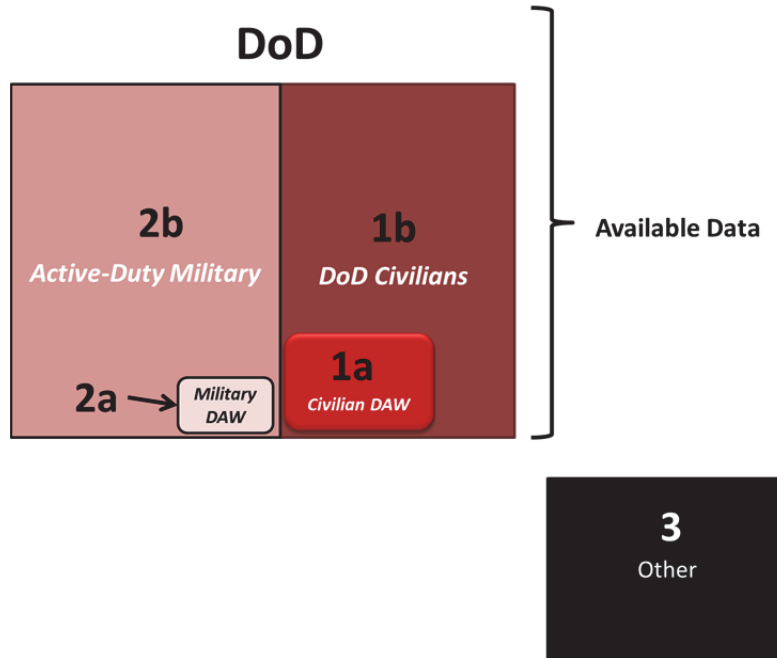
Adjustments for Double Counting

Some individuals are recorded in two different defense workforce files at the same time (i.e., in the same end-of-FY personnel inventory snapshots). Specifically, certain individuals appeared in both the ADMF and DoD civilian inventory files in the same annual data cuts. Although this is not a common occurrence—the number of individuals who appear in these two files at the same time on one or more occasions never exceeds 40 for any of the civilian DAW cohorts analyzed (which include thousands of observations)—and it is impossible to say exactly what is causing these "double counts" to occur, a decision had to be made about how to count the work experience for those individuals for those years.

After examining the data, one distinct pattern became clear. It is not uncommon for an active duty service member to join the DoD civilian workforce directly upon his or her separation from the active duty force. This is seen in the data as an individual appearing in the ADMF one year and then appearing in the DoD civilian inventory file the next year. In some cases, however, it seems that this transition has some overlap—creating this "double-count" issue. In particular, some individuals appear in the ADMF one year, then in both the ADMF and DoD civilian file the next year, and then only in the DoD civilian file the following year. This overlap could (1) stem from a lag in recording an individual's separation from the active duty military or (2) represent an individual who is on terminal leave from the active duty military and has already joined the DoD civilian workforce. These "double-count" instances are adjusted accordingly under this assumption. Specifically, for the "double-count" cases that match this pattern,

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individuals are marked as only in the DoD civilian workforce (and not in the active-duty military) during that "double-count" year.[39]

For the "double-count" cases that do not follow the pattern described above, individuals are marked as only in the active-duty military (and not in the DoD civilian workforce). It is impossible to know what exactly is causing these particular "double-count" instances to occur. However, this adjustment seemed logical because one reasonable hypothesis for some of these "double-count" instances is as follows: Perhaps some of these cases stem from DoD civilian employees being called to serve on active duty (and being recorded in the ADMF, per DoDI 1120.11 (U.S. Department of Defense, 2015a)), while they—at the same time—maintain their DoD civilian positions in the personnel files.

DAWIA data are used post adjustment to determine if individuals should be marked as in the DAW for each "double-count" case. If the adjustments described above mark an individual as only in the DoD civilian workforce (and not in the active-duty military) for a particular "double-count" instance, he or she is determined to be in the civilian DAW at that time under two circumstances: (1) if the DAWIA data indicate that individual to be in the DAW that year and show that individual to be in the *civilian* DAW at that time or (2) if that individual is marked as in the civilian DAW for that year because of the DAWIA lag adjustment described above. Otherwise, the individual is simply marked as in the wider (non-DAW) DoD civilian workforce for that particular "double-count" instance.

If the adjustments mark an individual as only in the active-duty military (and not in the DoD civilian workforce) for a particular "double-count" instance, he or she is determined to be in the military DAW at that particular time if the DAWIA data indicate that individual to be in the DAW that year and show that individual to be in the *military* DAW at that time. Otherwise, the individual is simply marked as in the wider (non-DAW) active-duty military for that particular "double-count" instance.

The following fictional example illustrates this adjustment process in full. Assume that Jane, a fictional individual, is a member of the FY 2010 civilian DAW cohort. When characterizing Jane's prior work experience, the data show Jane to be in the DoD civilian workforce from 1995 to 2002 (i.e., Jane appears in the end-of-FY 1995-2002 DoD civilian personnel files). The data also show Jane to be in the active-duty military in years 1997 and 1998 (i.e., Jane appears in the end-of-FY 1997-1998 ADMFs). The issue, then, is that Jane appears in the end-of-FY 1997-1998 ADMFs and DoD civilian personnel files. Jane's "double-count" instances in FYs 1997 and 1998 do not follow the overlap pattern described above. Therefore, following the rule outlined above, these "double-count" instances for Jane are adjusted to show her as only in the active-duty military in 1997 and 1998 (and not in the DoD civilian workforce). After this adjustment is made, the DAWIA data are considered. Jane does not appear in the end-of-FY 1997-1998

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[39] For the cases where the "double-count" year is FY 1980, since it is not possible to look back a year, an individual is marked as only in the DoD civilian workforce in FY 1980 if that person is marked as only in the DoD civilian workforce in FY 1981. In all other cases where the "double-count" year is FY 1980, that individual is recorded as being only in the active-duty military for FY 1980.

DAWIA data. For this reason, Jane is ultimately marked as being in the wider (non-DAW) active-duty military for FYs 1997 and 1998, her "double-count" years.

Limitations to Methodologies for Defining Civilian DAW Cohorts and Characterizing Past Work Experience

Using the administrative end-of-FY personnel files to define cohorts and characterize past work experience is simple and effective: The annual files are available for both the civilian and active-duty military personnel going back to end-of-FY 1980. They are intuitive to work with, and—as illustrated above—they capture the basic information needed for this study.

However, the use of the annual files does have its limitations. This technique misses some individuals and miscategorizes others. First, in terms of defining who is in each of the civilian DAW cohorts, the end-of-FY data only capture individuals who are in the civilian DAW at the end of each FY. Individuals who are not in a civilian DAW position at the end of a FY (from FY 2000 to FY 2014) are, therefore, not included in the cohort for that FY. In particular, an individual could join the civilian DAW in March of one year and then leave the workforce before the end of that FY. In this case, this particular individual would not be recorded as a member of that FY's cohort, as he or she was never recorded in an end-of-FY inventory file. Additionally, it is important to note that the data and methodology used include seasonal employees in the civilian DAW cohorts. However, the number of instances where this happens is quite small: There are only 30 total instances of a seasonal employee being included in the FY 2000-2014 civilian DAW cohorts, with no single cohort having more than eight, and there are never fewer than 4,000 individuals in a cohort.

The use of annual end-of-FY inventory files to characterize work experience means that individuals who are in a particular DoD workforce on September 30th of each FY are counted has having a year of experience in that workforce. This method gives certain individuals, particularly those who leave the workforce not too long before the end of the FY, less experience in that workforce than they really had. On the other hand, this method gives other individuals, particularly those who enter a workforce right before the end of the FY, more experience in that workforce than they really had. This limitation is even more salient when accounting for past work experience of individuals with a background as a seasonal DoD civilian employees: Seasonal DoD civilians likely enter and leave the DoD civilian workforce more frequently, remaining in the workforce for shorter periods of time, thereby exacerbating the over- and undercounting of past DoD Civilian experience.[40] Additionally, it is also important to note that the data and methodology used do not distinguish between full-time and not-full-time experience in the DoD civilian workforce.[41]

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[40] The end-of-FY 1980 and end-of-FY 1981 files report no seasonal employees. It is not known if the 1980 and 1981 files contain no seasonal employees or if seasonal employees in these files were not properly recorded.

[41] The DoD civilian personnel data include all types of workers, including "Full-time," "Part-time," and "Intermittent" employees ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary),"

This methodology—using administrative end-of-FY inventory files to record DoD experience—does not perfectly illustrate the past work experience of civilian DAW entrants: It undercounts experience for some individuals and over counts experience for others. However, given that this analysis is at an aggregate cohort level (and considering that there are thousands of individuals in each cohort), these over- and undercounts may even out in the end. Additionally, this methodology should not significantly skew descriptions of whether or not a professional has particular work experiences: Only individuals who have been in a particular workforce but never appear in an end-of-FY file for that workforce would be falsely recorded as never having been in that workforce. Theoretically, then, this "false negative" could only occur in instances where individuals are in a workforce for less than one year at one time, and it is unlikely that a single year of experience (or less) in a particular workforce would be significantly influential. In the end, this technique provides a good approximation of the past DoD work experience of civilian DAW entrants.

Past Work Experience Information for FY Cohorts 2000-2014

Once each civilian DAW entrant is categorized into one of the workforces in each FY (from FY 1980 to the FY prior to him or her joining the civilian DAW) based on the methodology described above, indicator variables are created that flag what prior work experiences each individual has had. The prior-DoD-experience indicator variables are not mutually exclusive: An entrant could have prior experience in the active-duty military non-DAW (AD), in the wider non-DAW DoD civilian workforce (DoD Civ), in the military DAW (Mil DAW), and/or in the civilian DAW (Civ DAW). Some individuals, however, join the civilian DAW with no prior experience in the DoD (No DoD). The statistics for these prior-DoD-experience indicator variables are shown in table 6.1, below. These are the data used in the descriptive analysis discussed in Chapter 7.

Table 6.1. Prior-DoD-Experience Indicator Variable Means, FY Cohorts 2000-2014

| | | FY Cohorts | | | | | | | | | | | | | | |
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	N	4433	8487	10356	8966	10717	10220	8044	8680	12448	17308	19073	12843	9738	8019	8256
AD	%	21.09	21.2	24.77	26.05	24.62	29.77	32.81	33.74	33.62	31.88	33.46	37.04	39.03	38.85	38.94
DoD Civ	%	58.85	68.71	60.76	55.64	60.04	57.78	48.62	45.81	42.92	32.67	29.59	39.06	44.65	47.71	45.55
Mil DAW	%	2.41	2.25	2.91	4.07	3.48	4.45	5.64	6.79	5.6	5.59	5.94	6.53	4.72	5.51	6.2
Civ DAW	%	22.29	14.96	12.06	15.44	16.54	13.34	12.49	13.78	14.09	9.93	9.43	12.07	12.88	13.12	14.53
No DoD	%	28.38	19.74	25.44	27.93	25.95	25.19	30.37	32.76	34.94	44.96	45.21	35.39	30.84	30.12	31.87

2010, p. 4). "Intermittent" employees are those individuals who do not have a regular, set "Work Schedule" ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010, p. 4).

The Outcome Variable—Retention

After defining the civilian DAW cohorts and characterizing prior work experience, the analysis adds the necessary tenure information and control factors in order to examine retention trends. These retention analyses focus on the pre-policy cohorts (FY cohorts 2001-2005 and 2007) [42] and the policy cohorts (FY cohorts 2008-2011). The aim of the retention analyses is to understand civilian DAW retention trends—how these trends might differ across individuals with different past work experiences and between pre-policy and policy cohorts. To this end, retention analysis Part I also investigates retention in the wider non-DAW DoD civilian workforce. This tangential investigation into retention in the wider DoD civilian workforce helps to further clarify the relationship between prior work experience and retention in the civilian DAW. The following sections define retention in the wider DoD civilian workforce and in the civilian DAW, list and explain the control factors included in the retention analyses, and outline the final data file used for the retention analyses.

Defining Retention in the Wider DoD Civilian Workforce

An individual is marked as a loss from the DoD civilian workforce at the end of FY t if he or she is in the DoD civilian workforce at the end FY t but not in the DoD civilian workforce at the end of FY $t+1$. Figure 6.5 provides an illustration.

Figure 6.5. This Individual is Marked as a DoD Civilian Loss at the end of FY t
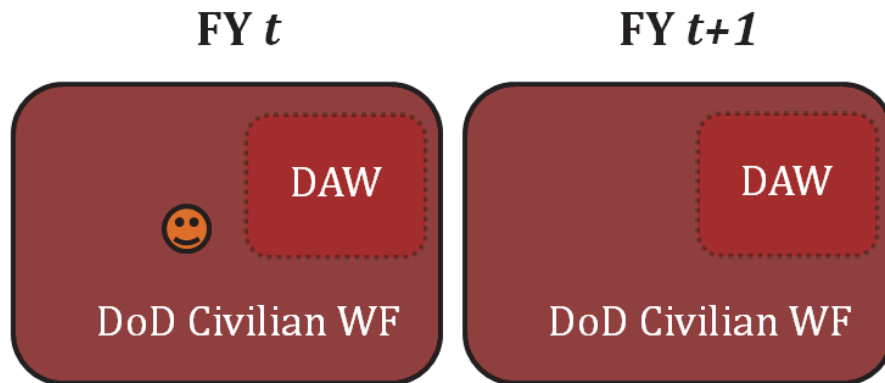
Each individual's tenure in the DoD civilian workforce is calculated by subtracting his or her civilian DAW cohort FY for that particular instance (since some individuals are in multiple civilian DAW cohorts) from the FY at the end of which he or she is recorded as a loss (in Figure 6.5, this would be FY t). For example, an individual who is in the FY 2003 civilian DAW cohort

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[42] The FY 2006 cohort is dropped from the retention analyses because a large number of observations in this cohort do not have information for the race variable, as described below.

and is recorded as a loss at the end of FY 2010 has a tenure in the DoD civilian workforce of seven years.

Defining Retention in the Civilian DAW

Defining retention in the civilian DAW is more complicated because there are three different types of civilian DAW losses that individuals can experience (Gates et al., 2013).[43] An individual can separate from the civilian DAW, which involves leaving the DoD civilian workforce altogether. Or an individual can transfer—either substantively or administratively—out of the civilian DAW (Gates et al., 2013). These three loss types are described in more detail below and illustrated in Figure 6.6.

Figure 6.6. There are Three Different Types of Losses from the Civilian DAW
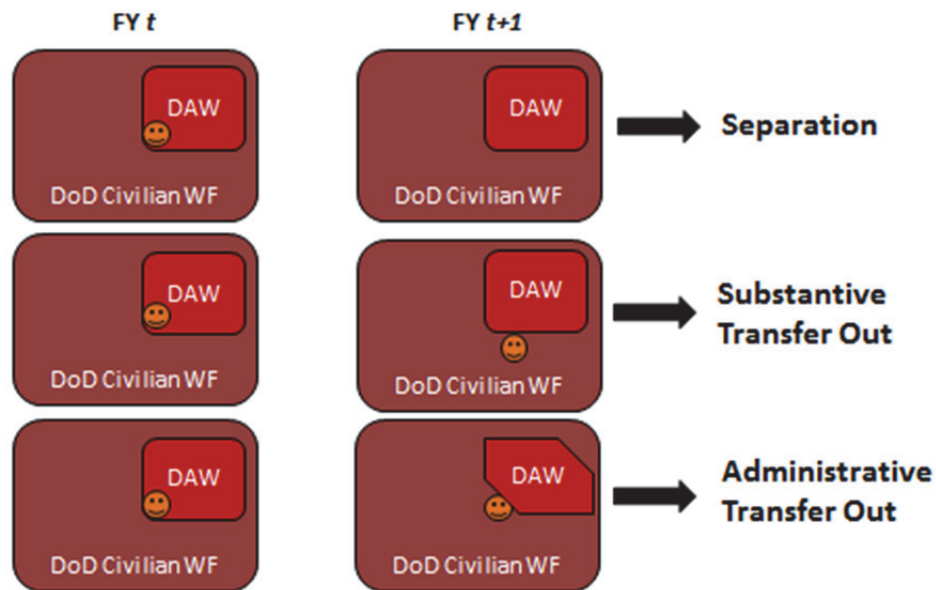
- "separations" from the civilian DAW (Gates et al., 2013, pp. 7-8)

    An individual is marked as separating from the civilian DAW at the end of FY *t* when he or she is in the civilian DAW one year (in FY *t*) and not in the DoD civilian workforce at all in the following year (FY *t+1*) (Gates et al., 2013, p. 8).

- "transfers" out of the civilian DAW[44]

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[43] The definitions of these three loss types come from Gates et al. (2013) (pp. 7-12).

[44] Gates et al. (2013) mainly use the term "switches" (pp. 8-12) instead of "transfers." However, on a few occasions, they also use the term "transfers" (pp. xiii, xv). This report mainly uses "transfers."

An individual is considered a transfer out of the civilian DAW at the end of FY *t* if he or she (1) is in a civilian defense acquisition position in FY *t* and (2) is in a wider (non-acquisition) DoD civilian position in FY *t+1* (Gates et al., 2013).

Like Gates et al. (2013), this analysis makes a distinction between professionals who substantively transfer out of the civilian DAW and those who administratively transfer (Gates et al., 2013, pp. 8-12). A "substantive" transfer is when an individual actually changes position or jobs when he or she moves out of the civilian acquisition workforce (Gates et al., 2013, pp. 8-12). On the other hand, an "administrative" transfer is when a DoD civilian remains in the same position from one year to the next but that position changes from an acquisition position to an non-acquisition position (Gates et al., 2013, pp. 8-12). In coding terms, a substantive transfer is flagged when a transfer out of the civilian DAW is accompanied by a change in agency/service, bureau, functional occupational group, or occupational series. A substantive transfer is also flagged if an individual transferring out of the civilian DAW is coming from or going into an SES position or if that individual changes pay grade while remaining in the same pay plan. In all other cases, a transfer to the civilian DAW is recorded as administrative (Gates et al., 2013).

The distinction between substantive and administrative transfers is made because substantive transfers involve actual personnel movement, whereas administrative transfers are simply bureaucratic re-categorizations.

Each individual's tenure in the civilian DAW workforce is calculated by subtracting his or her civilian DAW cohort FY for that particular instance (since some individuals are in multiple civilian DAW cohorts) from the FY at the end of which he or she is recorded as a loss from the civilian DAW (in Figure 6.6, this would be FY *t*). For example, a professional who is in the FY 2004 civilian DAW cohort and is recorded as a loss from the civilian DAW at the end of FY 2009 has a civilian DAW tenure of five years.

Control and Balance Variables

In order to understand the relationship between prior work experience and workforce retention, the analyses must consider and control for confounding factors, i.e., observable characteristics that relate to both prior work experience and retention. For example, certain characteristics, such as age and education, vary systematically with prior work experience, and these factors also influence retention. The following analyses control for these factors in order to uncover the true relationship between prior work experience and workforce retention.

The DoD personnel data files used in this study contain a broad range of personnel characteristics, many of which conceivably affect retention. Table 6.2 includes a list of all factors included in this study and a brief argument about why each factor is included as a control. These variables are called observable characteristics.

In contrast to Guo, Hall-Partyka and Gates (2014), this study includes observations that experience administrative losses in the analyses.

Table 6.2. Control and Balance Variables

Variable[45]	Description[46]	Note
Compensation	"The amount of annualized basic pay" (p. 82) upon entrance into the civilian DAW. This does not include bonuses or allowances.	One would expect entrants with higher base pay to have greater retention. Guo, Hall-Partyka and Gates (2014) show that compensation is positively related to retention.
Age	The age, in years, of the entrant upon joining the civilian DAW.	Age upon entrance should influence workforce retention, but this relationship may differ at different age ranges. For example, the youngest entrants likely experience more churn; middle-age entrants may be more attached to the workforce; and older entrants are likely closer to retirement. Guo, Hall-Partyka and Gates (2014) estimate that age—at an overall level—has an inverse relationship with retention.
Race	Indicates whether the entrant is "white" or "other."	Although it seems plausible that race could relate to workforce retention, Guo, Hall-Partyka and Gates (2014) find that race is not related to retention in the civilian DAW once they control for other factors.
Education	"Education Level" (p. 25) upon entrance to the civilian DAW. Marks individuals as having (1) less than a Bachelor's degree, (2) a Bachelor's degree, or (3) more than a Bachelor's degree.	Individuals with different levels of education likely have different job opportunities outside of the DoD civilian workforce/civilian DAW. Therefore, one would expect education level to influence how long an individual stays in the workforce. Guo, Hall-Partyka and Gates (2014) find that entrants who join the civilian DAW with a Bachelor's or Master's degree tend to have higher retention than those with no higher-education degree (i.e., less than a Bachelor's degree). Asch (2001), in an analyses on the wider DoD civilian workforce, also found that entrants with a Bachelor's degree tend to have greater retention in the DoD civilian workforce than entrants with no Bachelor's degree, but Asch (2001) found no significant difference between the retention trends of entrants with a Master's degree upon entrance and those with no higher-education degree (Guo, Hall-Partyka and Gates, 2014).
DoD Organization	The DoD organization the entrant joins. The four categories are: (1) Army, (2) Navy, (3) Air Force, (4) Other. The Marine Corps falls under Navy.	Each of the DoD organizations manages its civilian DAW differently. Therefore, it is plausible that the gaining institution could influence workforce retention. Guo, Hall-Partyka and Gates (2014) find some evidence suggesting that entrants into the Army's civilian DAW have lower retention compared to entrants into the "other" DoD organizations (i.e., the non-military-department DoD organizations).
Gender	The gender (male or female) of each entrant.	It is possible that men and women have different retention trends. However, Guo, Hall-Partyka and Gates (2014) find no relationship between retention and gender once other factors are controlled for.

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[45] Although they are not quoted and indicated with a page number, some of the variable names listed below come directly from the DoD-civilian-file data dictionary ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010).

[46] The DoD-civilian-file data dictionary ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010) outlines the variables available in the DoD civilian file and includes a description of these variables. This study has access to a number of the variables listed in the dictionary. Phrases from the data dictionary that are used in the description below are quoted and indicated with a page number ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010). Although some of the particular values listed in the description below also come directly from the data dictionary, they are not quoted and indicated with a page number ("DoD APF Civ Personnel Edit Unpacked File (200803 and After, Data Dictionary)," 2010).

The acquisition career field variable comes from the acquisition position data file.

Variable[45]	Description[46]	Note
Position Type	Indicates which type of position an individual joins: (1) Administrative, (2) Professional, (3) Technical, (4) Other.	Each type of position offers a different experience, which could conceivably influence retention. This could be especially true when considering administrative exits from the civilian DAW. One hypothesis would be that administrative employees are more likely to administratively transfer out of the civilian DAW—that they work more at the margins of the civilian DAW.
Supervisor	Indicates whether an entrant is in a "supervisory" (p.24)/managerial/ leadership position.	Guo, Hall-Partyka and Gates (2014) find that entrants who join the civilian DAW in a supervisory position tend to have lower retention than those who join in a non-supervisory position.
Acquisition Career Field	Indicates which acquisition career field an entrant joins upon entrance. In cases where an entrant is missing a career field indicator in the cohort year, the career field from the following year is used (if available). Guo, Hall-Partyka and Gates (2014) use a similar technique to fill missing career-field information (see p. 10). The Industrial Property Management, Purchasing, and Science and Technology career fields are marked as "Other."	Different acquisition career fields have different requirements and responsibilities, leading to contrasting experiences across career fields and the expectation that retention rates would also vary. Guo, Hall-Partyka and Gates (2014) find that retention does vary across acquisition career fields.
Retirement Plan	Describes each entrant's "retirement plan" (p. 15): (1) CSRS, (2) FERS, (3) Other.	The retirement plans differ in how benefits are calculated and paid, thereby changing the incentive structure for remaining in the civil-service workforce and influencing how long individuals choose to remain in the DoD civilian workforce and in the civilian DAW.
Region	The geographic "region" (p. 56) in which the entrant is brought into the civilian DAW. There are ten regions.	Each geographic region is unique in terms of the local economy and job-opportunity environment. One would hypothesize that entrants in regions with strong economies and higher-paying job opportunities would tend to have lower retention rates than entrants in regions that are struggling economically.
Career Level Upon Entrance	Indicates whether an entrant joins as an (1) entry-level, (2) mid-level, or (3) senior/executive employee. Some entrants are marked as "uncategorized." See Appendix J for the definitions of these career levels.	One would expect that the level of responsibility that an individual has upon entering an organization would relate to how long that individual remains in the workforce. Guo, Hall-Partyka and Gates (2014) find that mid-level entrants tend to have higher retention than entrants who join as entry-level employees.
Cohort Year	Marks which FY cohort each entrant is in.	The FY in which the hire occurred could potentially influence retention in a couple of ways. First, the economic environment has changed over the years—individuals in the civilian DAW would likely be less willing to leave the DoD civilian workforce for the private sector during FY 2008 and for several years thereafter because of the struggling economy. Second, civil-service workforce management has also changed, and this could also influence separations and transfers out. Guo, Hall-Partyka and Gates (2014) find that retention trends do vary across cohort years.

Variable[45]	Description[46]	Note
Years to Retirement Eligibility	Describes how many years an entrant has until he or she is eligible for retirement benefits. Categories are: (1) twenty-plus years, (2) ten to nineteen years, (3) five to nine years, (4) fewer than 5 years, (5) already eligible for retirement.	One would expect entrants who are already eligible for retirement to have lower retention rates than other entrants. On the other extreme, the incentives are such that entrants who have fewer than five years until they are fully eligible for retirement would have very high retention rates in those five years. This factor likely plays a major role in workforce retention. Although "Years to Retirement Eligibility" is likely correlated closely with age, this variable captures the unique, dichotomous effect of one being or not being eligible for retirement.
Pay Plan	Indicates which "pay plan" (p. 20) an individual has: (1) Broad GS, (2) NSPS, (3) Acquisition Demonstration, or (4) Other.	Pay plans define the relationship between tenure, performance, and pay. Each of the pay plans outlines a different incentive structure. These incentive structures undoubtedly play a role in how long an individual may stay in the workforce.
Handicap	Indicates which individuals have a handicap.	Although the vast majority of the entrants included in this study do not have a handicap, it is important to include this characteristic as a control factor as individuals with a handicap may be (1) more or less likely to have certain past work experiences and (2) may tend to have certain retention trends. Guo, Hall-Partyka and Gates (2014) show that there is some evidence suggesting that handicapped individuals tend to have lower retention rates than non-handicapped individuals.

Retention Analysis Data File

The data file used for the retention analyses combines all of the factors described above: prior work experience information, retention data, and the other observable characteristics. The file includes the pre-policy cohorts (FY cohorts 2001-2005 & 2007)[47] and the policy cohorts (FY 2008-2011). The entire FY 2006 cohort, and a number of observations in each of the other cohorts are dropped due to missing values for one or more of the covariates listed in Table 6.2.

The analysis drops any individual that (1) has an abnormally low compensation amount;[48] (2) does not have a years-until-retirement descriptor; (3) does not have a valid position type; (4) has missing education information; (5) does not have a race indicator; (6) does not have a gender indicator; (7) is not a full-time employee; or (8) is missing a handicap indicator. These specifications drop a number of observations from the final analysis dataset used for the retention analyses, but—with the exception of the FY 2006 cohort—the vast majority of observations remain. Table 6.3 shows the number of observations in each cohort before and after these adjustments. A significant number of individuals in the FY 2006 cohort are missing a race indicator, which is why the analysis drops more than 36 percent of the FY 2006 entrants. Because of this missing information, the retention analyses do not include the FY 2006 cohort.

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[47] The FY 2000 cohort is not included in the base retention analysis data file because the FY 2000 cohort is much smaller than the other pre-policy cohorts. Given the number of entrants in FY 2000 relative to the other cohorts examined, the FY 2000 cohort may be a part of the end of the workforce drawdowns of the 1990s (see Chapter 2).

[48] There are some observations that have an annualized basic compensation of $100 or less. This analysis assumes that these extremely low compensation levels are data-entry errors, so these observations are dropped from the sample.

Among the other cohorts included, the adjustments do not drop more than five percent of the original number of observations in each cohort.

Table 6.3. Dropped Data Due to Missing Information

	FY Cohort										
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Total Entrants	8487	10356	8966	10717	10220	8044	8680	12448	17308	19073	12843
Dropped Observations	(106)	(133)	(346)	(447)	(254)	(2948)	(273)	(610)	(607)	(550)	(457)
Entrants in Analysis Dataset	8381	10223	8620	10270	9966	5096	8407	11838	16701	18523	12386
Percentage Dropped	1.2%	1.3%	3.9%	4.2%	2.5%	36.6%	3.1%	4.9%	3.5%	2.9%	3.6%

The final dataset used for the retention analyses is presented in Table 6.4, below.[49] The cohort characteristics do not change significantly after dropping observations (see Appendix A).

Table 6.4. Final Dataset for Retention Analyses

		FY Cohort									
		2001	**2002**	**2003**	**2004**	**2005**	**2007**	**2008**	**2009**	**2010**	**2011**
All	N	8381	10223	8620	10270	9966	8407	11838	16701	18523	12386
AGE	Mean	42	40	40	40	39	39	39	38	40	40
COMPENSATION[a]	Mean	51812	51121	52102	54177	52496	55189	56120	57938	62902	63311
RACE											
Other	%	21.94	23.8	23.09	21.56	23.93	21.23	23.66	20.9	19.9	20.19
White	%	78.06	76.2	76.91	78.44	76.07	78.77	76.34	79.1	80.1	79.81
GENDER											
Male	%	61.51	64.83	65.29	66.88	61.78	65.15	66.07	67.18	68.04	68.35
Female	%	38.49	35.17	34.71	33.12	38.22	34.85	33.93	32.82	31.96	31.65
SUPERVISORY CODE											
Spvsr/Mngr/Ldr	%	9.95	6.96	7.65	8.36	7.84	8.29	6.97	5.95	6.4	8.38
All Other Positions	%	90.05	93.04	92.35	91.64	92.16	91.71	93.03	94.05	93.6	91.62
EDUCATION											
Less than BA	%	36.82	31.56	31.42	29.44	31.71	24.93	24.41	23.27	24.27	24.5
BA	%	41.53	47.86	46.26	47.16	45.94	48.35	50.63	49.41	46.28	44.49
More than BA	%	21.64	20.58	22.32	23.4	22.36	26.72	24.96	27.32	29.46	31
HANDICAP											
Not Handicapped	%	91.54	90.82	91.55	92.04	92.43	91.99	91.97	91.59	92.37	91.02
Handicapped	%	8.46	9.18	8.45	7.96	7.57	8.01	8.03	8.41	7.63	8.98

[49] Table 6.4 does not show the past work experience information as these data are already described in Table 6.1.

		FY Cohort									
		2001	2002	2003	2004	2005	2007	2008	2009	2010	2011
DOD ORGANIZATION											
Air Force	%	12.95	13.53	19.14	12.99	17.91	14.33	13.45	19.81	19.25	23.27
Army	%	53.12	35.18	36.91	57.47	44.21	30.28	36.92	30.96	32.33	29.78
Navy	%	28.39	39.16	34.11	21.91	19.88	36.09	34.06	34.91	31.65	32.21
Other	%	5.55	12.14	9.84	7.63	18	19.29	15.58	14.32	16.77	14.74
REGION											
Other or Missing[b]	%	3.76	2.65	2.47	2.65	2.82	1.86	2.33	1.87	2.21	2.87
New England	%	3.63	4.21	4.15	3.36	3.44	3.45	2.85	3.96	3.79	3.21
Mid Atlantic	%	10.45	10.17	9.44	11.39	11.17	12.63	12.62	9.04	7.63	5.83
East North Central	%	10.75	9.28	11.64	12.65	13.99	10.8	11.93	14.96	13.54	13.04
West North Central	%	1.16	1.51	1.4	1.92	1.71	1.14	1.28	1.12	1.01	1.34
South Atlantic	%	32.26	35.91	33.16	34	32.17	39.16	35.01	37.22	37.56	40.37
East South Central	%	11.72	6.8	7.12	9.27	8.6	8.41	7.81	7.08	11.73	9.47
West South Central	%	7.55	6.55	7.82	7.1	7.31	4.47	6.38	6.18	5.3	7.08
Mountain	%	6.62	5.98	7.02	6.86	7.2	5.64	4.62	5.54	5.46	5.33
Pacific	%	12.1	16.94	15.78	10.8	11.59	12.44	15.17	13.02	11.76	11.47
POSITION TYPE											
Administrative	%	43.78	36.66	40.13	37.36	41.85	37.65	38.6	36.99	43.04	43.44
Other	%	1.26	1.52	1.35	1.15	1.1	1.15	0.71	0.96	0.43	1.6
Professional	%	49.99	56.85	53.11	55.88	51.54	55.57	54.84	56.92	51.99	50
Technical	%	4.96	4.97	5.42	5.61	5.51	5.63	5.85	5.13	4.53	4.96
ACQ CAREER FIELD											
Business (CE or FM)	%	10.89	6.58	9.51	6.16	8.59	7.71	6.87	7.69	7.78	7.6
Contracting	%	13.41	17.34	14.07	13.46	17.27	20.29	21.32	21.87	18.78	17.6
Engineering	%	27.71	30.63	27.92	24.59	17.57	22.73	19.76	23.25	20.86	20.64
Facilities Engineering	%	0.23	2.06	6.22	13.58	3.6	4.4	7.03	6.61	5.44	6.32
Information Tech	%	5.49	9.03	6.42	3.65	4.31	3.96	4.18	4.2	6.17	6.64
Life Cycle Logistics	%	12.35	7.85	9	10.95	14.36	12.94	14.87	12.95	14.37	14.45
Prod, Quality & Manuf	%	3.65	3.97	5.64	6.42	7.93	7.62	7.47	6.16	5.69	6.04
Program Management	%	9.58	8.72	7.71	7.8	7.67	6.53	6.68	7.62	11.2	10.97
Test and Eval	%	4.12	5.44	5.52	4.4	4.01	4.48	4.38	3.53	4.34	3.52
Other	%	3.78	4.08	3.57	3.27	2.6	3.25	2.24	2.93	2.05	3.23
Unknown or Missing	%	8.79	4.3	4.41	5.72	12.09	6.08	5.21	3.19	3.32	2.99
RETIREMENT PLAN											
CSRS	%	26.56	17.4	17.03	14.85	10.65	6.53	5.64	3.32	2.72	2.85
FERS	%	72.9	82.1	82.29	84.4	88.42	92.67	93.32	95.71	96.41	96.04
Other	%	0.54	0.5	0.68	0.75	0.93	0.8	1.04	0.98	0.87	1.11
CAREER LEVEL											
Entry-Level	%	21.3	28.5	29.07	29.99	30.03	33.96	35.06	36.65	25.02	21.4
Sen/Exec	%	7.78	5.91	5.56	6.78	6	9.74	9.65	9.36	9.84	11.08
Mid-Level	%	70.34	64.4	64.47	61.97	63.02	55.42	54.51	53.43	64.66	65.83
Uncategorized	%	0.58	1.18	0.9	1.27	0.94	0.88	0.79	0.56	0.48	1.69

		FY Cohort									
		2001	**2002**	**2003**	**2004**	**2005**	**2007**	**2008**	**2009**	**2010**	**2011**
PAY PLAN											
Other	%	0.51	0.98	0.92	1.24	0.87	0.79	0.62	1.53	1.25	2.13
Demo	%	15.51	21.5	19.33	19.66	16.54	13.89	12.72	11.05	11.81	21.87
Broad GS	%	83.98	77.52	79.76	79.1	82.59	70.43	58.71	50.85	68.58	75.9
NSPS	%	.	.	.	.	.	14.89	27.95	36.57	18.36	0.1
YRS UNTIL RET ELIG											
20+ YRs To Go	%	32.76	42.08	42.02	43.7	45.06	48.25	48.96	51.92	47.66	45.79
10 to 19 Yrs to Go	%	36.13	33.18	31.87	30.96	31.65	31.09	30.11	28.95	30.59	31.45
5-9 Yrs to Go	%	16.62	13.31	13.71	12.77	11.63	10.93	10.97	10.33	11.47	11.93
<5 Yrs to Go	%	9.01	7.58	8.07	8.09	7.61	6.49	6.64	6.14	7.26	7.29
Ret Eligible	%	5.48	3.84	4.33	4.48	4.05	3.24	3.32	2.66	3.02	3.53
LOSS FROM DOD CIV											
No	%	49.42	54.14	56.16	59.85	62.81	72.81	76.07	77.82	79.78	81.83
Yes	%	50.58	45.86	43.84	40.15	37.19	27.19	23.93	22.18	20.22	18.17
LOSS FROM CIV DAW											
No loss	%	27.3	33.28	32.37	31.74	38.81	54.34	57.82	63.38	66.93	68.58
Administrative	%	21.38	16.59	17.1	22.84	17.54	8.91	8.95	6.56	5.95	6.09
Substantive	%	18.39	17.8	19.88	18.44	17.1	14.68	13.52	10.73	8.77	8.97
Separation	%	32.93	32.33	30.65	26.97	26.55	22.08	19.71	19.33	18.36	16.37
TENURE DOD CIV	Mean	10	9	8	8	7	6	5	4	4	3
TENURE CIV DAW	Mean	7	7	6	5	5	5	4	4	3	2

[a] Although the mean for COMPENSATION is displayed in this table, the propensity-score-based weighting procedures and the Cox PH models in this study use the log of COMPENSATION (ln(COMPENSATION))

[b] This category includes individuals in U.S. territories that are not states, individuals in foreign locations, and individuals for whom location information is not recorded

Chapter 7. Descriptive Analysis

The goal of the descriptive analysis is to explore the past work experience data files described in the previous chapter to address the first research question: How did the growth initiative change who the civilian DAW hired into its ranks, in terms of prior work experience? As described in Chapter 5, one should expect to see a larger percentage of entrants with no prior DoD experience in the growth initiative cohorts, compared to the cohorts prior to FY 2008.

The descriptive analysis examines the data from a number of perspectives. First, the analysis describes the cohorts in terms of where the entrants were in the FY prior to the year they joined the civilian DAW. After that, the analysis describes each cohort in terms of the entrants' overall prior DoD experience, reaching back to FY 1980.

In the end, the evidence supports the hypothesis: The hiring surge cohorts have a significantly higher percentage of outside hires with no prior DoD experience.

The Growth Initiative was Fueled Mainly by Outside Hires with No Prior Work Experience in the DoD

Based on the methodology described above, each civilian DAW entrant from FY 2000 to FY 2014 included in this analysis is marked as in one of three workforces in each FY from 1980 to 1991 and in one of five workforces from 1992 until he or she enters the civilian DAW (see Figures 6.3 and 6.4). This allows one to examine which workforce an entrant was in in the FY before he or she entered the civilian DAW, shedding light on where (which workforces) civilian DAW entrants tend to come from.

Figure 7.1, below, shows where civilian DAW entrants have come from over the past 15 years. The graphic shows that the cohort-size increase during the years of the DAW hiring surge was almost entirely fueled by hires from outside of the DoD. During the four years of the DAW growth initiative (FYs 2008-2011), a total of 41,853 individuals joined the civilian DAW from a position outside of the DoD; more than 14,000 of those individuals were hired in FY 2010 alone. In contrast, a total of 47,160 individuals joined the civilian DAW from a position outside of the DoD during the 11 non-growth-initiative years included in this analysis (FYs 2000-2007 and 2012-2014), with no more than 5,700 individuals coming from an outside-of-the-DoD position in any given FY.

Figure 7.1 illustrates that the number of civilian DAW entrants coming from a non-acquisition DoD civilian position has remained relatively constant for every cohort examined in this analysis, including those cohorts during the DAW hiring surge years. Specifically, no cohort has fewer than 2,100 or more than 5,800 entrants coming from a non-acquisition DoD civilian position.

Figure 7.1. DAW Hiring Surge was Fueled by Hires from Outside of the DoD
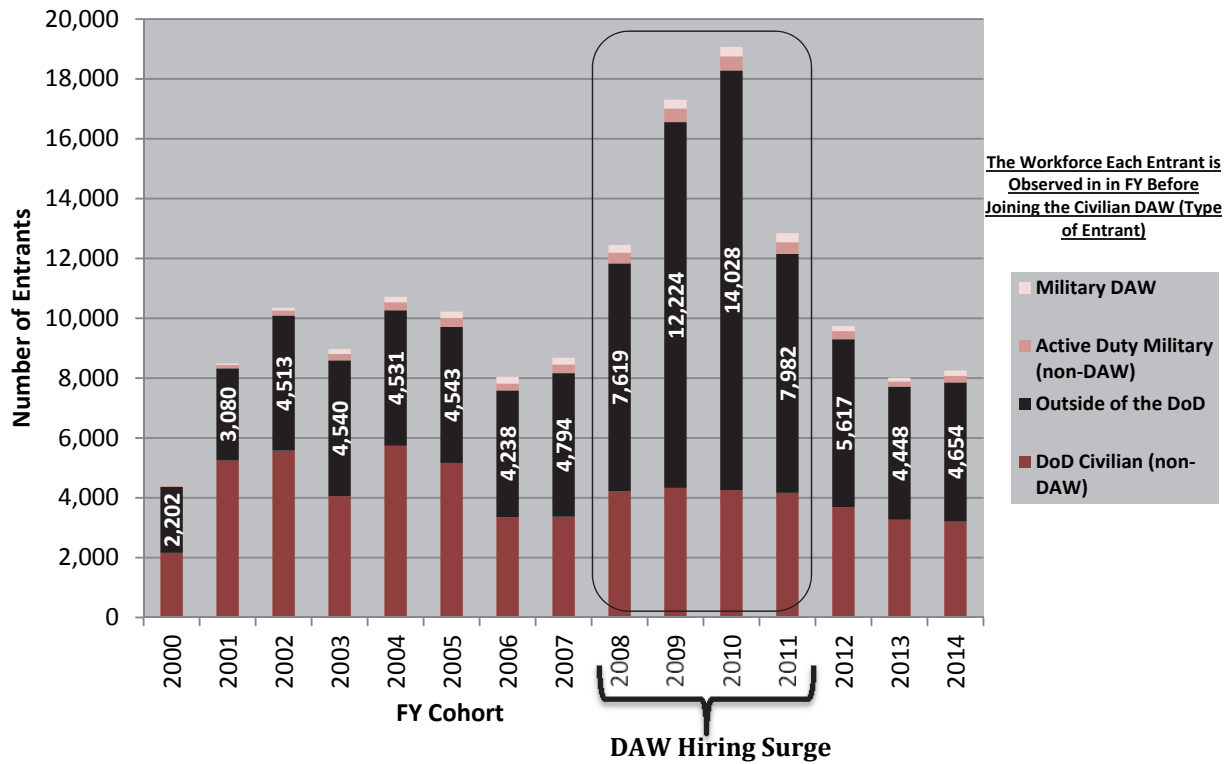
Individuals who join the civilian DAW from a position that is outside of the DoD could still have some DoD experience in previous years. In the end, the data reveal that although many outside-of-the-DoD hires have some prior DoD experience, the majority of them do not.

Figure 7.2 shows the number of outside-of-the-DoD hires in each cohort who do and do not have prior DoD experience upon entering the civilian DAW. The graphic shows that hires from outside of the DoD are more likely to have no prior DoD experience when they enter the workforce. This trend holds for every cohort examined—even for the larger cohorts during the DAW growth initiative. In fact, the percentage of outside-of-the-DoD hires without prior DoD experience remains relatively stable for every cohort, hovering between 53 and 64 percent every FY, even though the overall cohort size increased substantially in response to the growth initiative.

Figure 7.2. Most Individuals Hired into the Civilian DAW Directly from Positions Outside of the DoD Have No Prior DoD Work Experience
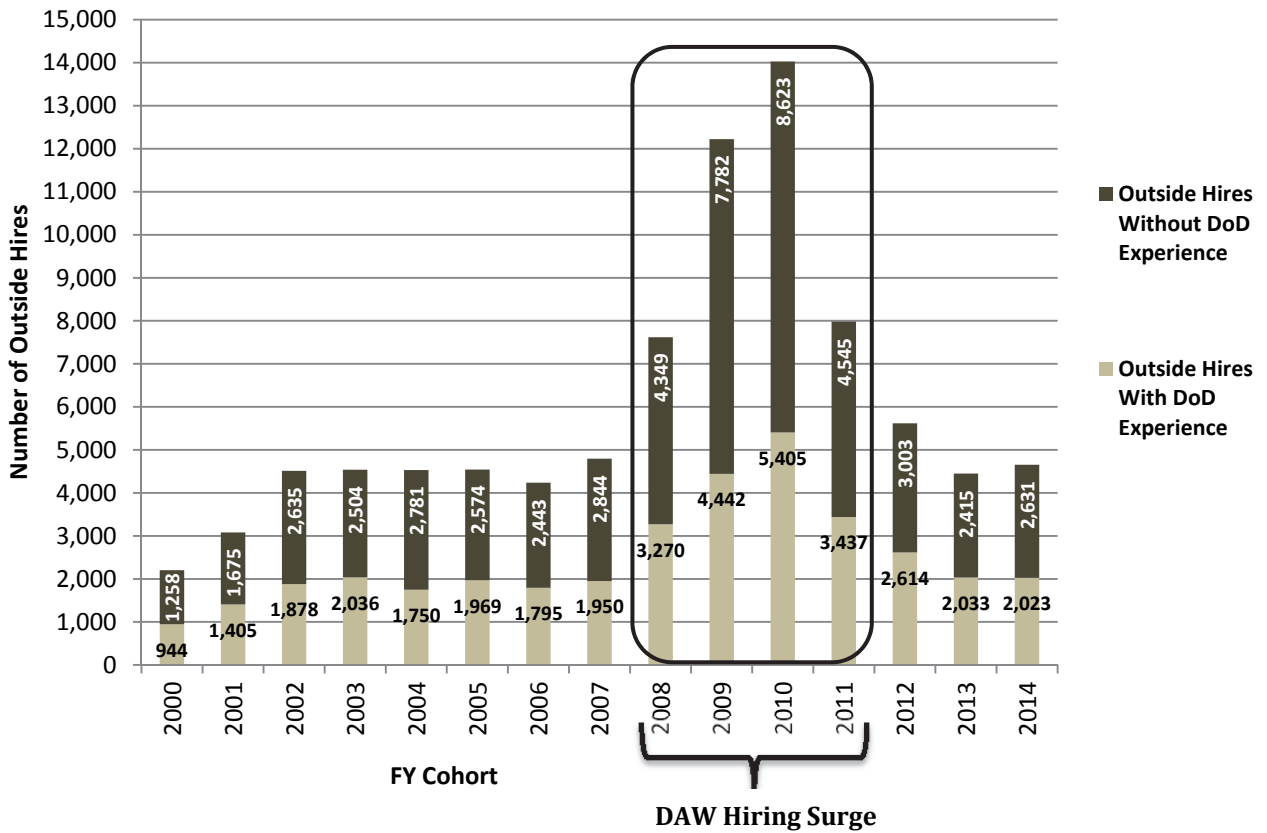
The Fraction of Entrants with the DoD Civilian Prior Career Profile Decreased During the Hiring Surge

The following figures divide each cohort into mutually exclusive prior-work-experience-combination groups, or "prior career profiles." These profiles are listed and described in Table 7.1. The first five profiles are the top five most common prior DoD experience combinations. Entrants with other past DoD experience combinations fall into the "Other DoD Experience" profile, and entrants with no prior DoD experience fall into the "No DoD Experience" profile. Each entrant for all cohorts examined is categorized into only one of these profiles.

Table 7.1. Prior Career Profiles

Prior Career Profile	An Entrant is Categorized into this Profile When...
DoD Civilian	The only DoD experience an individual has is in the DoD civilian workforce (in a non-DAW position)
DoD Civilian + Civilian DAW	An individual has had experience in both the DoD civilian workforce and in the civilian DAW but has no other type of DoD experience
Active Duty	The only DoD experience an individual has is in the active duty military (in a non-DAW position)
Active Duty + DoD Civilian	An individual has had experience in both the active duty military (in a non-DAW position) and in the DoD civilian workforce (in a non-DAW position) but has no other type of DoD experience
Active Duty + Military DAW	An individual has been in the active duty military in both an acquisition position and a non-acquisition position but has no other type of DoD experience
Other DoD Experience	An individual has any other prior DoD experience combination
No DoD Experience	An individual has no prior DoD work experience

Figure 7.3, below, shows how the number of entrants with each of these prior career profiles changes from FY 2000 until FY 2014. Each line represents the number of entrants in each cohort with that particular profile. The sum of all lines for a given cohort year is the total number of entrants in each FY cohort. The chart illustrates that the civilian DAW growth initiative was mainly fueled by outside hires with no prior DoD experience. There is also an increase—although not as drastic—in the number of entrants with active duty (non-DAW) experience. This is because outside hires *with* DoD experience tend to have active duty military experience.

Figure 7.4 shows the same data but in percentage terms so that the prior career profiles can be compared more easily across FY cohorts. This chart highlights that there is a significant decrease in the percentage of entrants with the DoD civilian prior career profile and an increase in the percentage of hires with no prior DoD experience during the hiring surge years. Also, note that the percentage of entrants who join the civilian DAW with active duty experience does not change significantly during the growth initiative years. In fact, this line suggests that the percentage of entrants with active duty experience has been slowly increasing over these 15 cohort years.

Figure 7.3. Civilian DAW Growth was Mainly Fueled by Outside Hires with No Prior DoD Experience
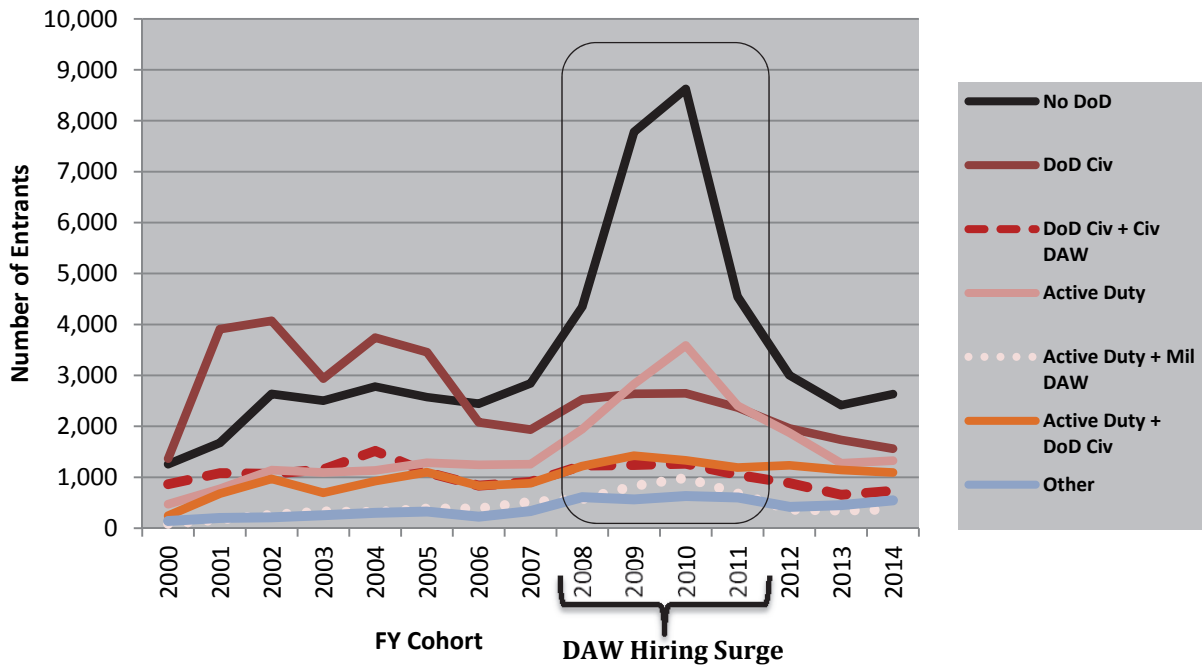
Figure 7.4. The Hiring Surge Saw a Decrease in the Percentage of Entrants with the DoD Civilian Prior Career Profile and an Increase in the Percentage of Entrants with No Prior DoD Experience
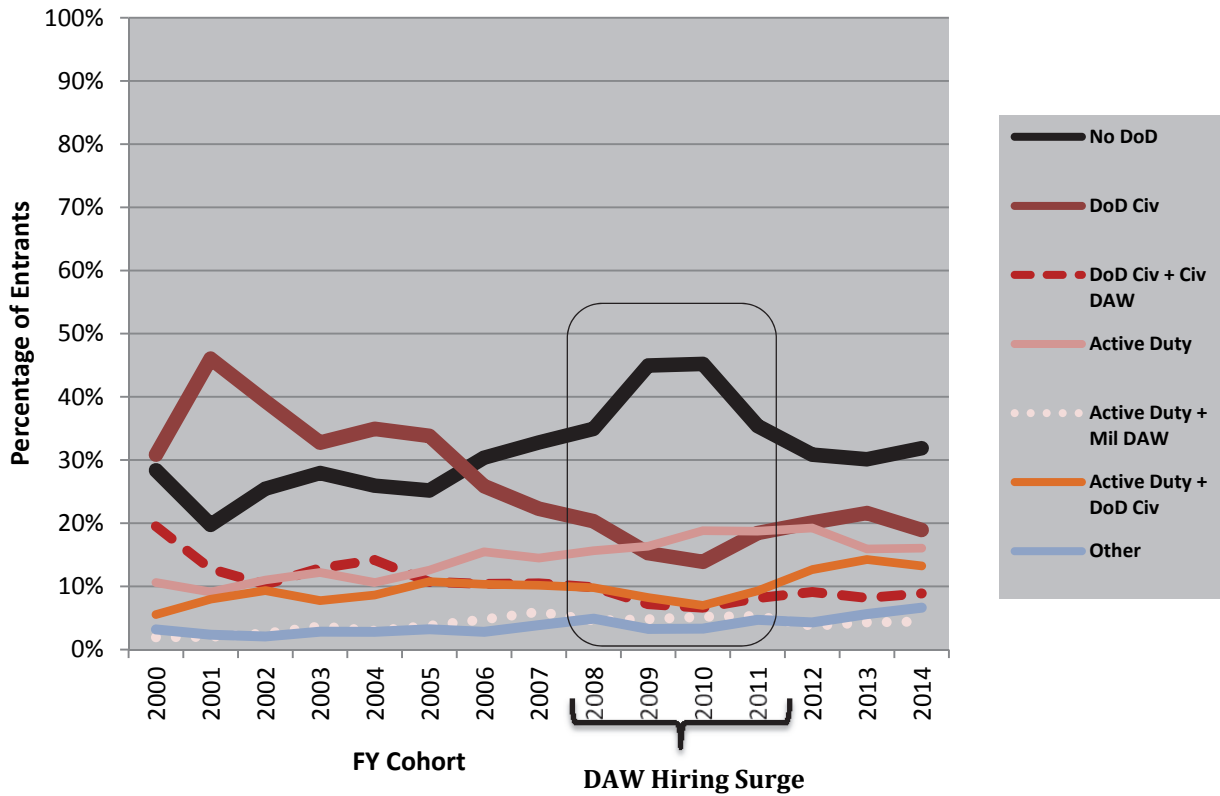
In the end, the analysis supports the hypothesis. The hiring surge was mostly fueled by hires from outside of the DoD, and the majority of these outside hires have never been official DoD employees. The analysis shows that the growth initiative cohorts have a greater percentage of outside hires with no prior DoD experience and a lower fraction of entrants with the DoD civilian prior career profile. This shift in cohort characteristics brought about by the growth initiative could have overall retention implications. The following chapters explore the relationship between prior work experience and retention.

Chapter 8. Retention Analysis Part I: How DoD Experience Relates to Retention

The following analysis utilizes the retention data and survival-analysis techniques to address the second research question: How does entrants' prior work experience relate to retention? To address this question, this retention analysis focuses on the pre-policy cohorts because tests on these earlier cohorts capture longer-term retention trends. The analysis utilizes the retention analysis data file outlined in Table 6.4.

To check robustness, the analysis runs separate tests on three different pre-policy cohort groups. These cohort groups are outlined in Table 8.1. The "early pre-policy cohort group" consists of FY cohorts 2001-2003. The "later pre-policy cohort group" consists of FY cohorts 2004, 2005, and 2007.[50] And the "combination pre-policy cohort group" consists of all of the available pre-policy cohorts (FY cohorts 2001-2005 and 2007). The retention analysis described in this chapter includes tests on all three of these pre-policy cohort groups. A robust finding is one that holds across all three samples.

Table 8.1. Pre-Policy Cohort Groups for Analysis

Cohort Group Name	FY Cohorts Included
Early pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007

This study uses Cox Proportional Hazard (Cox PH) regression models to statistically test for differences in retention trends across different prior work experience groups. The Cox PH model produces an estimate called the hazard ratio. For the purposes of the following analyses, the hazard ratio estimates the probability that individuals with certain prior work experiences experience a loss, i.e., substantively transfer out of or separate from the civilian DAW, in any given year in the workforce relative to a reference group (Allison, 2010; Guo, Hall-Partyka and Gates, 2014). A hazard ratio estimate that is greater than one, say 1.06, indicates that that particular group of individuals is more likely (specifically, six percent more likely) than the reference group to experience a loss in any given year in the workforce (i.e., they have a greater "hazard" of experiencing a loss). On the contrary, a hazard ratio that is less than one, say 0.90, indicates that that particular group of individuals is less likely (specifically, ten percent less

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[50] As described in Chapter 6, the FY 2006 cohort is excluded because a substantial percentage of individuals in the FY 2006 civilian DAW cohort has missing information.

likely) than the reference group to experience a loss in any given year in the workforce (i.e., they have a lower "hazard" of experiencing a loss) (Allison, 2010, p. 132; Guo, Hall-Partyka and Gates, 2014, p. 13).

Individuals who join the civilian DAW with different prior work experiences also tend to differ across the other explanatory variables listed in Table 6.2, and these observable characteristics may also influence retention. Therefore, in order to tease out the true relationship between prior work experience and retention, this analysis uses two methods to control for these differences in characteristics: (1) propensity-score-based weighting and (2) "multivariate adjustment"[51] techniques.[52] Propensity-score-based weighting balances the "comparison group[s]"[53] (e.g., entrants with prior DoD experience and entrants with no prior DoD experience) on the observable characteristics using weights. The weights emphasize certain individuals but deemphasize others in each group in order to make each comparison group look more like the overall average observation, based on all of the available descriptors (Griffin and McCaffrey, 2015a; Griffin and McCaffrey, 2015b; McCaffrey, Ridgeway and Morral, 2004). Multivariate adjustment involves including the relevant covariates in the Cox PH models (Griffin and McCaffrey, 2015d).

Tests comparing retention trends between only two groups (e.g., entrants with prior DoD experience vs. entrants with no prior DoD experience) use these two control techniques together—to produce what are called "doubly robust"[54] estimates (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c, p. 41; Griffin and McCaffrey, 2015a, p. 45). Griffin and McCaffrey (2015d) state that doubly robust models are the "gold standard" in terms of adjusting for observable confounding factors.

It is not possible to use doubly robust Cox PH models to test for differences in retention trends across the different prior career profiles outlined in Table 7.1. The individuals in certain prior career profile groups are too fundamentally different, in terms of observable characteristics, from individuals with no prior DoD experience (the reference group)—applied propensity-score weights cannot bring these groups into balance. This highlights the fact that there is not much "overlap" (Griffin and McCaffrey, 2015a, p. 29; Griffin and McCaffrey, 2015b) between individuals with certain prior career profiles that include DoD experience and non-DoD-experienced entrants, weakening the argument for causality. Given this, the results from the non-doubly-robust models (i.e., the models that test for retention differences across the various prior career profiles and that incorporate only multivariate adjustment) are interpreted conservatively,

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[51] Griffin and McCaffrey (2015d) use the term "multivariate adjustment." This study uses this same term.

[52] See Appendix B for more detailed information on these methods.

[53] McCaffrey, Ridgeway and Morral (2004) (p. 404), Griffin and McCaffrey (2015a) (p. 36), and Griffin and McCaffrey (2015b) use the phrase "comparison group" in their work on propensity-score weighting. This analysis uses the same phrase.

[54] The term "doubly robust" stems from Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015d), Griffin and McCaffrey (2015c) (p. 41), Griffin and McCaffrey (2015a) (p. 45). This analysis also uses this term.

focusing on the general direction of the hazard ratio estimates rather than on the precise estimate numbers.

As described in Chapter 6, there are three types of losses from the civilian DAW: (1) administrative transfers out, (2) substantive transfers out, and (3) separations. The following analyses focus on substantive transfers out and separations; administrative transfers out are censored in all cases since these represent bureaucratic changes rather than actual personnel movement. In other words, the term "retention" (in regard to retention in the civilian DAW) refers to an individual's hazard of substantively transferring out of or separating from the civilian DAW. Individuals with a lower hazard of substantively transferring out of or separating from the civilian DAW (i.e., those who are less likely to substantively transfer out or separate) are said to have greater retention. Although the focus of this analysis is on this definition of retention, which includes both uncensored loss types—substantive transfers out and separations—the analysis also examines these loss types individually in order to further explore the relationship between prior work experience and retention.

There is No Evidence Suggesting that Prior DoD Experience Leads to Greater Retention in the Civilian DAW

Entrants with prior DoD experience are, on average, fundamentally different from entrants with no prior DoD experience. Tables C.1.1-C.3.1 in Appendix C illustrate how the two groups balance in terms of the other observable characteristics included in this study. Specifically, the tables show that, among other things, DoD-experienced entrants tend to be older and—in general—closer to retirement eligibility relative to entrants with no prior DoD experience.

To control for these systematic differences between entrants with and without DoD experience, the following tests include propensity score weights[55] and multivariate controls. The doubly robust Cox PH models show that—all else equal—there is no statistically significant difference in retention trends between entrants with prior DoD experience and those with no prior DoD experience. Table 8.2 shows these results.

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[55] Appendix C shows that the applied propensity-score weights significantly improve the balance between the two groups (i.e., entrants with prior DoD experience and entrants with no prior DoD experience), based on the characteristics listed in Table 6.2.

Table 8.2. All Else Equal, There is No Evidence Suggesting that Entrants with prior DoD Experience Have a Lower Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to Entrants with No Prior DoD Experience

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	Later	Combination
N	27224	28643	55867
Degrees of Freedom	27223	28642	55866
Estimation	-0.024	0.028	0.014
Hazard Ratio	0.976	1.028	1.014
Standard Error	0.057	0.044	0.033
p-value	0.6705	0.5334	0.6755

Some Evidence Suggests that Internal Hires Have Lower Civilian DAW Retention than External Hires

One can also examine how each entrant's most recent work experience relates to retention outcomes. Specifically, as shown in Figure 7.1, there are a number of entrants who join the civilian DAW directly from a non-DAW DoD civilian position. Hereafter, these individuals are referred to as "internal hires." Those who join the civilian DAW from another workforce—from the military DAW, the wider active-duty military, or somewhere outside the DoD—are hereafter referred to as "external hires."[56] As depicted in Figure 7.1, most of the external hires are outside hires (i.e., they come from a position outside of the DoD entirely). The following analyses examine how civilian DAW retention trends may differ between internal and external hires.

The doubly robust Cox PH models[57] show some evidence that internal hires have lower retention in the civilian DAW than external hires.[58] These results are shown in Table 8.3, below.

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[56] "External hires" are similar to "new hires," and "internal hires" are similar to "substantive transfers" as defined in the "Defining a Cohort" section in Chapter 6. However, the "external hire" and "internal hire" definitions are based on the past-work-experience characterization (specifically, which workforce each entrant was in in the FY prior to him or her joining the civilian DAW), which adjusts for "double-count" years (FYs in which one individual appears in both the active-duty data file and the DoD civilian data file). Therefore, some individuals who are included in a cohort as a transfer are actually counted as external hires. This, however, is not common—there are only 10 instances where this occurs. See Appendix I for more information.

[57] Appendix D shows that the applied propensity-score weights significantly improve the balance between the two groups (i.e., internal hires and external hires), based on the characteristics listed in Table 6.2.

[58] This is counter to what Guo, Hall-Partyka and Gates (2014) find. As outlined in Chapter 3, Guo, Hall-Partyka and Gates (2014) find that "Employees who transferred into the [civilian DAW]" from a non-DAW DoD civilian position have greater retention than employees who came from other sources (pp. 14, 22). The models used by Guo, Hall-Partyka and Gates (2014) differ from those used in this study because the analyses address different questions. Guo, Hall-Partyka and Gates (2014) ask how "personnel quality," measured by "education and performance ratings," relates to civilian DAW retention (p. xi). This study asks how past work experience relates to civilian DAW retention. As such, Guo, Hall-Partyka and Gates (2014) include performance ratings, another workforce outcome, as an explanatory variable; this study does not. This analysis is not interested in understanding how prior

Specifically, the analysis on the early pre-policy cohort groups fails to show a difference in retention trends between the two groups, but tests on the later and combination pre-policy cohort groups show that internal hires are six to eight percent more likely to substantively transfer out of or separate from the civilian DAW in any given year relative to external hires.

Table 8.3. There is Some Evidence Suggesting that Internal Hires Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	27224	28643	55867
Degrees of Freedom	27223	28642	55866
Estimation	0.038	0.076	0.059
Hazard Ratio	1.039	1.079	1.061
Standard Error	0.034	0.028	0.020
p-value	0.2583	0.0065	0.0030

Although the tests suggest that internal hires may have lower levels of overall civilian DAW retention, analyses that examine each loss type individually show that internal hires are actually less likely than external hires to separate from the civilian DAW but much more likely to substantively transfer out of the civilian DAW. These results are shown in Tables 8.4 and 8.5, below. According to these doubly robust Cox PH models, internal hires are approximately 30-42 percent more likely to substantively transfer out of the civilian DAW in any given year relative to external hires. On the contrary, the models estimate that internal hires are approximately eight to 11 percent less likely to separate from the civilian DAW in any given year relative to external hires.

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work experience relates to performance and retention separately; rather, it is interested in understanding how past work experience relates to retention, regardless of how retention and performance interact. This difference in model specification, along with other differences, may play a role in these contrasting estimates.

Table 8.4. Internal Hires Have a Greater Hazard of Substantively Transferring Out of the Civilian DAW Relative to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	27224	28643	55867
Degrees of Freedom	27223	28642	55866
Estimation	0.262	0.351	0.315
Hazard Ratio	1.300	1.421	1.371
Standard Error	0.057	0.048	0.035
p-value	<.0001	<.0001	<.0001

Table 8.5. Internal Hires Have a Lower Hazard of Separating From the Civilian DAW Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	27224	28643	55867
Degrees of Freedom	27223	28642	55866
Estimation	-0.086	-0.120	-0.098
Hazard Ratio	0.918	0.887	0.906
Standard Error	0.042	0.036	0.025
p-value	0.0404	0.0008	<.0001

In the end, these analyses show some evidence that entrants who join the civilian DAW directly from a non-DAW DoD civilian position have lower rates of retention than other civilian DAW entrants. And the tests that focus on substantive transfers out and separations individually suggest that internal hires are more attached to the DoD civilian workforce in general than are external hires. Analyses on retention in the wider DoD civilian workforce support this finding: Internal hires have higher retention trends in the wider DoD civilian workforce than external hires. The results for these tests on retention differences in the wider DoD civilian workforce are shown in Table F.1 in Appendix F.

Among External Hires, Those with Prior DoD Experience Tend to Have Lower Civilian DAW Retention

The following analyses estimate how retention trends vary across prior work experiences for the external-hire population.

The first tests estimate how civilian DAW retention differs between external hires with prior DoD experience and those with no prior DoD experience. The results from the doubly robust

Cox PH models[59] are shown in Table 8.6, below. The models show that—among external hires—entrants with prior DoD experience tend to have lower retention than those with no prior DoD experience. Specifically, the models estimate that external hires with prior DoD experience are 13-15 percent more likely to substantively transfer out of or separate from the civilian DAW in any given year compared to external hires with no prior DoD experience.

Table 8.6. Among External Hires, Those with Prior DoD Experience Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to Those with No Prior DoD Experience

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	Later	Combination
N	12471	14578	27049
Degrees of Freedom	12470	14577	27048
Estimation	0.141	0.126	0.119
Hazard Ratio	1.151	1.134	1.126
Standard Error	0.051	0.055	0.038
p-value	0.0053	0.0210	0.0018

"DoD experience" is a broad term: Individuals could have a number of different prior-work-experience combinations within the DoD, and retention trends could vary across these different experience profiles. The following analysis estimates how the various prior career profiles relate to civilian DAW retention patterns, focusing solely on external hires. These models are not "doubly robust"—they incorporate multivariate controls but not propensity score weights. The results are interpreted generally, not specifically, focusing on the general direction of the hazard ratio estimates, not on the precise estimate number.

The Cox PH models show that external hires with the DoD Civilian prior career profile have lower civilian DAW retention than external hires with no prior DoD experience. The models estimate the same relationship for external hires with the Active Duty, Active Duty + DoD Civilian, or Other prior career profile, and there is some evidence that this is also true for external hires with the DoD Civilian + Civilian DAW prior career profile. External hires with the Active Duty + Military DAW prior career profile exhibit significantly greater retention trends in the analysis on the early pre-policy cohort group and significantly lower retention trends in the analysis on the later pre-policy cohort group. The results for these tests are displayed in Table 8.7. In summary, there is some evidence suggesting that external hires with any of the prior career profiles that include DoD experience (with the exception of those with the Active Duty +

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[59] Appendix E shows that the applied propensity-score weights significantly improve the balance between the two groups (i.e., external hires with no prior DoD experience and external hires with prior DoD experience), based on the characteristics listed in Table 6.2.

Military DAW prior career profile, who also exhibit greater retention in one analysis) have lower retention than external hires with no prior DoD experience.[60]

Table 8.7. In General, External Hires with a Prior Career Profile that Includes DoD Experience (With the Exception of the Active Duty + Military DAW Prior Career Profile) Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to External Hires with No Prior DoD Experience

Cox PH with Controls	Hazard Ratio Estimation (ref="no prior DoD experience")					
	Early		Later		Combination	
Prior Career Profile	**% External Hires**	**Estimate**	**% External Hires**	**Estimate**	**% External Hires**	**Estimate**
DoD Civ	8.36	***1.186	5.76	**1.147	6.95	***1.167
DoD Civ + Civ DAW	5.97	1.101	4.23	**1.159	5.03	**1.123
Active Duty	23.4	***1.178	24.34	**1.108	23.91	***1.139
Active Duty + DoD Civ	1.91	***1.334	1.62	***1.379	1.75	***1.363
Other DoD Experience	1.76	***1.482	2.15	***1.383	1.97	***1.43
Active Duty + Mil DAW	5.82	*1.126	8.18	**0.865	7.09	0.977

p-value < *0.1, **0.05, ***0.01

In the end, the estimates displayed above show that—in general[61]—external hires with prior DoD experience tend to have lower retention rates in the civilian DAW than external hires with no prior DoD experience.

The Results Fail to Support the Hypothesis

The retention analysis fails to support the original hypothesis—that entrants with prior DoD experience would have greater retention in the civilian DAW than entrants with no prior DoD experience. In fact, some results suggest the opposite relationship. Specifically, the analyses find some evidence that internal hires have lower civilian DAW retention rates than external hires. And additional tests find that, in general, external hires with no prior DoD experience tend to have the greatest civilian DAW retention.

The tests that examine substantive transfers out and separations individually, as well as tests on retention in the wider DoD civilian workforce, shed some light on the potential mechanisms behind these unexpected findings. In particular, the tests show that internal hires are significantly more likely than external hires to substantively transfer out of the civilian DAW but significantly less likely to separate from the civilian DAW in any given year. In addition, internal hires are

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[60] The sensitivity analysis in Appendix H shows that when the "lag instances" are not included in the civilian DAW cohorts, the tests on the early and later pre-policy cohort groups between external hires with the Active Duty + Military DAW prior career profile and external hires with no prior DoD experience find no statistically significant difference in retention trends (see Table H.1.7).

[61] With the exception of external hires with the Active Duty + Military DAW prior career profile

found to have greater retention in the wider DoD civilian workforce than external hires. These findings suggest that internal hires are much more comfortable, relative to external hires, moving from a civilian DAW position to a position in the wider DoD civilian workforce.

Chapter 9. Retention Analysis Part II: How the Growth Initiative Relates to Retention

The second part of the retention analysis addresses the third and final research question. Specifically, the analysis aims to evaluate how the hiring surge may have influenced retention in the civilian DAW. It is impossible to tell exactly what would have happened (in terms of retention outcomes) if the growth initiative had not happened, but the following analysis uses a synthetic-cohort comparison technique to make an estimate. These estimates will help acquisition personnel managers understand what effect the DAW hiring surge has on overall cohort-level retention, which will in turn help inform workforce policy decisions in the future.

The following analysis utilizes the retention analysis data file described in Table 6.4. The analysis separates the available FY cohorts (2001-2005, 2007-2011) into four cohort groups. Similar to the analysis described in Chapter 8, the early pre-policy cohort group consists of FY cohorts 2001-2003; the later pre-policy cohort group consists of FY cohorts 2004, 2005, and 2007; and the combination pre-policy cohort group consists of FY cohorts 2001-2005 and 2007. The policy cohort group is made up of the four growth initiative years, FY cohorts 2008-2011. These cohort groups are displayed in Table 9.1.

Table 9.1. Pre-Policy and Policy Cohort Groups for Retention Analysis, Part II[62]

Cohort Group Name	FY Cohorts Included
Early pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007
Policy cohort group	2008-2011

One way to understand how the growth initiative may have influenced overall retention trends in the civilian DAW is to estimate what would have happened (in terms of retention outcomes) if the policy cohorts had looked more like their pre-policy counterparts, based on the available observable characteristics, including the prior-career-profile characteristics. In other words, what would the FY 2008-2011 cohort group retention rates have been if the growth initiative had not occurred?

To address this question, the following analysis uses a synthetic-cohort technique. This involves two steps: (1) creating a counterfactual, by weighting the policy cohort group to look

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[62] As described in Chapter 6, the FY 2006 cohort is excluded because a substantial percentage of individuals in the FY 2006 civilian DAW cohort has missing information.

like a pre-policy cohort group, based on most of the characteristics in Table 6.2[63] and on the prior-career-profile characteristics, and (2) comparing retention trends between the weighted policy cohort group with the unweighted policy cohort group. Three synthetic cohort groups are created: one weighted to match the early pre-policy cohort group (hereafter called the "synthetic early pre-policy cohort group"), one weighted to match the later pre-policy cohort group (hereafter called the "synthetic later pre-policy cohort group"), and another weighted to match the combination pre-policy cohort group (hereafter referred to as the "synthetic combination pre-policy cohort group").[64] After creating these counterfactuals, the analysis tests for differences in retention trends between the unweighted policy cohort group and each of the synthetic pre-policy cohort groups. Cox PH models are used to test for differences in retention. The models include multivariate controls for specific cohort year, as the cohort year distribution may differ between the unweighted policy cohort group and the synthetic pre-policy cohort groups. Table 9.2, below, outlines the three comparison tests. Running comparison tests using all three synthetic pre-policy cohort groups is a way to test the results' robustness. If the normal, unweighted policy cohort group tends to have higher rates of retention than the synthetic pre-policy cohort groups, then one would conclude that the growth initiative likely increased overall levels of retention.

Table 9.2. To Understand What Policy Cohort Retention Trends Would Have Been had the Policy Cohorts Looked More Like Pre-Policy Cohorts, the Analysis Runs the Following Comparisons

Use Cox PH models to...
1. Compare retention trends from the policy cohort group to the retention trends from the synthetic early pre-policy cohort group[a]
2. Compare retention trends from the policy cohort group to the retention trends from the synthetic later pre-policy cohort group[b]
3. Compare retention trends from the policy cohort group to the retention trends from the synthetic combination pre-policy cohort group[c]

[a] The synthetic early pre-policy cohort group is the policy cohort group weighted to look like the early pre-policy cohort group
[b] The synthetic later pre-policy cohort group is the policy cohort group weighted to look like the later pre-policy cohort group
[c] The synthetic combination pre-policy cohort group is the policy cohort group weighted to look like the combination pre-policy cohort group

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[63] The following characteristics are not used in the creation of the synthetic cohort groups: Cohort Year and LN(Compensation). Cohort Year is not included because it is impossible to weight one cohort group to match the cohort year distribution of another cohort group. LN(Compensation) is not included because, in general, nominal compensation levels tend to increase over time, so it would be inaccurate to weight one cohort group to match the compensation distribution of another cohort group. For the creation of the synthetic cohorts, the Broad GS Pay Plan group and the NSPS Pay Plan group are combined into one group, which is called "Broad GS or NSPS."

[64] Appendix G explains in more detail how these synthetic cohort groups are created. Appendix G also shows that the weighting schemes used to create the synthetic pre-policy cohort groups are successful—the variable means from the synthetic pre-policy cohort groups resemble those from the actual pre-policy cohort groups.

The policy cohorts and pre-policy cohorts differ across several dimensions, not just in their past work experience, making it difficult to precisely estimate what role the change in past-work-experience characteristics plays in any difference in retention. For example, a smaller fraction of entrants in the policy cohort group are enrolled in the Civil Service Retirement System (CSRS) retirement plan relative to entrants in the pre-policy cohort groups (see the Tables in Appendix G). Additionally, among other things, the distributions across DoD organizations and years-until-retirement-eligibility groups also differ between the policy and pre-policy cohort groups. These fundamental differences could play a role in retention trends. However, given the results from the descriptive analysis (presented in Chapter 7) and from Part I of the retention analysis (presented in Chapter 8), it would not be unreasonable to conjecture that the shift in past-work-experience-characteristics brought about by the growth initiative may play some part in any differences in retention that may exist.

The analysis also runs these comparisons in the other direction to check the robustness of the initial findings. Specifically, the same overall method is used to estimate what the pre-policy retention trends would have been if these pre-policy cohorts had looked more like the policy cohorts. To do this, three synthetic cohorts are created: First, the early pre-policy cohort group is weighted to look more like the policy cohort group based on most of the characteristics listed in Table 6.2[65] and on the prior-career-profile characteristics—this synthetic cohort group is hereafter referred to as "synthetic policy cohort group 1." Then, the later pre-policy cohort group is weighted to look like the policy cohort group—this synthetic cohort group is hereafter called "synthetic cohort group 2." Lastly, an additional synthetic policy cohort group is created, "synthetic policy cohort group 3," by weighting the combination pre-policy cohort group to look like the policy cohort group.[66] After creating synthetic policy cohort groups 1-3, the analysis compares retention trends between the unweighted pre-policy cohort groups and their respective synthetic policy cohort groups. Cox PH models are used to test for differences in retention. The models include multivariate controls for specific cohort year. Table 9.3, below, outlines the thre comparisons.

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[65] The following characteristics are not used in the creation of the synthetic cohort groups: Cohort Year and LN(Compensation). Cohort Year is not included because it is impossible to weight one cohort group to match the cohort year distribution of another cohort group. LN(Compensation) is not included because, in general, nominal compensation levels tend to increase over time, so it would be inaccurate to weight one cohort group to match the compensation distribution of another cohort group. For the creation of the synthetic cohorts, the Broad GS Pay Plan group and the NSPS Pay Plan group are combined into one group, which is called "Broad GS or NSPS."

[66] Appendix G explains in more detail how these synthetic cohort groups are created. Appendix G also shows that the weighting schemes used to create the synthetic policy cohort groups are successful—the variable means from the synthetic policy cohort groups resemble those from the actual policy cohort group.

Table 9.3. To Understand What Pre-Policy Cohort Retention Trends Would Have Been had the Pre-Policy Cohorts Looked More Like Policy Cohorts, the Analysis Runs the Following Comparisons

Use Cox PH models to...
1. Compare retention trends from the early pre-policy cohort group to retention trends from synthetic policy cohort group 1[a]
2. Compare retention trends from the later pre-policy cohort group to retention trends from synthetic policy cohort group 2[b]
3. Compare retention trends from the combination pre-policy cohort group to retention trends from synthetic policy cohort group 3[c]

[a] Synthetic policy cohort group 1 is the early pre-policy cohort group weighted to look like the policy cohort group
[b] Synthetic policy cohort group 2 is the later pre-policy cohort group weighted to look like the policy cohort group
[c] Synthetic policy cohort group 3 is the combination pre-policy cohort group weighted to look like the policy cohort group

One major advantage of the synthetic-cohort technique, which compares weighted and unweighted versions of the same dataset, is that it effectively controls for any global time-specific confounding factors, such as the strength of the national economy and labor market.

As in Chapter 8, the following analyses focus on substantive transfers out and separations; administrative transfers out are censored in all cases since these represent bureaucratic changes rather than actual personnel movement. In other words, the term "retention" (in regard to retention in the civilian DAW) refers to an individual's hazard of substantively transferring out of or separating from the civilian DAW. Individuals with a lower hazard of substantively transferring out of or separating from the civilian DAW (i.e., those who are less likely to substantively transfer out or separate in any given year) are said to have greater retention.

If Policy Cohorts Had Looked More Like Pre-Policy Cohorts, Retention Would Have Been Lower

The first Cox PH models compare the retention patterns of the synthetic pre-policy cohort groups to the unweighted policy cohort group. Table 9.4 displays the results. All three tests estimate a hazard ratio greater than one, meaning that the synthetic pre-policy cohort groups have lower retention than the policy cohort group. Specifically, the models estimate that individuals in the synthetic pre-policy cohort group are approximately 11-12 percent more likely, compared to those in the policy cohort group, to substantively transfer out of or separate from the civilian DAW in any given year.

Table 9.4. Individuals in the Synthetic Pre-Policy Cohort Groups Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Relative to Individuals in the Policy Cohort Group

Cox PH	Synthetic Early Pre-Policy Cohort Group[a]	Synthetic Later Pre-Policy Cohort Group[b]	Synthetic Combination Pre-Policy Cohort Group[c]
N	118896	118896	118896
Estimation	0.110	0.102	0.108
Hazard Ratio	1.116	1.107	1.114
Standard Error	0.018	0.013	0.015
p-value	<.0001	<.0001	<.0001

[a] The policy cohort group weighted to look like the early pre-policy cohort group
[b] The policy cohort group weighted to look like the later pre-policy cohort group
[c] The policy cohort group weighted to look like the combination pre-policy cohort group

This result suggests that the growth initiative may have produced cohorts that actually tend to have greater civilian DAW retention.

If Pre-Policy Cohorts had Looked More Like Policy Cohorts, Overall Retention Would Have Been Higher

Next, the analysis uses Cox PH models to test for differences in retention trends between the pre-policy cohort groups and their respective synthetic policy cohort groups. The results are outlined in Table 9.5. The results reveal that—on average—the synthetic policy cohort groups have higher rates of retention relative to their respective pre-policy cohort groups. Specifically, the models estimate that individuals in the synthetic policy cohort groups are approximately four to seven percent less likely to substantively transfer out of or separate from the civilian DAW in any given year compared to individuals in the pre-policy cohort groups.

Table 9.5. Individuals in the Synthetic Policy Cohort Groups Have a Lower Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Relative to Individuals in the Pre-Policy Cohort Groups

Cox PH	Synthetic Policy Cohort Group 1[a]	Synthetic Policy Cohort Group 2[b]	Synthetic Policy Cohort Group 3[c]
N	54448	57286	111734
Estimation	-0.045	-0.071	-0.066
Hazard Ratio	0.956	0.932	0.936
Standard Error	0.017	0.014	0.010
p-value	0.0065	<.0001	<.0001

[a] The early pre-policy cohort group weighted to look like the policy cohort group
[b] The later pre-policy cohort group weighted to look like the policy cohort group
[c] The combination pre-policy cohort group weighted to look like the policy cohort group

Similar to the tests presented in Table 9.4, these results suggest that the growth initiative may have increased overall cohort-level retention.

The Evidence Suggests that the Growth Initiative Increased Cohort-Level Retention Rates

In the end, the synthetic cohort analysis suggests that the growth initiative may have increased overall cohort-level retention rates. Given that there are a number of differences between the pre-policy and policy cohort groups, it is difficult to say what role the change in past-work-experience characteristics plays in this difference in retention. Nonetheless, given the results presented in Chapters 7 and 8, it is not unreasonable to conjecture that the shift in past-work-experience characteristics may play some part: The descriptive analysis illustrates that the growth initiative was fueled by outside hires with no prior DoD experience, and retention analysis Part I shows some evidence that these DoD newcomers—in general—tend to have the greatest propensity to stay in the civilian DAW. Given only this information, one would predict a positive relationship between the growth initiative and retention, and that is what this synthetic-cohort analysis has found. At the same time, however, there are likely other factors, other than past work experience, that contribute to this difference in retention trends.

Chapter 10. Conclusions and Discussion

The goals of the growth initiative, and the policies that helped fuel the hiring surge (i.e., the DAWDF and the Expedited Hiring Authority), were to increase the size of the workforce, which some had considered to be inadequate, and limit the consequences of the forecasted increase in attrition. Although it is clear that the growth initiative was successful in increasing the size of the overall DAW, this analysis aimed to uncover what implications this strong surge in hiring might have on the makeup of the workforce, in terms of past-work-experience characteristics, and on overall rates of retention.

This study utilizes DoD personnel data to (1) describe who is joining the civilian DAW, in terms of past work experience, and illustrate how the hiring surge has changed the past-work-experience characteristics of civilian DAW cohorts; (2) evaluate how prior work experience relates to retention in the civilian DAW; and (3) estimate how the growth initiative has influenced overall cohort-level retention rates. In the end, the analyses reveal that the growth initiative was fueled by outside hires with no prior DoD experience and some evidence suggests that these DoD newcomers—in general—tend to have the highest retention in the civilian DAW.[67] Additionally, the analyses reveal that internal hires are more attached to the DoD civilian workforce than are external hires. In line with these conclusions, the synthetic-cohort analysis finds that the hiring surge likely produced cohorts with greater civilian DAW retention. These findings, and their policy implications, are discussed below.

(1) The Growth Initiative was Fueled by Outside Hires with No Prior DoD Experience

After constructing past-work-experience descriptors for each entrant in the FY 2000-2014 civilian DAW cohorts, the descriptive analysis examines the cohorts to understand how the past-work-experience characteristics change during the hiring surge years (FYs 2008-2011). Given that part of the growth initiative was aimed at "converting" "contractors" into actual DoD personnel (Gates, 2009a), the analysis hypothesized that many of the hires during the growth initiative years would come from positions outside of the DoD, and that is what the descriptive analysis finds.[68] Even more, the study shows that more than half of the outside hires who were

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[67] One exception: Test results in Table 8.11 show some evidence suggesting that external hires with the Active Duty + Military DAW prior career profile may have greater retention in the civilian DAW than entrants with no prior DoD experience.

[68] As outlined in "Chapter 6. Data and Definitions," individuals are marked as being in the DoD for a particular FY if they appear in either the end-of-FY ADMF or end-of-FY DoD civilian personnel file for that particular FY. Individuals who do not appear in one of these files are considered to be outside of the DoD for that FY. Because defense contractors are not included in the ADMFs or DoD civilian personnel files, they are marked as being outside of the DoD.

brought in during the hiring surge did not have any prior experience in the DoD. Ultimately, the analysis reveals that cohort makeup, in terms of prior work experience, shifted considerably during the growth initiative: Hiring surge cohorts have a significantly greater percentage of outside hires with no prior DoD experience compared to the cohorts before the hiring surge.

(2) Some Evidence Suggests that These DoD Newcomers—in General— Have the Greatest Retention in the Civilian DAW

Retention analysis Part I addresses the second research question. Specifically, the analysis examines the relationship between prior experience in the DoD and civilian DAW retention outcomes. In the end, the analysis fails to support the original hypothesis—that entrants with prior DoD experience, particularly those with prior experience in the DoD civilian workforce or civilian DAW, would have greater retention in the civilian DAW than entrants with no prior DoD experience. In fact, some results suggest the opposite. Specifically, the analysis finds some evidence that internal hires (entrants who join directly from a non-DAW DoD civilian position) tend to have lower civilian DAW retention than external hires (entrants who come directly from a military position—DAW or otherwise—or from outside of the DoD entirely), and additional tests find that, among external hires, those with no prior DoD experience—in general—tend to have the greatest retention in the civilian DAW.[69]

(3) Internal Hires are More Attached to the DoD Civilian Workforce than are External Hires

The tests that examine substantive transfers out and separations individually, as well as tests on retention in the wider DoD civilian workforce, shed some light on the potential mechanisms behind these unexpected findings. In particular, the tests show that internal hires are (1) significantly more likely, than external hires, to substantively transfer out of the civilian DAW (into the wider non-DAW DoD civilian workforce) and (2) significantly less likely to separate from the civilian DAW (leave the DoD civilian workforce entirely) in any given year. These results suggest that internal hires are much more comfortable, relative to external hires, moving from a civilian DAW position to a position in the wider DoD civilian workforce. In fact, analyses on retention in the wider DoD civilian workforce show that internal hires have greater retention in the wider DoD civilian workforce than do external hires.

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[69] One exception: Test results in Table 8.11 show some evidence suggesting that external hires with the Active Duty + Military DAW prior career profile may have greater retention in the civilian DAW than entrants with no prior DoD experience.

(4) The Growth Initiative Likely Increased Cohort-Level Retention Rates

The second retention analysis uses a synthetic-cohort analysis technique to address the third and final research question, which asks how the hiring surge affected overall cohort-level retention rates. In the end, the analysis suggests that the growth initiative may have produced cohorts with greater civilian DAW retention (relative to what would have happened had the pre-policy cohort trends continued). This outcome is counter to the original hypothesis but makes sense given the findings from the descriptive analysis and from retention analysis Part I—that the hiring surge was mostly fueled by outside hires with no prior DoD experience and that some evidence suggests that these DoD newcomers, in general, tend to have the greatest propensity to stay in the civilian DAW.

Policy Implications

The findings listed above have important policy implications. First, at the strategic workforce planning level, the findings suggest that DAW "rightsizing"[70] initiatives do more than influence workforce size; the policies also influence workforce characteristics and outcomes, such as retention. Policymakers at the Office of the Secretary of Defense and Undersecretary of Defense for Acquisition, Technology and Logistics should consider these factors when enacting policy to guide workforce growth initiatives or downsizing efforts. Although there are certainly a number of factors that influence workforce retention, the findings presented in this study suggest that hiring surges that bring in outside hires with no prior DoD experience may produce cohorts with greater levels of retention. On the other hand, a hiring surge accomplished by increasing the number of internal hires from the wider DoD civilian workforce may produce cohorts with lower retention rates.

These findings also have retention-policy implications. Specifically, the results suggest that policies aimed at improving civilian DAW retention should distinguish between internal and external hires as the two entrant types exhibit different civilian DAW loss-type patterns. The study shows that internal hires are more likely to substantively transfer out of but less likely to separate from the civilian DAW in any given year compared to external hires. This suggests that internal hires may identify more as DoD civilians than do external hires. Therefore, policies aimed at improving civilian DAW retention among internal hires should focus on reducing substantive transfers out. For example, policies targeted at internal hires could focus on forging entrants' identity as acquisition professionals, thereby making internal hires feel more attached to the acquisition workforce specifically. On the other hand, policies aimed at improving civilian DAW retention among external hires should focus on reducing separations. For example, policies targeted at external hires could emphasize integrating external hires into the DoD

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[70] Gates et al. (2008) write, "A popular term used in discussing the management of government agencies is 'rightsizing'—having the optimal or appropriate number of employees to accomplish the required tasks" (p. 3). This study also uses the term "rightsizing."

civilian workforce more broadly. Further research (perhaps a qualitative investigation) is needed to recommend more-specific policies to improve retention among civilian DAW entrants. At a minimum, however, this study suggests that policies aimed at improving civilian DAW retention should distinguish between internal and external hires.

Lastly, the results can also help inform individual-level hiring decisions. For example, the analysis shows some evidence suggesting that among similar entrants, internal hires (i.e., those who transferred into the civilian DAW from a non-DAW DoD civilian position) tend to have shorter tenure as civilian defense acquisition professionals than external hires (i.e., those who joined from a military position—DAW or otherwise—or from a position outside of the DoD). Personnel managers should consider these trends when making hiring decisions. However, further research is needed to understand whether this relationship holds across all of the acquisition career fields.

Study Limitations and Further Research

This study presents a detailed examination of the civilian DAW, the recent growth initiative, and how past work experience relates to retention outcomes, yielding interesting and useful results. However, it does have its limitations, presenting opportunities for further research.

First, one of the study's limitations is that it uses annual end-of-FY personnel inventory files to (1) define each civilian DAW cohort; (2) characterize prior work experience; and (3) measure retention. Using administrative end-of-FY data is an effective but imperfect way to define cohorts and characterize past work experience—this technique misses some individuals and miscategorizes others. In particular, individuals who are not in a civilian DAW position at the end of a FY (in this study, at the end of FYs 2000 to 2014) are not included in the cohort for that FY. Similarly, in terms of characterizing prior work experience, the annual files do not capture the prior DoD work experience for individuals who are not in a particular DoD workforce at the end of the FY.[71] Retention information is also derived from these end-of-FY inventory files, making the retention data also approximate. Future analyses could utilize the personnel transaction data, which contain precise start and end dates, to address these limitations and produce improved estimates.

Another limitation is that this study only uses DoD data to characterize prior work experience. Although the majority of entrants analyzed in this study have some prior DoD work experience (see Table 6.1), little is known about the work history for those individuals who do not have prior experience in the DoD. These individuals could have a range of different work experiences outside of the DoD. For example, among other possibilities, these individuals could be experienced government contractors with years of acquisition experience, federal civil servants who have never worked under the Defense Department, or even recent college graduates with no work experience at all. These various past work experiences could have different effects

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[71] Although, prior work experience that is less than one year in duration may not be too influential.

on retention outcomes in the civilian DAW. Further research that expands on the data used to characterize prior work experience—potentially including federal and private-sector personnel data files—would improve the understanding of how prior work experience relates to civilian DAW retention outcomes.

Additionally, this study uses broad categories to characterize prior work experience: experience in the active-duty military (non-DAW); experience in the wider (non-DAW) DoD civilian workforce; experience in the military DAW; and prior experience in the civilian DAW. Although the analysis distinguishes between acquisition and non-acquisition experience, further distinctions between different types of jobs within these broader workforces could highlight more specific connections between prior work experience and retention.

This analysis examines the civilian DAW entrants as a whole. However, the relationship between prior work experience and retention outcomes could vary across career fields within the civilian DAW. Future analyses should explore how certain past work experiences influence retention in the top acquisition career fields. This would help guide hiring decisions within those career fields.

This study uses the Cox PH model to test for differences in retention trends. This model is "robust" in that it makes no assumption regarding the underlying hazard function (Allison, 2010, pp. 125-126). The model also allows for the incorporation of weights and controls. However, the Cox PH model is limited in that it assumes a constant hazard ratio—one that does not vary with time in the workforce (see appendix B). Further analyses should use alternative methods to explore these data. This would add additional, perhaps more nuanced, insights into the relationship between prior work experience and civilian DAW retention.

Lastly, while this study focuses on retention, future analyses could explore the relationship between prior work experience and other workforce outcomes, such as performance or career progression. Such analyses would help managers make more-informed decisions when hiring new personnel and recommending strategic workforce plans.

Appendix A. Dropping Observations Does Not Significantly Change Cohort Characteristics

In order to examine whether dropping observations changes cohort characteristics, the analysis data file is divided into four cohort groups, reflecting the groups used in Parts I and II of the retention analysis (see Table A.1). Sections A.1 through A.4, below, show that dropping observations due to missing information does not significantly change the composition of the cohort groups, based on the characteristics listed in Table 6.2. The "Absolute standard difference"[72] between variable means before and after dropping observations never exceeds 0.06.

Table A.1. Pre-Policy and Policy Cohort Groups for Retention Analyses

Cohort Group Name	FY Cohorts Included
Early Pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007
Policy cohort group	2008-2011

A.1 Early Pre-Policy Cohort Group

Table A.1.1. Variable Means and Standard Deviations Before and After Dropping Observations, Early Pre-Policy Cohort Group

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
1	AGE	40.347	11.006	40.311	11.022	0.003
2	AGE: Missing	0	0	0	0.015	.
3	LN(COMPENSATION)	10.801	0.325	10.798	0.331	0.008
4	LN(COMPENSATION): Missing	0	0	0.007	0.084	.
5	RACE: Other	0.23	0.421	0.228	0.42	0.004
6	RACE: Unknown/Missing	0	0	0.005	0.071	.
7	RACE: White	0.77	0.421	0.767	0.423	0.008
8	EDUCATION: BA	0.454	0.498	0.453	0.498	0.003
9	EDUCATION: Less than BA	0.331	0.471	0.33	0.47	0.003

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[72] This phrase stems from Griffin and McCaffrey (2015c) (p. 28). The phrase is used throughout the following section.

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
10	EDUCATION: Missing	0	0	0.002	0.046	.
11	EDUCATION: More than BA	0.215	0.411	0.215	0.411	-0.002
12	DOD ORG: Air Force	0.151	0.358	0.15	0.357	0.004
13	DOD ORG: Army	0.413	0.492	0.414	0.493	-0.003
14	DOD ORG: Navy	0.342	0.475	0.343	0.475	-0.001
15	DOD ORG: Other	0.094	0.292	0.093	0.291	0.002
16	REGION: East North Central	0.105	0.306	0.104	0.305	0.003
17	REGION: East South Central	0.084	0.278	0.084	0.277	0
18	REGION: Mid Atlantic	0.1	0.3	0.1	0.3	0.002
19	REGION: Mountain	0.065	0.247	0.065	0.247	-0.002
20	REGION: New England	0.04	0.196	0.04	0.196	0.001
21	REGION: Other or Missing	0.029	0.169	0.029	0.168	0.001
22	REGION: Pacific	0.151	0.358	0.151	0.358	0
23	REGION: South Atlantic	0.339	0.473	0.341	0.474	-0.004
24	REGION: West North Central	0.014	0.116	0.014	0.116	0.001
25	REGION: West South Central	0.073	0.26	0.072	0.259	0.001
26	GENDER: Female	0.36	0.48	0.36	0.48	0
27	GENDER: Male	0.64	0.48	0.639	0.48	0.001
28	GENDER: Missing	0	0	0.001	0.023	.
29	POSITION TYPE: Administrative	0.4	0.49	0.396	0.489	0.006
30	POSITION TYPE: Other	0.014	0.117	0.015	0.121	-0.01
31	POSITION TYPE: Professional	0.536	0.499	0.537	0.499	-0.004
32	POSITION TYPE: Technical	0.051	0.22	0.051	0.22	0.001
33	POSITION TYPE: Unknown/Missing	0	0	0	0.015	.
34	SUPERVISOR: All Other Positions	0.919	0.273	0.919	0.272	-0.001
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.081	0.273	0.081	0.272	0.001
36	ACQ CAREER FLD: Business (CE or FM)	0.088	0.284	0.088	0.283	0.003
37	ACQ CAREER FLD: Contracting	0.151	0.358	0.151	0.358	-0.001
38	ACQ CAREER FLD: Engineering	0.289	0.453	0.29	0.454	-0.003
39	ACQ CAREER FLD: Facilities Engineering	0.028	0.165	0.029	0.167	-0.004
40	ACQ CAREER FLD: Information Tech	0.071	0.257	0.071	0.256	0.002
41	ACQ CAREER FLD: Life Cycle Logistics	0.096	0.295	0.095	0.294	0.002
42	ACQ CAREER FLD: Other	0.038	0.192	0.038	0.191	0.001
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.044	0.205	0.044	0.205	0.001
44	ACQ CAREER FLD: Program Management	0.087	0.281	0.087	0.281	0
45	ACQ CAREER FLD: Test and Eval	0.051	0.219	0.051	0.22	-0.001
46	ACQ CAREER FLD: Unknown/Missing	0.057	0.232	0.057	0.232	0.001
47	RETIREMENT PLAN: CSRS	0.201	0.401	0.199	0.399	0.006
48	RETIREMENT PLAN: FERS	0.793	0.405	0.794	0.404	-0.002
49	RETIREMENT PLAN: Other	0.006	0.075	0.007	0.085	-0.021
50	CAREER LEVEL: Entry-Level	0.265	0.441	0.266	0.442	-0.003
51	CAREER LEVEL: Mid-Level	0.663	0.473	0.661	0.474	0.004

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
52	CAREER LEVEL: Sen/Exec	0.064	0.244	0.064	0.245	-0.001
53	CAREER LEVEL: Uncategorized	0.009	0.095	0.01	0.098	-0.006
54	COHORT YEAR: 2001	0.308	0.462	0.305	0.46	0.006
55	COHORT YEAR: 2002	0.376	0.484	0.372	0.483	0.006
56	COHORT YEAR: 2003	0.317	0.465	0.322	0.467	-0.012
57	YRS TO RET ELIG: <5 Yrs to Go	0.082	0.274	0.081	0.273	0.002
58	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.337	0.473	0.337	0.473	-0.001
59	YRS TO RET ELIG: 20+ YRs to Go	0.392	0.488	0.393	0.489	-0.003
60	YRS TO RET ELIG: 5-9 Yrs to Go	0.145	0.352	0.144	0.351	0.003
61	YRS TO RET ELIG: Ret Eligible	0.045	0.207	0.044	0.206	0.002
62	YRS TO RET ELIG: Unknown/Missing	0	0	0	0.015	.
63	PAY PLAN: Broad GS	0.802	0.398	0.799	0.4	0.007
64	PAY PLAN: Demo	0.19	0.392	0.192	0.394	-0.006
65	PAY PLAN: Other	0.008	0.09	0.009	0.093	-0.007
66	HCAP: Handicapped	0.087	0.282	0.09	0.285	-0.008
67	HCAP: Not Handicapped	0.913	0.282	0.91	0.286	0.01
68	HCAP: Unknown/Missing	0	0	0.001	0.024	.

Figure A.1.1. Early Pre-Policy Cohort Group: Absolute Standard Difference in Variable Means is Never Greater than 0.025

A.2 Later Pre-Policy Cohort Group

Table A.2.1. Variable Means and Standard Deviations Before and After Dropping Observations, Later Pre-Policy Cohort Group

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
1	AGE	39.257	11.492	39.297	11.573	-0.004
2	LN(COMPENSATION)	10.834	0.349	10.827	0.359	0.019
3	LN(COMPENSATION): Missing	0	0	0.002	0.043	.
4	RACE: Other	0.223	0.416	0.218	0.413	0.011
5	RACE: Unknown/Missing	0	0	0.017	0.13	.
6	RACE: White	0.777	0.416	0.765	0.424	0.03
7	EDUCATION: BA	0.471	0.499	0.469	0.499	0.004
8	EDUCATION: Less than BA	0.289	0.453	0.288	0.453	0.003
9	EDUCATION: Missing	0	0	0.005	0.069	.
10	EDUCATION: More than BA	0.24	0.427	0.239	0.426	0.003
11	DOD ORG: Air Force	0.151	0.358	0.15	0.357	0.003
12	DOD ORG: Army	0.449	0.497	0.443	0.497	0.013
13	DOD ORG: Navy	0.254	0.435	0.25	0.433	0.009
14	DOD ORG: Other	0.147	0.354	0.158	0.365	-0.032
15	REGION: East North Central	0.126	0.332	0.124	0.329	0.007
16	REGION: East South Central	0.088	0.283	0.086	0.281	0.005
17	REGION: Mid Atlantic	0.117	0.321	0.116	0.32	0.002
18	REGION: Mountain	0.066	0.249	0.069	0.253	-0.01
19	REGION: New England	0.034	0.182	0.035	0.183	-0.002
20	REGION: Other or Missing	0.025	0.155	0.024	0.154	0.002
21	REGION: Pacific	0.116	0.32	0.117	0.322	-0.006
22	REGION: South Atlantic	0.349	0.477	0.348	0.476	0.002
23	REGION: West North Central	0.016	0.126	0.016	0.127	-0.002
24	REGION: West South Central	0.064	0.245	0.065	0.246	-0.002
25	GENDER: Female	0.354	0.478	0.355	0.479	-0.002
26	GENDER: Male	0.646	0.478	0.645	0.479	0.002
27	GENDER: Missing	0	0	0	0.012	.
28	POSITION TYPE: Administrative	0.39	0.488	0.387	0.487	0.006
29	POSITION TYPE: Other	0.011	0.106	0.014	0.119	-0.028
30	POSITION TYPE: Professional	0.543	0.498	0.543	0.498	0
31	POSITION TYPE: Technical	0.056	0.23	0.055	0.229	0.001
32	POSITION TYPE: Unknown/Missing	0	0	0	0.008	.
33	SUPERVISOR: All Other Positions	0.918	0.274	0.919	0.272	-0.004
34	SUPERVISOR: Supvisor/Mngr/Ldr	0.082	0.274	0.081	0.272	0.004
35	ACQ CAREER FLD: Business (CE or FM)	0.075	0.263	0.074	0.261	0.004
36	ACQ CAREER FLD: Contracting	0.168	0.374	0.171	0.377	-0.009

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
37	ACQ CAREER FLD: Engineering	0.216	0.412	0.214	0.41	0.006
38	ACQ CAREER FLD: Facilities Engineering	0.074	0.262	0.073	0.26	0.004
39	ACQ CAREER FLD: Information Tech	0.04	0.195	0.039	0.194	0.003
40	ACQ CAREER FLD: Life Cycle Logistics	0.127	0.333	0.125	0.33	0.008
41	ACQ CAREER FLD: Other	0.03	0.171	0.031	0.173	-0.003
42	ACQ CAREER FLD: Prod, Quality & Manuf	0.073	0.26	0.074	0.262	-0.006
43	ACQ CAREER FLD: Program Management	0.074	0.261	0.073	0.26	0.004
44	ACQ CAREER FLD: Test and Eval	0.043	0.203	0.042	0.201	0.003
45	ACQ CAREER FLD: Unknown/Missing	0.08	0.272	0.084	0.278	-0.014
46	RETIREMENT PLAN: CSRS	0.109	0.312	0.108	0.31	0.005
47	RETIREMENT PLAN: FERS	0.882	0.322	0.879	0.327	0.011
48	RETIREMENT PLAN: Other	0.008	0.091	0.014	0.116	-0.059
49	CAREER LEVEL: Entry-Level	0.312	0.463	0.315	0.465	-0.007
50	CAREER LEVEL: Mid-Level	0.604	0.489	0.6	0.49	0.008
51	CAREER LEVEL: Sen/Exec	0.074	0.261	0.073	0.261	0.001
52	CAREER LEVEL: Uncategorized	0.01	0.101	0.011	0.106	-0.009
53	COHORT YEAR: 2004	0.359	0.48	0.362	0.481	-0.007
54	COHORT YEAR: 2005	0.348	0.476	0.345	0.475	0.006
55	COHORT YEAR: 2007	0.294	0.455	0.293	0.455	0.001
56	YRS TO RET ELIG: <5 Yrs to Go	0.075	0.263	0.075	0.263	-0.001
57	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.312	0.463	0.311	0.463	0.002
58	YRS TO RET ELIG: 20+ YRs to Go	0.455	0.498	0.455	0.498	0
59	YRS TO RET ELIG: 5-9 Yrs to Go	0.118	0.323	0.118	0.322	0.002
60	YRS TO RET ELIG: Ret Eligible	0.04	0.195	0.041	0.199	-0.009
61	PAY PLAN: Broad GS	0.778	0.416	0.777	0.416	0.001
62	PAY PLAN: Demo	0.169	0.375	0.167	0.373	0.004
63	PAY PLAN: NSPS	0.044	0.204	0.044	0.206	-0.003
64	PAY PLAN: Other	0.01	0.098	0.011	0.105	-0.015
65	HCAP: Handicapped	0.078	0.269	0.077	0.267	0.004
66	HCAP: Not Handicapped	0.922	0.269	0.922	0.268	-0.003
67	HCAP: Unknown/Missing	0	0	0	0.019	.

Figure A.2.1. Later Pre-Policy Cohort Group: Absolute Standard Difference in Variable Means is Never Greater than 0.06
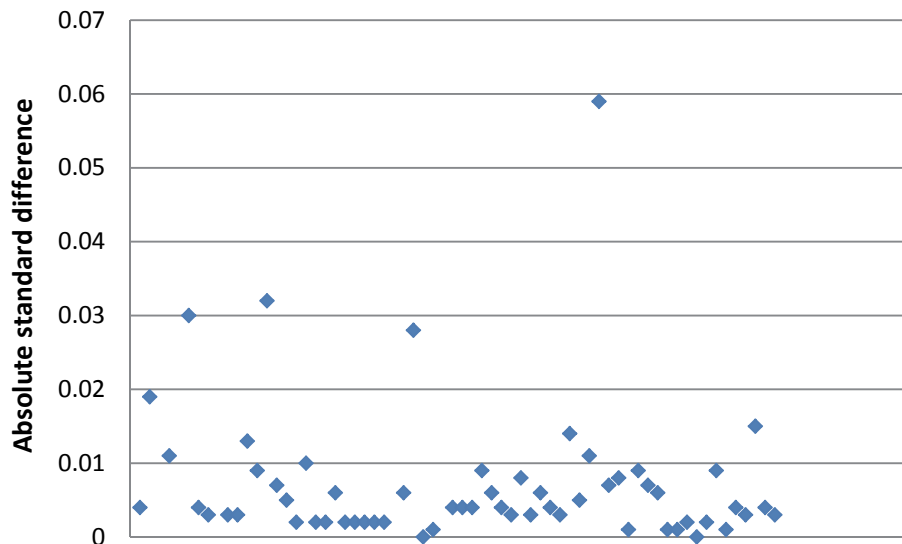
A.3 Combination Pre-Policy Cohort Group

Table A.3.1. Variable Means and Standard Deviations Before and After Dropping Observations, Combination Pre-Policy Cohort Group

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
1	AGE	39.788	11.271	39.788	11.321	0
2	AGE: Missing	0	0	0	0.01	.
3	LN(COMPENSATION)	10.818	0.338	10.813	0.346	0.014
4	LN(COMPENSATION): Missing	0	0	0.004	0.067	.
5	RACE: Other	0.226	0.418	0.223	0.416	0.008
6	RACE: Unknown/Missing	0	0	0.011	0.106	.
7	RACE: White	0.774	0.418	0.766	0.424	0.019
8	EDUCATION: BA	0.463	0.499	0.461	0.498	0.003
9	EDUCATION: Less than BA	0.31	0.462	0.308	0.462	0.003
10	EDUCATION: Missing	0	0	0.003	0.059	.
11	EDUCATION: More than BA	0.228	0.419	0.227	0.419	0.001
12	DOD ORG: Air Force	0.151	0.358	0.15	0.357	0.004
13	DOD ORG: Army	0.431	0.495	0.429	0.495	0.005
14	DOD ORG: Navy	0.297	0.457	0.295	0.456	0.005
15	DOD ORG: Other	0.121	0.326	0.127	0.333	-0.018
16	REGION: East North Central	0.116	0.32	0.114	0.318	0.005
17	REGION: East South Central	0.086	0.28	0.085	0.279	0.003
18	REGION: Mid Atlantic	0.109	0.311	0.108	0.311	0.002
19	REGION: Mountain	0.066	0.248	0.067	0.25	-0.006
20	REGION: New England	0.037	0.189	0.037	0.189	-0.001
21	REGION: Other or Missing	0.027	0.162	0.027	0.161	0.002
22	REGION: Pacific	0.133	0.339	0.134	0.34	-0.002
23	REGION: South Atlantic	0.344	0.475	0.345	0.475	-0.001
24	REGION: West North Central	0.015	0.121	0.015	0.122	-0.001
25	REGION: West South Central	0.068	0.252	0.068	0.252	0
26	GENDER: Female	0.357	0.479	0.358	0.479	-0.001
27	GENDER: Male	0.643	0.479	0.642	0.479	0.002
28	GENDER: Missing	0	0	0	0.018	.
29	POSITION TYPE: Administrative	0.395	0.489	0.392	0.488	0.006
30	POSITION TYPE: Other	0.013	0.111	0.015	0.12	-0.018
31	POSITION TYPE: Professional	0.539	0.498	0.54	0.498	-0.002
32	POSITION TYPE: Technical	0.054	0.225	0.053	0.225	0.001
33	POSITION TYPE: Unknown/Missing	0	0	0	0.012	.
34	SUPERVISOR: All Other Positions	0.919	0.273	0.919	0.272	-0.003
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.081	0.273	0.081	0.272	0.003
36	ACQ CAREER FLD: Business (CE or FM)	0.081	0.273	0.08	0.272	0.004

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
37	ACQ CAREER FLD: Contracting	0.16	0.366	0.162	0.368	-0.005
38	ACQ CAREER FLD: Engineering	0.251	0.434	0.251	0.433	0.002
39	ACQ CAREER FLD: Facilities Engineering	0.052	0.221	0.052	0.221	0
40	ACQ CAREER FLD: Information Tech	0.055	0.228	0.054	0.227	0.003
41	ACQ CAREER FLD: Life Cycle Logistics	0.112	0.315	0.11	0.313	0.005
42	ACQ CAREER FLD: Other	0.034	0.182	0.034	0.182	-0.001
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.059	0.235	0.06	0.237	-0.003
44	ACQ CAREER FLD: Program Management	0.08	0.271	0.08	0.271	0.002
45	ACQ CAREER FLD: Test and Eval	0.047	0.211	0.046	0.21	0.001
46	ACQ CAREER FLD: Unknown/Missing	0.069	0.254	0.071	0.257	-0.008
47	RETIREMENT PLAN: CSRS	0.154	0.361	0.152	0.359	0.006
48	RETIREMENT PLAN: FERS	0.839	0.368	0.838	0.369	0.003
49	RETIREMENT PLAN: Other	0.007	0.083	0.011	0.102	-0.042
50	CAREER LEVEL: Entry-Level	0.289	0.453	0.291	0.454	-0.005
51	CAREER LEVEL: Mid-Level	0.633	0.482	0.629	0.483	0.007
52	CAREER LEVEL: Sen/Exec	0.069	0.253	0.069	0.253	0
53	CAREER LEVEL: Uncategorized	0.01	0.098	0.011	0.102	-0.008
54	COHORT YEAR: 2001	0.15	0.357	0.148	0.355	0.006
55	COHORT YEAR: 2002	0.183	0.387	0.18	0.384	0.007
56	COHORT YEAR: 2003	0.154	0.361	0.156	0.363	-0.005
57	COHORT YEAR: 2004	0.184	0.387	0.187	0.39	-0.007
58	COHORT YEAR: 2005	0.178	0.383	0.178	0.382	0.001
59	COHORT YEAR: 2007	0.15	0.358	0.151	0.358	-0.002
60	YRS TO RET ELIG: <5 Yrs to Go	0.078	0.268	0.078	0.268	0.001
61	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.324	0.468	0.324	0.468	0.001
62	YRS TO RET ELIG: 20+ YRs to Go	0.424	0.494	0.425	0.494	-0.002
63	YRS TO RET ELIG: 5-9 Yrs to Go	0.131	0.338	0.13	0.336	0.003
64	YRS TO RET ELIG: Ret Eligible	0.042	0.201	0.043	0.203	-0.003
65	YRS TO RET ELIG: Unknown/Missing	0	0	0	0.01	.
66	PAY PLAN: Broad GS	0.79	0.408	0.788	0.409	0.004
67	PAY PLAN: Demo	0.179	0.383	0.179	0.383	0
68	PAY PLAN: NSPS	0.022	0.148	0.023	0.15	-0.003
69	PAY PLAN: Other	0.009	0.094	0.01	0.1	-0.011
70	HCAP: Handicapped	0.083	0.275	0.083	0.276	-0.002
71	HCAP: Not Handicapped	0.917	0.275	0.916	0.277	0.003
72	HCAP: Unknown/Missing	0	0	0	0.022	.

Figure A.3.1. Combination Pre-Policy Cohort Group: Absolute Standard Difference in Variable Means is Never Greater than 0.045
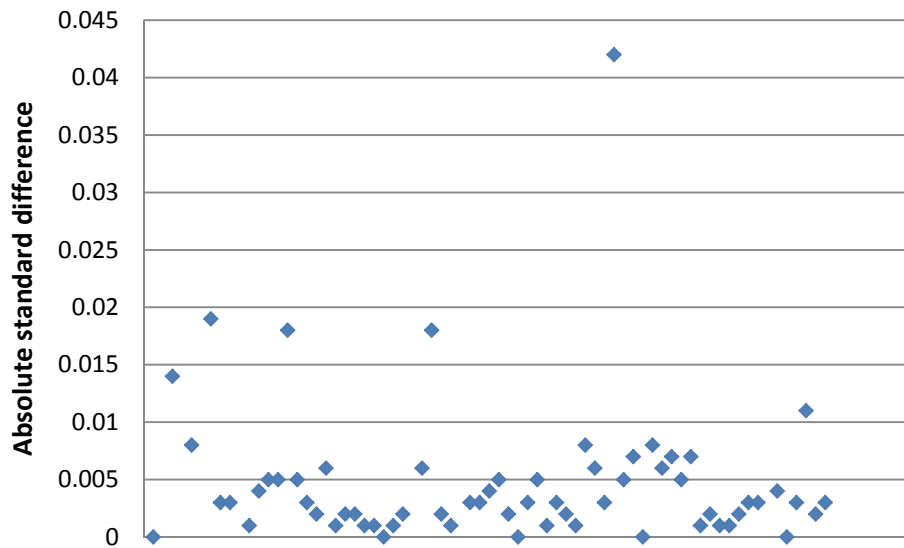
A.4 Policy Cohort Group

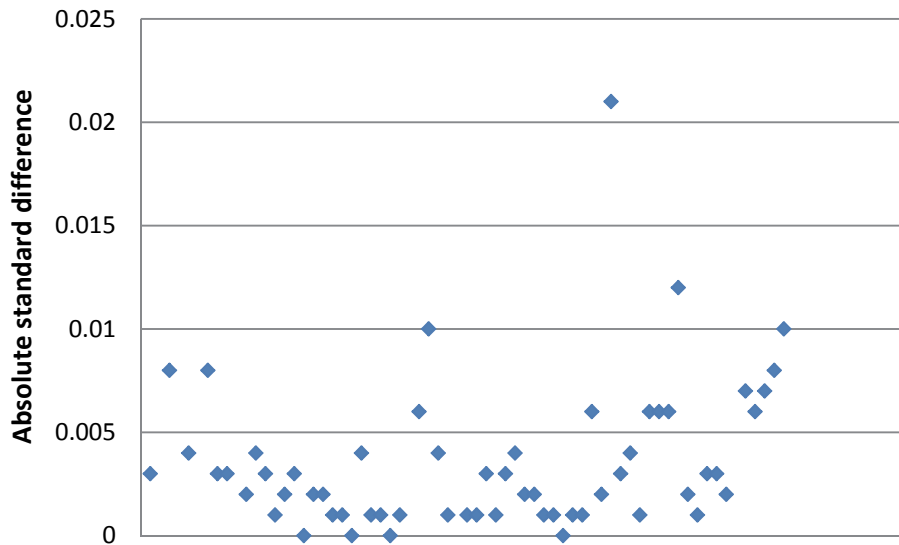**Table A.4.1. Variable Means and Standard Deviations Before and After Dropping Observations, Policy Cohort Group**

	Parameter	After Drops		Before Drops		Standard Difference in Means
		Mean	SD	Mean	SD	
1	AGE	39.372	11.638	39.385	11.714	-0.001
2	LN(COMPENSATION)	10.938	0.369	10.93	0.382	0.02
3	LN(COMPENSATION): Missing	0	0	0	0.008	.
4	RACE: Other	0.21	0.407	0.205	0.403	0.013
5	RACE: Unknown/Missing	0	0	0.025	0.156	.
6	RACE: White	0.79	0.407	0.77	0.421	0.049
7	EDUCATION: BA	0.477	0.499	0.473	0.499	0.007
8	EDUCATION: Less than BA	0.241	0.427	0.245	0.43	-0.01
9	EDUCATION: Missing	0	0	0.002	0.043	.
10	EDUCATION: More than BA	0.283	0.45	0.28	0.449	0.006
11	DOD ORG: Air Force	0.191	0.393	0.19	0.392	0.002
12	DOD ORG: Army	0.323	0.468	0.325	0.468	-0.003
13	DOD ORG: Navy	0.332	0.471	0.328	0.47	0.007
14	DOD ORG: Other	0.154	0.361	0.157	0.364	-0.008
15	REGION: East North Central	0.135	0.342	0.133	0.34	0.006
16	REGION: East South Central	0.092	0.289	0.091	0.287	0.004
17	REGION: Mid Atlantic	0.086	0.281	0.087	0.281	-0.001
18	REGION: Mountain	0.053	0.224	0.055	0.228	-0.009
19	REGION: New England	0.035	0.185	0.035	0.184	0.002
20	REGION: Other or Missing	0.023	0.149	0.023	0.15	-0.001
21	REGION: Pacific	0.127	0.333	0.129	0.335	-0.006
22	REGION: South Atlantic	0.375	0.484	0.372	0.483	0.006
23	REGION: West North Central	0.012	0.107	0.012	0.108	-0.001
24	REGION: West South Central	0.061	0.24	0.064	0.244	-0.01
25	GENDER: Female	0.325	0.468	0.328	0.469	-0.005
26	GENDER: Male	0.675	0.468	0.672	0.469	0.005
27	GENDER: Missing	0	0	0	0.004	.
28	POSITION TYPE: Administrative	0.405	0.491	0.403	0.49	0.005
29	POSITION TYPE: Other	0.009	0.093	0.012	0.111	-0.039
30	POSITION TYPE: Professional	0.535	0.499	0.534	0.499	0.003
31	POSITION TYPE: Technical	0.051	0.219	0.051	0.219	-0.001
32	POSITION TYPE: Unknown/Missing	0	0	0	0.019	.
33	SUPERVISOR: All Other Positions	0.932	0.252	0.933	0.251	-0.003
34	SUPERVISOR: Supvisor/Mngr/Ldr	0.068	0.252	0.067	0.251	0.003
35	ACQ CAREER FLD: Business (CE or FM)	0.075	0.264	0.075	0.264	0.001
36	ACQ CAREER FLD: Contracting	0.199	0.399	0.202	0.402	-0.008

		After Drops		Before Drops		Standard Difference in Means
	Parameter	Mean	SD	Mean	SD	
37	ACQ CAREER FLD: Engineering	0.213	0.409	0.211	0.408	0.003
38	ACQ CAREER FLD: Facilities Engineering	0.063	0.242	0.062	0.242	0.002
39	ACQ CAREER FLD: Information Tech	0.053	0.224	0.053	0.224	0
40	ACQ CAREER FLD: Life Cycle Logistics	0.141	0.348	0.14	0.347	0.003
41	ACQ CAREER FLD: Other	0.026	0.159	0.026	0.159	-0.001
42	ACQ CAREER FLD: Prod, Quality & Manuf	0.062	0.242	0.064	0.244	-0.005
43	ACQ CAREER FLD: Program Management	0.092	0.29	0.091	0.288	0.005
44	ACQ CAREER FLD: Test and Eval	0.039	0.195	0.04	0.195	-0.001
45	ACQ CAREER FLD: Unknown/Missing	0.036	0.186	0.036	0.186	0.001
46	RETIREMENT PLAN: CSRS	0.035	0.184	0.035	0.185	-0.003
47	RETIREMENT PLAN: FERS	0.955	0.207	0.951	0.216	0.022
48	RETIREMENT PLAN: Other	0.01	0.099	0.014	0.117	-0.04
49	CAREER LEVEL: Entry-Level	0.295	0.456	0.297	0.457	-0.004
50	CAREER LEVEL: Mid-Level	0.597	0.49	0.596	0.491	0.003
51	CAREER LEVEL: Sen/Exec	0.099	0.299	0.098	0.298	0.003
52	CAREER LEVEL: Uncategorized	0.008	0.09	0.008	0.092	-0.004
53	COHORT YEAR: 2008	0.199	0.399	0.202	0.401	-0.007
54	COHORT YEAR: 2009	0.281	0.449	0.281	0.449	0.001
55	COHORT YEAR: 2010	0.312	0.463	0.309	0.462	0.005
56	COHORT YEAR: 2011	0.208	0.406	0.208	0.406	0
57	YRS TO RET ELIG: <5 Yrs to Go	0.068	0.252	0.069	0.253	-0.003
58	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.302	0.459	0.299	0.458	0.006
59	YRS TO RET ELIG: 20+ YRs to Go	0.487	0.5	0.488	0.5	-0.001
60	YRS TO RET ELIG: 5-9 Yrs to Go	0.111	0.315	0.112	0.315	-0.001
61	YRS TO RET ELIG: Ret Eligible	0.031	0.173	0.032	0.176	-0.007
62	PAY PLAN: Broad GS	0.632	0.482	0.632	0.482	-0.002
63	PAY PLAN: Demo	0.139	0.346	0.138	0.344	0.003
64	PAY PLAN: NSPS	0.216	0.411	0.216	0.411	0
65	PAY PLAN: Other	0.014	0.117	0.014	0.119	-0.004
66	HCAP: Handicapped	0.082	0.275	0.082	0.274	0.001
67	HCAP: Not Handicapped	0.918	0.275	0.918	0.275	0
68	HCAP: Unknown/Missing	0	0	0	0.018	.

**Figure A.4.1. Policy Cohort Group: Absolute Standard Difference in Variable Means is Never Greater than 0.05**
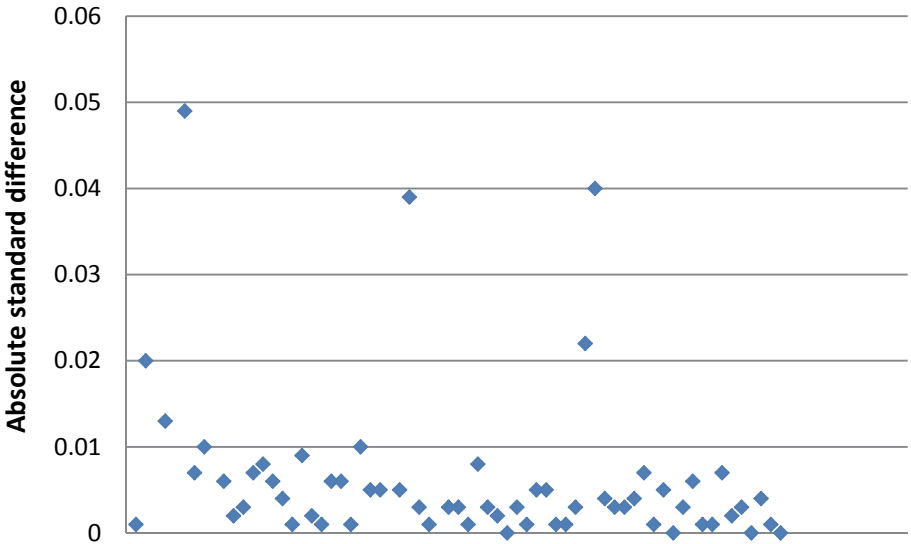
Appendix B. The Cox Proportional Hazard Model and Methods for Controlling for Confounding Factors

This appendix explains, in more detail, (1) the Cox Proportional Hazard (Cox PH) model, which is used to test for differences in retention, and (2) the methods used to control for confounding factors.

In general, the data used for the retention analyses consist of four parts for each civilian DAW entrant included in the analyses: (1) a past-work-experience category descriptor, (2) a loss-type indicator, (3) a tenure descriptor, and (4) other observable characteristics (used as control/balance factors) (Rich et al., 2010, pp. 2-3; Allison, 2010, p. 137). The loss-type indicator indicates whether an individual experienced a loss from the workforce, and—in the case of the civilian DAW—the loss-type indicator specifies which particular loss type an individual experienced (if any) (Rich et al., 2010; Allison, 2010). Analyses on civilian DAW retention focus on substantive transfers out and separations; administrative transfers out are censored.[73] Because this study uses annual data files, the tenure data are recorded in integer years (one year, two years, three years, etc.). The past-work-experience category descriptor allows the analyses to test for differences in retention trends between entrants with different past work experiences (Rich et al., 2010; Allison, 2010).

The Cox Proportional Hazard Model[74]

The Cox PH model is based on "the hazard function, $h(t)$" (Guo, Hall-Partyka and Gates, 2014, p.6). The hazard function, for the purposes of this analysis, "describes . . . . the probability that an individual" is marked as experiencing a loss from the workforce at the end of a given tenure year (t), "given that" he or she did not experience a loss in previous years in the workforce (Guo, Hall-Partyka and Gates, 2014, p.6). See Equation B.1.

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[73] All analyses on civilian DAW retention censor administrative transfers out. Analyses that specifically examine substantive transfers out of the civilian DAW censor administrative transfers out *and* separations. Analyses that specifically examine separations from the civilian DAW censor administrative transfers out *and* substantive transfers out.

[74] The Cox Proportional Hazard model is named after David Cox, who invented this hazard model estimation technique (Cox, 1972; Allison, 2010).
Allison (2010) and Guo, Hall-Partyka and Gates (2014) provide explanations of the Cox Proportional Hazard model. The description presented in this study is based on the explanations from Allison (2010) and Guo, Hall-Partyka and Gates (2014).

<div align="center">

Equation B.1. The hazard function[75]

</div>

$$h(t) = \frac{P\ (individual\ experiences\ loss\ from\ workforce\ at\ end\ of\ year\ t\ in\ workforce)}{P\ (individual\ still\ in\ workforce\ at\ end\ of\ year\ t\ in\ workforce)}$$

The hazard model used in the Cox PH model is shown in Equation B.2, below (Guo, Hall-Partyka and Gates, 2014, p.6).

<div align="center">

Equation B.2. The hazard model used in the Cox PH model[76]

</div>

$$h_k(t) = \delta(t)\exp(\beta Z_k)$$

$h_k(t)$ "is the hazard of [experiencing a loss] for individual [k]" (Guo, Hall-Partyka and Gates, 2014, p.6) "at time t" (Allison, 2010, p. 127). $\delta(t)$ represents "the baseline hazard function" (i.e., the underlying hazard function, if all covariates were zero) (Guo, Hall-Partyka and Gates, 2014, p. 6; Allison, 2010, p. 127). β signifies "a vector of [estimated covariate] coefficients," and Z_k represents "the vector of" covariates (i.e., observable characteristics) included in the analysis for individual k (Guo, Hall-Partyka and Gates, 2014, p. 6; Allison, 2010). The observable characteristics used in this study are listed in Table 6.2.

The ultimate goal is to estimate the covariate coefficients, specifically the coefficient on the past-work-experience descriptors. To do this in Equation B.2, one would also have to estimate the underlying hazard function $\delta(t)$ (Allison, 2010). However, the Cox PH model uses "partial-likelihood techniques" (Guo, Hall-Partyka and Gates, 2014, p. 6) to "estimate the [covariate] coefficients . . . without having to specify the baseline hazard function" (Allison, 2010, p. 128). Specifically, the Cox PH model "estimation method" (Allison, 2010, pp. 126-127) estimates that "the hazard for any individual is a fixed proportion of the hazard for any other individual" (Allison, 2010, p. 127). See Equation B.3.

<div align="center">

Equation B.3. Cox PH estimation method[77]

</div>

$$\frac{h_k(t)}{h_i(t)} = \frac{\delta(t)\exp(\beta Z_k)}{\delta(t)\exp(\beta Z_i)} = \frac{\exp(\beta Z_k)}{\exp(\beta Z_i)} = exp\big(\beta(Z_k - Z_i)\big)$$

As alluded to above, the underlying hazard function, $\delta(t)$, falls out of the equation (Guo, Hall-Partyka and Gates, 2014, p. 6; Allison, 2010, pp. 127-128). Therefore, "The main

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[75] This equation stems from Guo, Hall-Partyka and Gates (2014) (p. 6).

[76] This equation stems from Guo, Hall-Partyka and Gates (2014) (p. 6) and Allison (2010) (p. 127).

[77] This equation stems from Guo, Hall-Partyka and Gates (2014) (p. 6) and Allison (2010) (p. 127).

assumption [of the Cox PH model] is that the hazard ratio is constant across time" (Guo, Hall-Partyka and Gates, 2014, p. 6; Allison, 2010).

Because the tenure data is recorded in integer years (one year, two years, three years, etc.), there are many individuals who are recorded as experiencing a loss from the workforce at the end of the same tenure year. Allison (2010) refers to these instances as "ties," "Tied Data," or "tied event times" (p. 142). Ties may worsen the estimates produced from the Cox PH model (Allison, 2010),[78] but the analyses include a large number of observations and cover a number of years, which should help mitigate this issue. Additionally, the analyses use the "approximation proposed by Efron (1977)" and, where possible, the "EXACT" estimation techniques to produce the best estimates using the tied data (Allison, 2010, pp. 142-153).[79]

Some individuals never "experience the [loss-type(s)] of interest" for a particular analysis within the years of analysis (Guo, Hall-Partyka and Gates, 2014, pp. 5-6). These individuals (or observations) are described as "right-censored observations" (Goel, Khanna and Kishore, 2010, p. 274; Allison, 2010; Rich et al., 2010; Guo, Hall-Partyka and Gates, 2014).[80] For analyses on retention in the wider DoD civilian workforce, this occurs when an individual is never recorded as leaving the DoD civilian workforce within the years of analysis. For analyses on retention in the civilian DAW, observations are right censored if they are never recorded as leaving the civilian DAW within the years of analysis or if they are marked as administratively transferring out of the civilian DAW.[81] The Cox PH model can handle these "censored data" (Guo, Hall-Partyka and Gates, 2014, p. 5; Allison, 2010). An observation that is "censored" at the end of year t is included in the calculations for year t but not counted as experiencing the loss-type of interest (Allison, 2010, p. 139). Then, the "censored observation" is not included in the calculations for the following years (Allison, 2010, p. 139).

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[78] Allison (2010) writes "When the number of ties is large, relative to the number at risk, the approximate methods tend to yield coefficients that are biased toward 0" (p. 152).

[79] The Cox PH models that include propensity score weights use "Efron's approximation" (Allison, 2010, p. 146; Efron, 1977). The models that do not include weights use the EXACT technique. See pages 144-148 in Allison (2010) for an explanation of "the EXACT method." Efron's approximation is from Efron's 1977 paper, Efron (1977) (Allison, 2010).

[80] The retention analysis is through the end-of-FY 2014. The end of FY 2014 is the last time the analysis observes losses from the workforce. This means that—for example—an entrant who is in the FY 2002 civilian DAW cohort and does not experience a loss within the years of analysis is recorded as having a tenure of 12 years. This individual is right censored: He or she could have a longer tenure, but one cannot tell given the data used (Guo, Hall-Partyka and Gates, 2014).

[81] All analyses on civilian DAW retention censor administrative transfers out. Analyses that specifically examine substantive transfers out of the civilian DAW censor administrative transfers out *and* separations. Analyses that specifically examine separations from the civilian DAW censor administrative transfers out *and* substantive transfers out.

Controlling for Differences in Observables

Individuals who join the civilian DAW with different past work experiences tend to also differ across the other explanatory variables listed in Table 6.2, and these observable characteristics may also influence retention. Therefore, in order to tease out the true relationship between prior work experience and retention, this analysis uses two methods to control for these differences in characteristics: (1) propensity-score-based weighting (using RAND's Toolkit for Weighting and Analysis of Nonequivalent Groups (TWANG) (Griffin et al., 2014)) and (2) "multivariate adjustment"[82] techniques. Cox PH models allow for weighted data and for the inclusion of multivariate controls to adjust for differences between groups.

Tests comparing retention trends between two groups (e.g., entrants with prior DoD experience vs. entrants with no prior DoD experience) use these two control techniques together—to produce what are called "doubly robust"[83] estimates (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a, p. 45; Griffin and McCaffrey, 2015c, p. 41; Griffin and McCaffrey, 2015d).

Propensity Score Weights[84]

The propensity-score weighting technique assigns a propensity score to each observation (civilian DAW entrant, in this case) included in each particular analysis. For a test comparing retention trends between entrants with and without prior DoD experience, the propensity score, *p(x)*, is the probability that an individual is in the treatment group (*T=1*) (i.e., has prior DoD experience), given that individual's observable characteristics (*Z*) (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004).

Equation B. 4. The propensity score[85]
$$p_i(x) = prob(T_i = 1 | Z_i)$$
where T is the treatment indicator and Z is the vector of covariates for individual i

Individuals with certain characteristics are more likely to have prior DoD work experience—the propensity score captures this. Individuals with these particular characteristics will have

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[82] Griffin and McCaffrey (2015d) use the term "multivariate adjustment." This description uses this same term.

[83] The term "doubly robust" stems from Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015d), Griffin and McCaffrey (2015c) (p. 41), Griffin and McCaffrey (2015a) (p. 45). This analysis also uses this term.

[84] Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015a), and McCaffrey, Ridgeway and Morral (2004) offer explanations of propensity scores and propensity-score-based weighting. The description presented in this study is based on the explanations from Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015a), and McCaffrey, Ridgeway and Morral (2004).

[85] This equation stems from Griffin and McCaffrey (2015a) (p. 28), Griffin and McCaffrey (2015b), and McCaffrey, Ridgeway and Morral (2004) (p. 405).

propensity score values closer to one (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a, p. 30).

RAND's TWANG uses a "Data adaptive, nonparametric model" called a Generalized Boosted Model (GBM) to estimate these propensity scores (Griffin and McCaffrey, 2015a, p. 37; McCaffrey, Ridgeway and Morral, 2004, p. 407; Griffin and McCaffrey, 2015b). The GBM uses "Regression trees" to create and combine small "piecewise" linear functions that—in aggregate—estimate the propensity score curves (McCaffrey, Ridgeway and Morral, 2004, p. 407; Griffin and McCaffrey, 2015a, p. 37; Griffin and McCaffrey, 2015b). This GBM technique is robust and flexible: It handles all types of covariates, including categorical and continuous variables (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004). It uncovers which of these explanatory variables are most important in terms of predicting treatment (e.g., whether an entrant has prior DoD experience), and the GBM outputs the propensity score estimations that provide the best balance between groups (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004). Prior studies[86] "have shown that boosting outperforms alternative methods in terms of prediction error" (McCaffrey, Ridgeway and Morral, 2004, p. 407).

Once each observation has an assigned propensity score based on the observable characteristics (which are listed in Table 6.2), one can compare the propensity scores for the individuals with and without prior DoD work experience. In general, if the covariates used in the analysis have predictive power in terms of whether an individual has prior DoD experience, individuals with DoD experience will tend to have higher propensity scores than those individuals without prior DoD experience (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004). This makes sense, given Equation B.4 (Griffin and McCaffrey, 2015b). Then, RAND's TWANG applies weights to each observation based on these estimated propensity scores to balance the propensity score distributions between these two groups (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004).

The models in Part I of the retention analysis estimate the average treatment effect (ATE). For these estimates, RAND's TWANG applies weights to observations in both the prior-DoD-experience group and the no-prior-DoD-experience group to make the average of each group look like the overall average observation (i.e., the average observation from the population of all entrants analyzed). Specifically, each observation (i) in the no-DoD-experience group (c) receives a weight equal to the inverse of one minus that observation's propensity score. Each observation (i) in the DoD-experienced group (T) receives a weight equal to the inverse of that observation's propensity score (McCaffrey, Ridgeway and Morral, 2004; Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a).

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[86] McCaffrey, Ridgeway and Morral (2004) list the following two studies (p. 407): Friedman (2001) and Madigan and Ridgeway (2004).

$$w_{ic} = \frac{1}{(1 - p_i(x))} \quad w_{iT} = \frac{1}{p_i(x)}$$

These weights bring the propensity score distributions for each of the groups closer to the propensity score distribution for the overall sample (that includes all entrants being analyzed) (McCaffrey, Ridgeway and Morral, 2004). Observations in the DoD-experienced group with *higher* propensity scores (closer to one) are weighted downward, while observations in the DoD-experienced group with *lower* propensity scores (closer to zero) are weighted upward and vice versa for the non-DoD-experienced group (McCaffrey, Ridgeway and Morral, 2004).

Balancing the groups on the propensity score distribution also balances the groups on the covariates used to estimate the propensity score—in terms of their means and distributions (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a).[88]

The above explanation uses the comparison between DoD-experienced entrants and entrants with no prior DoD experience as an example. The same process is used when comparing internal and external hires.

Controlling for differences in observable characteristics between groups using propensity scores relies on two major assumptions: (1) All confounding factors must be included in the propensity score matching process, and (2) there must be "overlap" in the observable characteristics between the groups (Griffin and McCaffrey, 2015a, p. 29; Griffin and McCaffrey, 2015b). Weighting the observations based on propensity scores improves the balance between groups for the observable characteristics included in the matching process; however, these weights will not account for differences in other, unobserved, confounding factors that may exist (Morgan and Winship, 2007; Shah et al., 2005; Zanutto, 2006; Austin, 2011; Austin et al., 2005). As such, this analysis includes an extensive list of factors in the propensity-score-weighting process (see Table 6.2).

"Multivariate Adjustment"[89]

All Cox PH models displayed in Part I of the retention analysis use multivariate adjustment to control for systematic differences between groups. This involves including relevant covariates in the Cox PH models (Griffin and McCaffrey, 2015d). The control factors (listed in Table 6.2) are included in the vector of observable characteristics (Z), as seen in Equation B.2.

For retention tests comparing two groups (e.g. entrants with prior DoD experience vs. those with no prior DoD experience), multivariate adjustment is used in combination with propensity

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[87] These equations stem from McCaffrey, Ridgeway and Morral (2004) (pp. 405-406), Griffin and McCaffrey (2015b), and Griffin and McCaffrey (2015a) (p. 44).

[88] McCaffrey, Ridgeway and Morral (2004) write, "Rosenbaum and Rubin (1983) showed that, conditional on [the propensity score], all observed pretreatment covariates are independent of group assignment and, in large samples, covariates will be distributed equally in both groups and will not confound estimated treatment effects" (p. 404).

[89] Griffin and McCaffrey (2015d) use the term "multivariate adjustment." This description uses this same term.

score weighting to produce what are called "doubly robust" estimates (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a, p. 45; Griffin and McCaffrey, 2015c, p. 41; Griffin and McCaffrey, 2015d).

Retention tests that compare retention trends across the prior career profiles only incorporate multivariate controls. The individuals in certain prior career profiles with DoD experience are too fundamentally different from individuals with the No DoD Experience prior career profile—applied propensity-score weights cannot bring these groups into balance. This highlights that there is not much "overlap" (Griffin and McCaffrey, 2015a, p. 29; Griffin and McCaffrey, 2015b) between the individuals with the prior-DoD-experience profiles and those with the No DoD Experience profile, weakening the argument for causality. Given this, the results from the non-doubly-robust models (i.e., the models that test for retention differences across the prior career profiles and that incorporate only multivariate adjustment) are interpreted conservatively, focusing on the general direction of the hazard ratio estimates rather than on the precise estimate number.

"Doubly robust estimation"[90]

Griffin and McCaffrey (2015d) state that doubly robust models—i.e., models that use both propensity score and multivariate techniques together—are the "gold standard" in terms of adjusting for observable confounding factors.

First, including multivariate controls after weighting the data based on propensity scores helps control for differences between groups that persist even after weighting (Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c). Secondly, propensity score weighting techniques rely on accurate propensity score estimation, and multivariate regression techniques rely on proper model specification (Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c; Morgan and Winship, 2007; Zanutto, 2006; Austin, 2011; Shah et al., 2005). By combining these techniques, i.e., first balancing on propensity scores then running the model with multivariate controls, the estimates are "doubly robust"—only one of the control methods has to be done correctly to produce unbiased estimates (Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c, p. 41).

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[90] The term "Doubly robust estimation" stems from Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015d), Griffin and McCaffrey (2015c) (p. 41), and Griffin and McCaffrey (2015a).

Appendix C. Balance Results for DoD-Experienced Entrants vs. Non-DoD-Experienced Entrants

Sections C.1-C.3 show how the pre-policy cohort groups analyzed in Part I of the retention analysis (see Table C.1, below) balance,[91] in terms of the observable characteristics listed in Table 6.2, before and after propensity-score weight implementation. Tables C.1.1-C.3.1 list the variable means and standard deviations before and after weighting. And the figures illustrate how effectively the propensity-score weights bring the variable means of the two groups (entrants with prior DoD experience vs. those with no prior DoD experience) into balance.

For all three cohort groups analyzed, the applied propensity-score weights significantly improve the balance between the two groups. Figures C.1.1-C.3.1 illustrate that the differences in the variable means between the two groups decrease substantially after weighting. In only two cases—post-weighting—is the "Absolute standard difference"[92] in variable means between groups greater than 0.2, which is the threshold referenced in the RAND TWANG (Griffin et al., 2014; Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c).[93] These two cases are in the early pre-policy cohort group and are highlighted below.

Figures C.1.2-C.3.2 show that after applying propensity-score weights some of the differences in variable means between groups are no longer statistically significant.

The tables and figures presented in sections C.1-C.3 come from the output of RAND's TWANG (Griffin et al., 2014).

Table C.1. Pre-Policy Cohort Groups Analyzed in Retention Analysis Part I

Cohort Group Name	FY Cohorts Included
Early pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007

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[91] Griffin and McCaffrey (2015b) and Griffin and McCaffrey (2015a) state that balance assessments should consider differences in variable means and variable distributions between groups. The balance analyses in this study focus on comparing variable means and do not include comparing variable distributions because most of the variables used are categorical—for these variables the means and distributions are essentially the same thing.

[92] This phrase stems from Griffin and McCaffrey (2015c) (p. 28). The phrase is used throughout the following section.

[93] Some researchers use a stricter threshold of 0.1 (Austin and Stuart, 2015).

C.1 Early Pre-Policy Cohort Group

Table C.1.1. Means and Standard Deviations Before and After Propensity-Score Weighting

| Balance Factors | Unweighted | | | | Weighted | | | |
| | DoD | | No DoD | | DoD | | No DoD | |
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 AGE	43.083	9.763	31.77	10.251	40.828	10.756	38.698	11.048
2 LN(COMPENSATION)	10.84	0.318	10.677	0.314	10.808	0.323	10.775	0.317
3 RACE: Other	0.228	0.42	0.235	0.424	0.225	0.418	0.214	0.41
4 RACE: White	0.772	0.42	0.765	0.424	0.775	0.418	0.786	0.41
5 EDUCATION: BA	0.379	0.485	0.691	0.462	0.441	0.496	0.496	0.5
6 EDUCATION: Less than BA	0.412	0.492	0.079	0.27	0.342	0.474	0.278	0.448
7 EDUCATION: More than BA	0.21	0.407	0.23	0.421	0.217	0.412	0.226	0.418
8 DOD ORG: Air Force	0.161	0.368	0.12	0.325	0.153	0.36	0.139	0.346
9 DOD ORG: Army	0.443	0.497	0.318	0.466	0.42	0.494	0.413	0.492
10 DOD ORG: Navy	0.293	0.455	0.497	0.5	0.331	0.471	0.372	0.483
11 DOD ORG: Other	0.103	0.304	0.065	0.246	0.096	0.294	0.077	0.266
12 REGION: East North Central	0.111	0.315	0.084	0.277	0.106	0.308	0.09	0.287
13 REGION: East South Central	0.088	0.284	0.071	0.257	0.085	0.279	0.071	0.256
14 REGION: Mid Atlantic	0.095	0.293	0.116	0.321	0.099	0.299	0.091	0.287
15 REGION: Mountain	0.072	0.258	0.045	0.207	0.066	0.248	0.069	0.254
16 REGION: New England	0.037	0.188	0.051	0.22	0.039	0.193	0.039	0.193
17 REGION: Other or Missing	0.037	0.188	0.007	0.082	0.031	0.172	0.028	0.165
18 REGION: Pacific	0.136	0.342	0.198	0.399	0.146	0.353	0.179	0.383
19 REGION: South Atlantic	0.327	0.469	0.378	0.485	0.341	0.474	0.373	0.484
20 REGION: West North Central	0.016	0.124	0.007	0.085	0.014	0.118	0.013	0.115
21 REGION: West South Central	0.082	0.274	0.043	0.203	0.074	0.262	0.047	0.211
22 GENDER: Female	0.376	0.484	0.311	0.463	0.36	0.48	0.339	0.473
23 GENDER: Male	0.624	0.484	0.689	0.463	0.64	0.48	0.661	0.473
24 POSITION TYPE: Administrative	0.493	0.5	0.107	0.309	0.411	0.492	0.317	0.465
25 POSITION TYPE: Other	0.015	0.122	0.01	0.099	0.014	0.117	0.009	0.096
26 POSITION TYPE: Professional	0.43	0.495	0.868	0.338	0.522	0.5	0.628	0.483
27 POSITION TYPE: Technical	0.063	0.242	0.015	0.122	0.053	0.224	0.047	0.211
28 SUPERVISOR: All Other Positions	0.896	0.305	0.99	0.1	0.916	0.278	0.936	0.245
29 SUPERVISOR: Supvisor/Mngr/Ldr	0.104	0.305	0.01	0.1	0.084	0.278	0.064	0.245
30 ACQ CAREER FLD: Business (CE or FM)	0.106	0.307	0.034	0.182	0.09	0.286	0.057	0.232
31 ACQ CAREER FLD: Contracting	0.147	0.354	0.162	0.369	0.153	0.36	0.18	0.384
32 ACQ CAREER FLD: Engineering	0.216	0.411	0.518	0.5	0.278	0.448	0.337	0.473
33 ACQ CAREER FLD: Facilities Engineering	0.022	0.148	0.046	0.209	0.027	0.162	0.036	0.186
34 ACQ CAREER FLD: Information Tech	0.086	0.28	0.025	0.157	0.073	0.261	0.057	0.232
35 ACQ CAREER FLD: Life Cycle Logistics	0.119	0.323	0.025	0.157	0.098	0.297	0.077	0.267
36 ACQ CAREER FLD: Other	0.046	0.209	0.015	0.121	0.039	0.194	0.045	0.208
37 ACQ CAREER FLD: Prod, Quality & Manuf	0.052	0.222	0.02	0.139	0.045	0.207	0.029	0.169
38 ACQ CAREER FLD: Program Management	0.106	0.307	0.027	0.163	0.09	0.286	0.069	0.254
39 ACQ CAREER FLD: Test and Eval	0.038	0.191	0.09	0.286	0.049	0.216	0.055	0.228

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.064	0.244	0.037	0.189	0.058	0.234	0.058	0.233
41 RETIREMENT PLAN: CSRS	0.263	0.44	0.008	0.088	0.209	0.407	0.129	0.335
42 RETIREMENT PLAN: FERS	0.731	0.443	0.987	0.112	0.785	0.411	0.866	0.34
43 RETIREMENT PLAN: Other	0.006	0.077	0.005	0.071	0.005	0.074	0.005	0.072
44 CAREER LEVEL: Entry-Level	0.172	0.378	0.554	0.497	0.248	0.432	0.304	0.46
45 CAREER LEVEL: Mid-Level	0.738	0.44	0.426	0.494	0.678	0.467	0.66	0.474
46 CAREER LEVEL: Sen/Exec	0.08	0.271	0.014	0.115	0.066	0.248	0.028	0.164
47 CAREER LEVEL: Uncategorized	0.01	0.099	0.007	0.081	0.009	0.094	0.008	0.089
48 COHORT YEAR: 2001	0.326	0.469	0.25	0.433	0.31	0.463	0.299	0.458
49 COHORT YEAR: 2002	0.37	0.483	0.393	0.488	0.372	0.483	0.397	0.489
50 COHORT YEAR: 2003	0.304	0.46	0.357	0.479	0.318	0.466	0.303	0.46
51 YRS TO RET ELIG: <5 Yrs to Go	0.1	0.3	0.025	0.156	0.084	0.277	0.065	0.247
52 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.399	0.49	0.143	0.35	0.347	0.476	0.315	0.465
53 YRS TO RET ELIG: 20+ YRs to Go	0.264	0.441	0.792	0.406	0.372	0.483	0.481	0.5
54 YRS TO RET ELIG: 5-9 Yrs to Go	0.179	0.383	0.036	0.187	0.149	0.357	0.119	0.324
55 YRS TO RET ELIG: Ret Eligible	0.058	0.234	0.004	0.064	0.047	0.211	0.019	0.138
56 PAY PLAN: Broad GS	0.84	0.366	0.682	0.466	0.806	0.395	0.789	0.408
57 PAY PLAN: Demo	0.15	0.357	0.313	0.464	0.185	0.389	0.205	0.404
58 PAY PLAN: Other	0.009	0.095	0.005	0.071	0.008	0.09	0.005	0.072
59 HCAP: Handicapped	0.094	0.291	0.067	0.25	0.089	0.285	0.09	0.287
60 HCAP: Not Handicapped	0.906	0.291	0.933	0.25	0.911	0.285	0.91	0.287

Figure C.1.1. Absolute Standard Differences in Means Decrease Substantially After Weighting
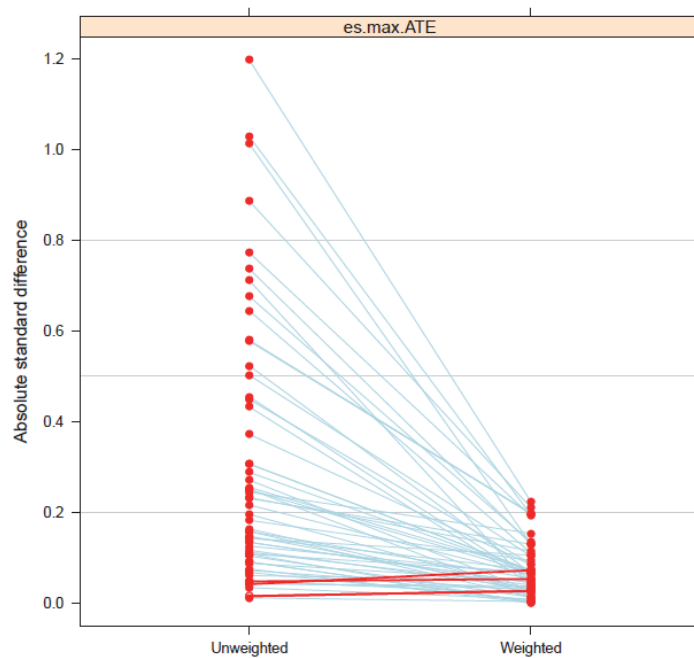
Figure C.1.2. After Weighting, a Few Differences in Means are no Longer Statistically Significant
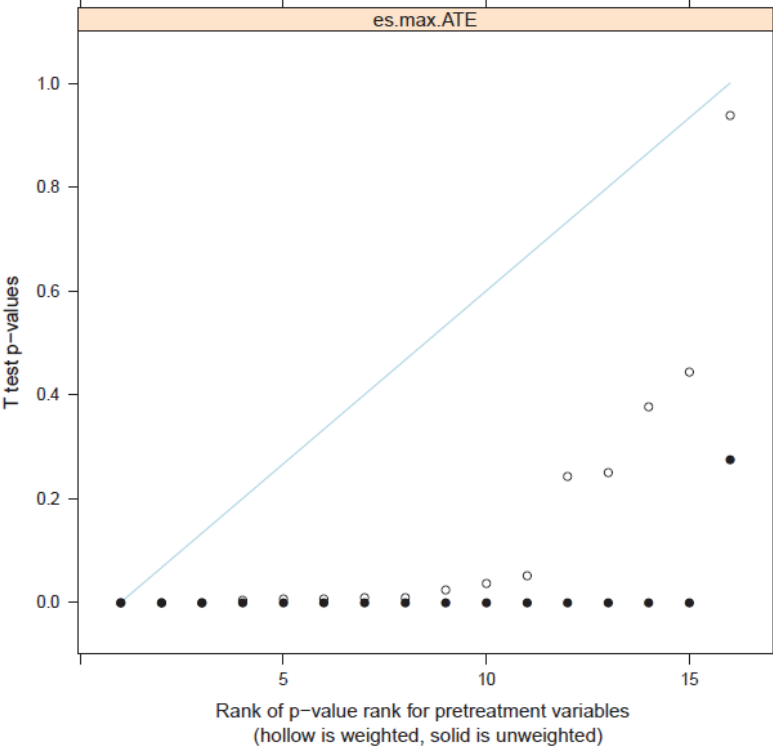
C.2 Later Pre-Policy Cohort Group

Table C.2.1. Means and Standard Deviations Before and After Propensity-Score Weighting

		Unweighted				Weighted			
	Balance Factors	DoD		No DoD		DoD		No DoD	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	AGE	42.28	10.517	31.223	10.017	39.708	11.338	38.018	11.267
2	LN(COMPENSATION)	10.897	0.336	10.665	0.325	10.842	0.348	10.817	0.351
3	RACE: Other	0.227	0.419	0.212	0.409	0.224	0.417	0.236	0.424
4	RACE: White	0.773	0.419	0.788	0.409	0.776	0.417	0.764	0.424
5	EDUCATION: BA	0.392	0.488	0.68	0.466	0.462	0.499	0.505	0.5
6	EDUCATION: Less than BA	0.367	0.482	0.082	0.275	0.298	0.457	0.248	0.432
7	EDUCATION: More than BA	0.241	0.428	0.238	0.426	0.239	0.427	0.247	0.431
8	DOD ORG: Air Force	0.174	0.379	0.089	0.284	0.154	0.361	0.122	0.327
9	DOD ORG: Army	0.463	0.499	0.411	0.492	0.447	0.497	0.439	0.496
10	DOD ORG: Navy	0.221	0.415	0.341	0.474	0.252	0.434	0.298	0.457
11	DOD ORG: Other	0.142	0.349	0.16	0.366	0.147	0.354	0.141	0.348
12	REGION: East North Central	0.131	0.337	0.112	0.315	0.128	0.334	0.115	0.319
13	REGION: East South Central	0.09	0.286	0.083	0.276	0.088	0.283	0.066	0.247
14	REGION: Mid Atlantic	0.09	0.287	0.187	0.39	0.113	0.316	0.115	0.318
15	REGION: Mountain	0.073	0.26	0.048	0.213	0.067	0.25	0.07	0.254
16	REGION: New England	0.033	0.179	0.037	0.189	0.034	0.181	0.037	0.188
17	REGION: Other or Missing	0.031	0.173	0.008	0.09	0.026	0.158	0.024	0.153
18	REGION: Pacific	0.111	0.314	0.128	0.334	0.113	0.317	0.133	0.34
19	REGION: South Atlantic	0.346	0.476	0.357	0.479	0.351	0.477	0.373	0.483
20	REGION: West North Central	0.019	0.136	0.009	0.095	0.016	0.127	0.011	0.103
21	REGION: West South Central	0.077	0.266	0.031	0.173	0.065	0.247	0.058	0.234
22	GENDER: Female	0.35	0.477	0.366	0.482	0.353	0.478	0.379	0.485
23	GENDER: Male	0.65	0.477	0.634	0.482	0.647	0.478	0.621	0.485
24	POSITION TYPE: Administrative	0.479	0.5	0.154	0.361	0.401	0.49	0.328	0.47
25	POSITION TYPE: Other	0.012	0.111	0.009	0.092	0.011	0.105	0.014	0.119
26	POSITION TYPE: Professional	0.44	0.496	0.816	0.387	0.53	0.499	0.613	0.487
27	POSITION TYPE: Technical	0.069	0.253	0.021	0.144	0.058	0.233	0.044	0.206
28	SUPERVISOR: All Other Positions	0.892	0.311	0.99	0.102	0.915	0.279	0.902	0.298
29	SUPERVISOR: Supvisor/Mngr/Ldr	0.108	0.311	0.01	0.102	0.085	0.279	0.098	0.298
30	ACQ CAREER FLD: Business (CE or FM)	0.084	0.278	0.049	0.217	0.077	0.266	0.078	0.268
31	ACQ CAREER FLD: Contracting	0.157	0.364	0.198	0.398	0.165	0.371	0.206	0.404
32	ACQ CAREER FLD: Engineering	0.151	0.358	0.388	0.487	0.209	0.406	0.245	0.43
33	ACQ CAREER FLD: Facilities Engineering	0.085	0.279	0.045	0.207	0.075	0.264	0.079	0.27
34	ACQ CAREER FLD: Information Tech	0.045	0.208	0.025	0.155	0.04	0.197	0.035	0.183
35	ACQ CAREER FLD: Life Cycle Logistics	0.157	0.364	0.047	0.211	0.13	0.337	0.086	0.28
36	ACQ CAREER FLD: Other	0.037	0.189	0.013	0.112	0.031	0.173	0.027	0.161
37	ACQ CAREER FLD: Prod, Quality & Manuf	0.085	0.279	0.04	0.196	0.074	0.261	0.05	0.218
38	ACQ CAREER FLD: Program Management	0.092	0.288	0.027	0.161	0.076	0.265	0.07	0.255
39	ACQ CAREER FLD: Test and Eval	0.035	0.185	0.063	0.242	0.043	0.203	0.044	0.205

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.071	0.256	0.106	0.308	0.08	0.271	0.083	0.275
41 RETIREMENT PLAN: CSRS	0.149	0.356	0.004	0.063	0.114	0.318	0.092	0.288
42 RETIREMENT PLAN: FERS	0.843	0.364	0.987	0.112	0.878	0.327	0.9	0.3
43 RETIREMENT PLAN: Other	0.008	0.09	0.009	0.093	0.008	0.089	0.009	0.093
44 CAREER LEVEL: Entry-Level	0.203	0.402	0.6	0.49	0.297	0.457	0.343	0.475
45 CAREER LEVEL: Mid-Level	0.691	0.462	0.372	0.483	0.616	0.486	0.578	0.494
46 CAREER LEVEL: Sen/Exec	0.095	0.294	0.016	0.126	0.076	0.266	0.069	0.254
47 CAREER LEVEL: Uncategorized	0.01	0.099	0.011	0.107	0.01	0.101	0.009	0.096
48 COHORT YEAR: 2004	0.37	0.483	0.329	0.47	0.362	0.481	0.354	0.478
49 COHORT YEAR: 2005	0.358	0.479	0.321	0.467	0.344	0.475	0.353	0.478
50 COHORT YEAR: 2007	0.272	0.445	0.35	0.477	0.294	0.456	0.293	0.455
51 YRS TO RET ELIG: <5 Yrs to Go	0.094	0.291	0.024	0.152	0.077	0.266	0.055	0.227
52 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.38	0.485	0.132	0.338	0.322	0.467	0.287	0.453
53 YRS TO RET ELIG: 20+ YRs to Go	0.322	0.467	0.808	0.394	0.438	0.496	0.518	0.5
54 YRS TO RET ELIG: 5-9 Yrs to Go	0.15	0.357	0.034	0.18	0.123	0.328	0.112	0.315
55 YRS TO RET ELIG: Ret Eligible	0.053	0.225	0.004	0.06	0.041	0.199	0.028	0.165
56 PAY PLAN: Broad GS	0.801	0.399	0.716	0.451	0.781	0.414	0.763	0.425
57 PAY PLAN: Demo	0.141	0.348	0.244	0.429	0.165	0.371	0.194	0.395
58 PAY PLAN: NSPS	0.049	0.215	0.03	0.171	0.045	0.207	0.035	0.184
59 PAY PLAN: Other	0.01	0.098	0.01	0.1	0.01	0.098	0.008	0.089
60 HCAP: Handicapped	0.089	0.284	0.051	0.22	0.08	0.271	0.072	0.259
61 HCAP: Not Handicapped	0.911	0.284	0.949	0.22	0.92	0.271	0.928	0.259

Figure C.2.1. Absolute Standard Differences in Means Decrease Substantially After Weighting
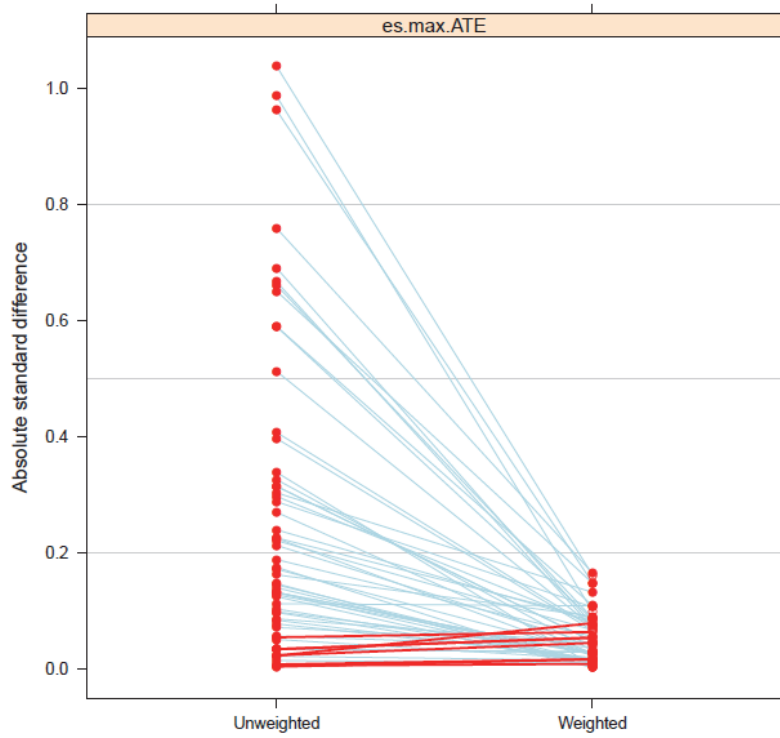
Figure C.2.2. After Weighting, Several Differences in Means are no Longer Statistically Significant
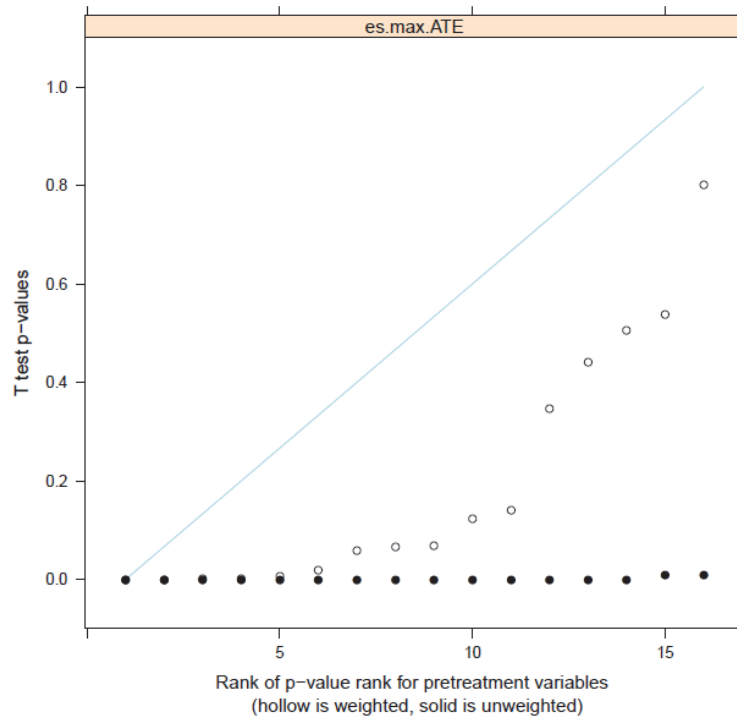
C.3 Combination Pre-Policy Cohort Group

Table C.3.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted				Weighted			
		DoD		No DoD		DoD		No DoD	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	AGE	42.68	10.156	31.473	10.128	40.162	11.104	38.681	11.229
2	LN(COMPENSATION)	10.869	0.329	10.67	0.32	10.824	0.337	10.805	0.344
3	RACE: Other	0.228	0.419	0.223	0.416	0.226	0.418	0.223	0.416
4	RACE: White	0.772	0.419	0.777	0.416	0.774	0.418	0.777	0.416
5	EDUCATION: BA	0.385	0.487	0.685	0.465	0.453	0.498	0.49	0.5
6	EDUCATION: Less than BA	0.389	0.488	0.081	0.273	0.318	0.466	0.272	0.445
7	EDUCATION: More than BA	0.225	0.418	0.234	0.423	0.229	0.42	0.237	0.425
8	DOD ORG: Air Force	0.168	0.374	0.103	0.304	0.153	0.36	0.125	0.33
9	DOD ORG: Army	0.453	0.498	0.369	0.482	0.433	0.495	0.426	0.495
10	DOD ORG: Navy	0.257	0.437	0.412	0.492	0.292	0.455	0.325	0.469
11	DOD ORG: Other	0.122	0.328	0.116	0.321	0.122	0.327	0.123	0.329
12	REGION: East North Central	0.121	0.326	0.099	0.299	0.117	0.321	0.107	0.309
13	REGION: East South Central	0.089	0.285	0.078	0.267	0.087	0.282	0.074	0.261
14	REGION: Mid Atlantic	0.093	0.29	0.155	0.362	0.106	0.308	0.101	0.301
15	REGION: Mountain	0.072	0.259	0.046	0.21	0.066	0.248	0.07	0.255
16	REGION: New England	0.035	0.183	0.043	0.204	0.037	0.189	0.039	0.193
17	REGION: Other or Missing	0.034	0.181	0.008	0.087	0.028	0.165	0.026	0.158
18	REGION: Pacific	0.123	0.329	0.16	0.367	0.13	0.336	0.147	0.354
19	REGION: South Atlantic	0.336	0.472	0.366	0.482	0.345	0.475	0.37	0.483
20	REGION: West North Central	0.017	0.13	0.008	0.09	0.015	0.123	0.013	0.112
21	REGION: West South Central	0.079	0.27	0.036	0.187	0.069	0.253	0.054	0.226
22	GENDER: Female	0.363	0.481	0.341	0.474	0.357	0.479	0.369	0.483
23	GENDER: Male	0.637	0.481	0.659	0.474	0.643	0.479	0.631	0.483
24	POSITION TYPE: Administrative	0.486	0.5	0.132	0.339	0.403	0.491	0.322	0.467
25	POSITION TYPE: Other	0.014	0.116	0.009	0.095	0.013	0.112	0.011	0.105
26	POSITION TYPE: Professional	0.435	0.496	0.84	0.367	0.529	0.499	0.614	0.487
27	POSITION TYPE: Technical	0.066	0.248	0.018	0.134	0.055	0.228	0.053	0.223
28	SUPERVISOR: All Other Positions	0.894	0.308	0.99	0.101	0.916	0.277	0.913	0.282
29	SUPERVISOR: Supvisor/Mngr/Ldr	0.106	0.308	0.01	0.101	0.084	0.277	0.087	0.282
30	ACQ CAREER FLD: Business (CE or FM)	0.095	0.293	0.042	0.202	0.084	0.277	0.066	0.248
31	ACQ CAREER FLD: Contracting	0.152	0.359	0.181	0.385	0.158	0.365	0.199	0.399
32	ACQ CAREER FLD: Engineering	0.183	0.387	0.448	0.497	0.244	0.43	0.279	0.448
33	ACQ CAREER FLD: Facilities Engineering	0.054	0.226	0.045	0.208	0.052	0.221	0.053	0.225
34	ACQ CAREER FLD: Information Tech	0.065	0.247	0.025	0.156	0.056	0.23	0.045	0.207
35	ACQ CAREER FLD: Life Cycle Logistics	0.138	0.345	0.037	0.189	0.114	0.318	0.076	0.264
36	ACQ CAREER FLD: Other	0.041	0.199	0.014	0.116	0.035	0.184	0.046	0.209
37	ACQ CAREER FLD: Prod, Quality & Manuf	0.069	0.253	0.031	0.173	0.06	0.237	0.042	0.2
38	ACQ CAREER FLD: Program Management	0.099	0.298	0.027	0.162	0.082	0.274	0.08	0.272
39	ACQ CAREER FLD: Test and Eval	0.037	0.188	0.075	0.264	0.046	0.21	0.049	0.215

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.067	0.25	0.075	0.263	0.069	0.254	0.066	0.249
41 RETIREMENT PLAN: CSRS	0.206	0.404	0.006	0.075	0.159	0.366	0.111	0.315
42 RETIREMENT PLAN: FERS	0.787	0.409	0.987	0.112	0.834	0.372	0.881	0.324
43 RETIREMENT PLAN: Other	0.007	0.083	0.007	0.083	0.007	0.082	0.008	0.088
44 CAREER LEVEL: Entry-Level	0.188	0.391	0.579	0.494	0.275	0.447	0.318	0.466
45 CAREER LEVEL: Mid-Level	0.715	0.452	0.397	0.489	0.644	0.479	0.609	0.488
46 CAREER LEVEL: Sen/Exec	0.088	0.283	0.015	0.121	0.071	0.257	0.064	0.245
47 CAREER LEVEL: Uncategorized	0.01	0.099	0.009	0.096	0.01	0.099	0.009	0.094
48 COHORT YEAR: 2001	0.163	0.369	0.114	0.318	0.15	0.357	0.134	0.341
49 COHORT YEAR: 2002	0.184	0.388	0.18	0.384	0.18	0.384	0.187	0.39
50 COHORT YEAR: 2003	0.151	0.358	0.163	0.37	0.152	0.359	0.134	0.34
51 COHORT YEAR: 2004	0.186	0.389	0.179	0.383	0.188	0.391	0.194	0.395
52 COHORT YEAR: 2005	0.18	0.384	0.174	0.379	0.178	0.382	0.194	0.395
53 COHORT YEAR: 2007	0.137	0.343	0.19	0.393	0.152	0.359	0.158	0.365
54 YRS TO RET ELIG: <5 Yrs to Go	0.097	0.296	0.024	0.154	0.08	0.271	0.065	0.247
55 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.39	0.488	0.137	0.343	0.332	0.471	0.305	0.46
56 YRS TO RET ELIG: 20+ YRs to Go	0.294	0.455	0.8	0.4	0.41	0.492	0.486	0.5
57 YRS TO RET ELIG: 5-9 Yrs to Go	0.165	0.371	0.035	0.184	0.135	0.341	0.116	0.32
58 YRS TO RET ELIG: Ret Eligible	0.056	0.229	0.004	0.062	0.044	0.205	0.028	0.165
59 PAY PLAN: Broad GS	0.821	0.384	0.7	0.458	0.792	0.406	0.767	0.423
60 PAY PLAN: Demo	0.145	0.353	0.275	0.447	0.177	0.381	0.203	0.402
61 PAY PLAN: NSPS	0.025	0.155	0.016	0.127	0.023	0.149	0.022	0.146
62 PAY PLAN: Other	0.009	0.097	0.008	0.088	0.009	0.095	0.008	0.091
63 HCAP: Handicapped	0.091	0.288	0.058	0.235	0.085	0.278	0.082	0.274
64 HCAP: Not Handicapped	0.909	0.288	0.942	0.235	0.915	0.278	0.918	0.274

Figure C.3.1. Absolute Standard Differences in Means Decrease Substantially after Weighting
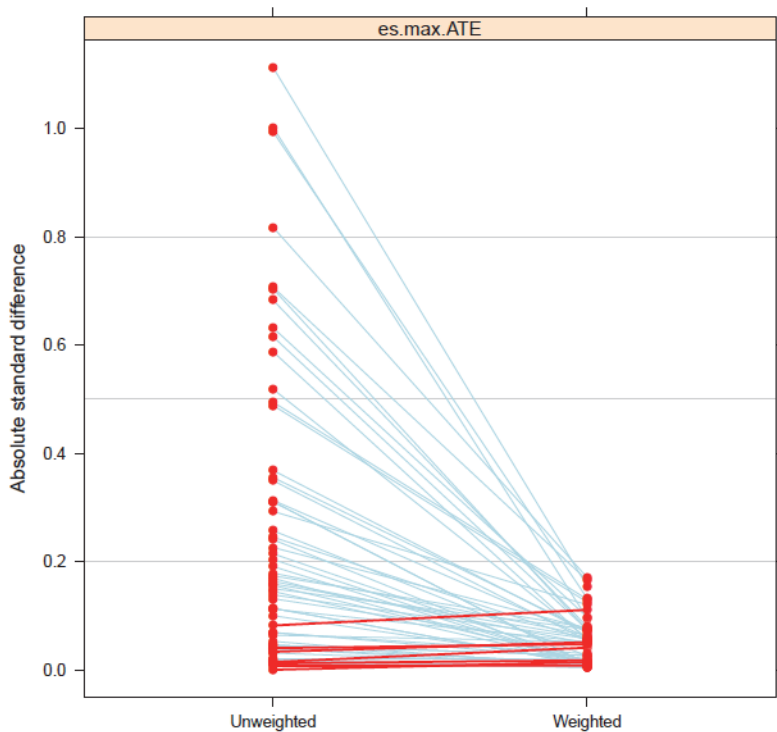
Figure C.3.2. After Weighting, a Few Differences in Means are No Longer Statistically Significant
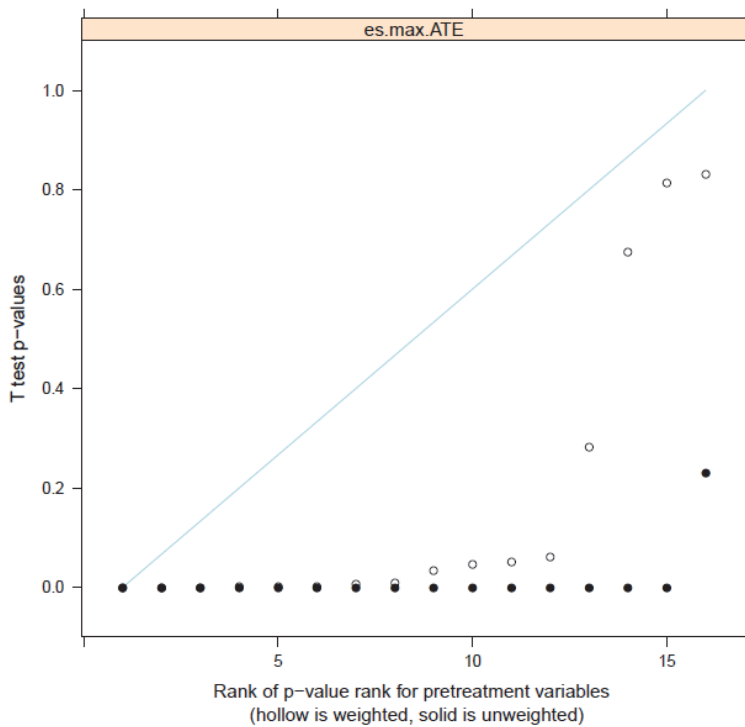
Appendix D. Balance Results for Internal Hires vs. External Hires

Sections D.1-D.3 show how the pre-policy cohort groups analyzed in Part I of the retention analysis (see Table D.1, below) balance,[94] in terms of the observable characteristics listed in Table 6.2, before and after propensity-score-weight implementation. Tables D.1.1-D.3.1 list the variable means and standard deviations before and after weighting. And the figures illustrate how effectively the propensity-score weights bring the variable means of the two groups (internal hires vs. external hires) into balance.

For all three cohort groups analyzed, the applied propensity-score weights significantly improve the balance between the two groups. Figures D.1.1-D.3.1 illustrate that the differences in the variable means between the two groups decrease substantially after weighting. In no cases—post-weighting—is the "Absolute standard difference"[95] in variable means between groups greater than 0.2, which is the threshold referenced in the RAND TWANG (Griffin et al., 2014; Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c).[96]

Figures D.1.2-D.3.2 show that after applying propensity-score weights, some of the differences in variable means between groups are no longer statistically significant.

The tables and figures presented in sections D.1-D.3 come from the output of RAND's TWANG (Griffin et al., 2014).

Table D.1. Pre-Policy Cohort Groups Analyzed in Retention Analysis Part I

Cohort Group Name	FY Cohorts Included
Early Pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007

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[94] Griffin and McCaffrey (2015b) and Griffin and McCaffrey (2015a) state that balance assessments should consider differences in variable means and variable distributions between groups. The balance analyses in this study focus on comparing variable means and do not include comparing variable distributions because most of the variables used are categorical—for these variables the means and distributions are essentially the same thing.

[95] This phrase stems from Griffin and McCaffrey (2015c) (p. 28). The phrase is used throughout the following section.

[96] Some researchers use a stricter threshold of 0.1 (Austin and Stuart, 2015).

D.1 Early Pre-Policy Cohort Group

Table D.1.1. Means and Standard Deviations Before and After Propensity-Score Weighting

| Balance Factors | Unweighted | | | | Weighted | | | |
| | Internal Hire | | External Hire | | Internal Hire | | External Hire | |
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 AGE	43.161	10.262	37.018	10.928	40.669	10.921	39.738	10.965
2 LN(COMPENSATION)	10.832	0.306	10.763	0.341	10.805	0.32	10.784	0.326
3 RACE: Other	0.243	0.429	0.215	0.411	0.225	0.418	0.22	0.414
4 RACE: White	0.757	0.429	0.785	0.411	0.775	0.418	0.78	0.414
5 EDUCATION: BA	0.37	0.483	0.554	0.497	0.441	0.497	0.467	0.499
6 EDUCATION: Less than BA	0.464	0.499	0.174	0.379	0.349	0.477	0.313	0.464
7 EDUCATION: More than BA	0.166	0.372	0.273	0.445	0.21	0.407	0.221	0.415
8 DOD ORG: Air Force	0.144	0.351	0.16	0.366	0.157	0.363	0.157	0.364
9 DOD ORG: Army	0.495	0.5	0.315	0.465	0.427	0.495	0.394	0.489
10 DOD ORG: Navy	0.257	0.437	0.444	0.497	0.314	0.464	0.355	0.479
11 DOD ORG: Other	0.104	0.306	0.081	0.273	0.103	0.303	0.094	0.292
12 REGION: East North Central	0.122	0.328	0.084	0.278	0.103	0.304	0.089	0.285
13 REGION: East South Central	0.097	0.296	0.069	0.254	0.081	0.272	0.069	0.253
14 REGION: Mid Atlantic	0.109	0.312	0.089	0.285	0.1	0.3	0.105	0.306
15 REGION: Mountain	0.065	0.247	0.065	0.247	0.068	0.252	0.067	0.25
16 REGION: New England	0.034	0.181	0.047	0.213	0.036	0.187	0.045	0.208
17 REGION: Other or Missing	0.04	0.195	0.017	0.129	0.032	0.177	0.027	0.161
18 REGION: Pacific	0.131	0.338	0.174	0.379	0.148	0.355	0.164	0.37
19 REGION: South Atlantic	0.293	0.455	0.393	0.488	0.341	0.474	0.352	0.478
20 REGION: West North Central	0.017	0.128	0.01	0.1	0.015	0.121	0.014	0.118
21 REGION: West South Central	0.091	0.288	0.051	0.219	0.075	0.264	0.069	0.254
22 GENDER: Female	0.447	0.497	0.258	0.438	0.368	0.482	0.357	0.479
23 GENDER: Male	0.553	0.497	0.742	0.438	0.632	0.482	0.643	0.479
24 POSITION TYPE: Administrative	0.535	0.499	0.239	0.426	0.413	0.492	0.357	0.479
25 POSITION TYPE: Other	0.015	0.121	0.013	0.112	0.014	0.119	0.016	0.125
26 POSITION TYPE: Professional	0.38	0.485	0.72	0.449	0.519	0.5	0.57	0.495
27 POSITION TYPE: Technical	0.07	0.255	0.029	0.168	0.053	0.225	0.058	0.233
28 SUPERVISOR: All Other Positions	0.886	0.318	0.958	0.2	0.914	0.28	0.932	0.252
29 SUPERVISOR: Supvisor/Mngr/Ldr	0.114	0.318	0.042	0.2	0.086	0.28	0.068	0.252
30 ACQ CAREER FLD: Business (CE or FM)	0.13	0.336	0.039	0.194	0.094	0.292	0.096	0.295
31 ACQ CAREER FLD: Contracting	0.123	0.329	0.184	0.387	0.154	0.361	0.163	0.369
32 ACQ CAREER FLD: Engineering	0.199	0.4	0.394	0.489	0.27	0.444	0.305	0.461
33 ACQ CAREER FLD: Facilities Engineering	0.021	0.144	0.036	0.187	0.027	0.161	0.03	0.17
34 ACQ CAREER FLD: Information Tech	0.098	0.297	0.04	0.195	0.076	0.265	0.057	0.232
35 ACQ CAREER FLD: Life Cycle Logistics	0.12	0.325	0.068	0.252	0.097	0.296	0.083	0.276
36 ACQ CAREER FLD: Other	0.051	0.22	0.023	0.15	0.04	0.196	0.046	0.21
37 ACQ CAREER FLD: Prod, Quality & Manuf	0.056	0.23	0.03	0.171	0.044	0.206	0.037	0.189
38 ACQ CAREER FLD: Program Management	0.105	0.307	0.065	0.246	0.089	0.285	0.07	0.255
39 ACQ CAREER FLD: Test and Eval	0.029	0.168	0.076	0.265	0.047	0.212	0.055	0.228

Balance Factors	Unweighted				Weighted			
	Internal Hire		External Hire		Internal Hire		External Hire	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.068	0.251	0.045	0.207	0.062	0.241	0.058	0.233
41 RETIREMENT PLAN: CSRS	0.33	0.47	0.049	0.215	0.219	0.414	0.171	0.377
42 RETIREMENT PLAN: FERS	0.668	0.471	0.941	0.235	0.778	0.416	0.822	0.382
43 RETIREMENT PLAN: Other	0.002	0.043	0.01	0.101	0.003	0.057	0.006	0.08
44 CAREER LEVEL: Entry-Level	0.168	0.374	0.379	0.485	0.243	0.429	0.285	0.452
45 CAREER LEVEL: Mid-Level	0.744	0.436	0.566	0.496	0.685	0.465	0.65	0.477
46 CAREER LEVEL: Sen/Exec	0.083	0.276	0.041	0.198	0.066	0.248	0.055	0.227
47 CAREER LEVEL: Uncategorized	0.005	0.068	0.014	0.119	0.007	0.082	0.01	0.098
48 COHORT YEAR: 2001	0.353	0.478	0.254	0.435	0.318	0.466	0.29	0.454
49 COHORT YEAR: 2002	0.376	0.484	0.375	0.484	0.364	0.481	0.377	0.485
50 COHORT YEAR: 2003	0.271	0.445	0.37	0.483	0.318	0.466	0.333	0.471
51 YRS TO RET ELIG: <5 Yrs to Go	0.12	0.325	0.037	0.188	0.086	0.281	0.065	0.247
52 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.353	0.478	0.317	0.465	0.345	0.475	0.337	0.473
53 YRS TO RET ELIG: 20+ YRs to Go	0.252	0.434	0.558	0.497	0.367	0.482	0.421	0.494
54 YRS TO RET ELIG: 5-9 Yrs to Go	0.201	0.401	0.077	0.267	0.153	0.36	0.14	0.347
55 YRS TO RET ELIG: Ret Eligible	0.074	0.261	0.011	0.105	0.049	0.216	0.038	0.191
56 PAY PLAN: Broad GS	0.871	0.336	0.721	0.448	0.817	0.387	0.793	0.406
57 PAY PLAN: Demo	0.126	0.332	0.265	0.441	0.177	0.382	0.198	0.399
58 PAY PLAN: Other	0.003	0.059	0.014	0.116	0.006	0.077	0.009	0.095
59 HCAP: Handicapped	0.085	0.278	0.09	0.286	0.093	0.29	0.088	0.283
60 HCAP: Not Handicapped	0.915	0.278	0.91	0.286	0.907	0.29	0.912	0.283

Figure D.1.1. Absolute Standard Differences in Means Decrease Substantially After Weighting
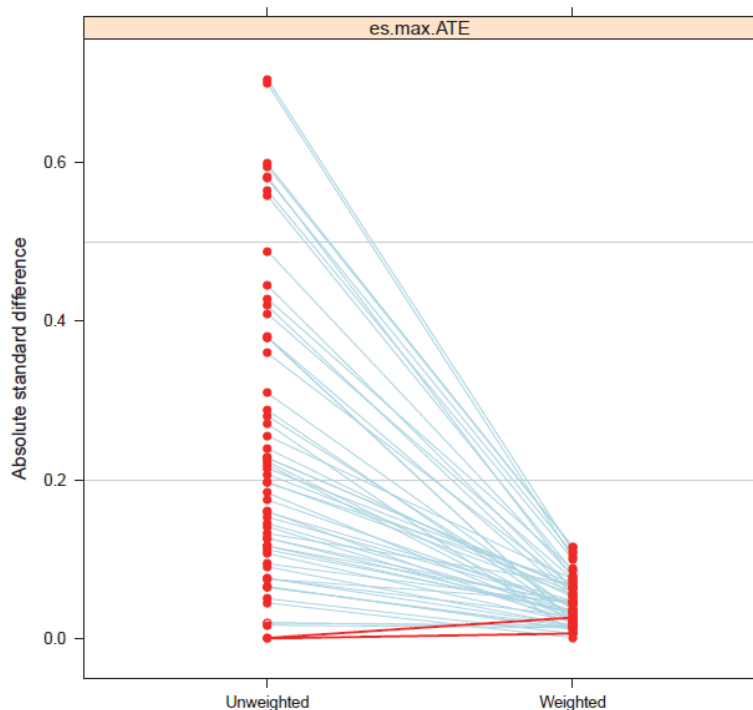
Figure D.1.2. After Weighting, Two Differences in Means are no Longer Statistically Significant
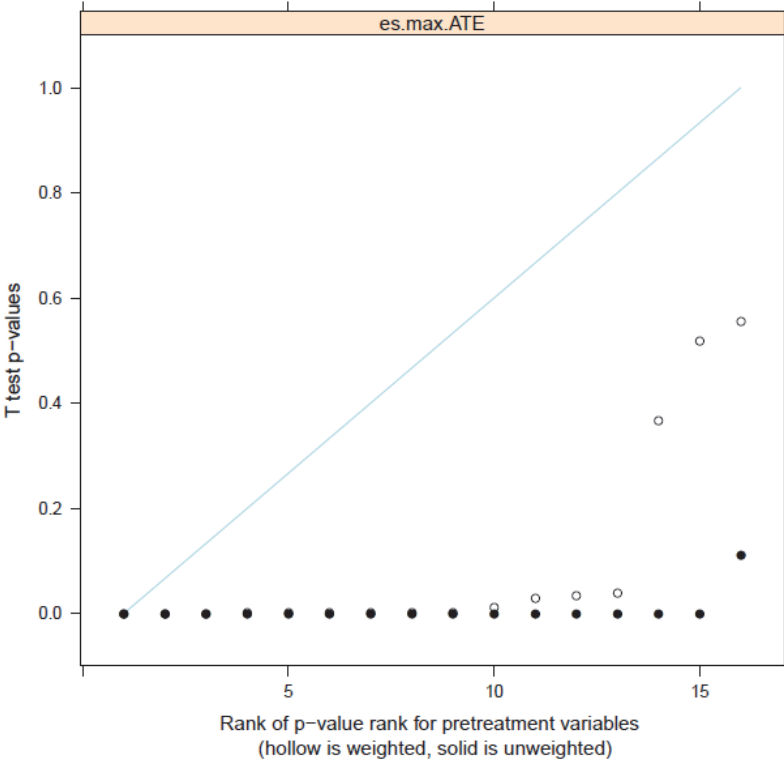
D.2 Later Pre-Policy Cohort Group

Table D.2.1. Means and Standard Deviations Before and After Propensity-Score Weighting

Balance Factors	Unweighted				Weighted			
	Internal Hire		External Hire		Internal Hire		External Hire	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 AGE	41.787	11.372	36.815	11.072	39.429	11.545	39.111	11.349
2 LN(COMPENSATION)	10.874	0.32	10.795	0.37	10.841	0.346	10.828	0.353
3 RACE: Other	0.237	0.425	0.21	0.407	0.224	0.417	0.22	0.414
4 RACE: White	0.763	0.425	0.79	0.407	0.776	0.417	0.78	0.414
5 EDUCATION: BA	0.402	0.49	0.537	0.499	0.47	0.499	0.476	0.499
6 EDUCATION: Less than BA	0.399	0.49	0.183	0.387	0.295	0.456	0.279	0.448
7 EDUCATION: More than BA	0.199	0.399	0.28	0.449	0.236	0.425	0.245	0.43
8 DOD ORG: Air Force	0.164	0.37	0.139	0.346	0.154	0.361	0.142	0.349
9 DOD ORG: Army	0.499	0.5	0.4	0.49	0.45	0.498	0.443	0.497
10 DOD ORG: Navy	0.191	0.393	0.314	0.464	0.254	0.435	0.261	0.439
11 DOD ORG: Other	0.146	0.353	0.148	0.355	0.142	0.349	0.155	0.361
12 REGION: East North Central	0.145	0.352	0.107	0.309	0.125	0.331	0.124	0.33
13 REGION: East South Central	0.094	0.292	0.082	0.274	0.084	0.278	0.079	0.269
14 REGION: Mid Atlantic	0.103	0.304	0.13	0.337	0.115	0.319	0.117	0.321
15 REGION: Mountain	0.069	0.254	0.063	0.243	0.066	0.248	0.069	0.253
16 REGION: New England	0.032	0.175	0.036	0.188	0.032	0.177	0.034	0.182
17 REGION: Other or Missing	0.031	0.173	0.019	0.136	0.026	0.159	0.028	0.165
18 REGION: Pacific	0.106	0.307	0.125	0.331	0.117	0.321	0.123	0.328
19 REGION: South Atlantic	0.321	0.467	0.376	0.484	0.349	0.477	0.351	0.477
20 REGION: West North Central	0.02	0.139	0.013	0.112	0.017	0.128	0.015	0.122
21 REGION: West South Central	0.08	0.272	0.048	0.214	0.068	0.252	0.061	0.239
22 GENDER: Female	0.416	0.493	0.294	0.456	0.358	0.479	0.348	0.476
23 GENDER: Male	0.584	0.493	0.706	0.456	0.642	0.479	0.652	0.476
24 POSITION TYPE: Administrative	0.496	0.5	0.288	0.453	0.4	0.49	0.373	0.484
25 POSITION TYPE: Other	0.012	0.11	0.01	0.102	0.012	0.108	0.011	0.103
26 POSITION TYPE: Professional	0.417	0.493	0.664	0.472	0.532	0.499	0.558	0.497
27 POSITION TYPE: Technical	0.075	0.263	0.037	0.19	0.057	0.231	0.058	0.233
28 SUPERVISOR: All Other Positions	0.888	0.315	0.947	0.223	0.915	0.278	0.922	0.268
29 SUPERVISOR: Supvisor/Mngr/Ldr	0.112	0.315	0.053	0.223	0.085	0.278	0.078	0.268
30 ACQ CAREER FLD: Business (CE or FM)	0.1	0.3	0.05	0.218	0.078	0.268	0.082	0.275
31 ACQ CAREER FLD: Contracting	0.119	0.323	0.215	0.411	0.166	0.372	0.175	0.38
32 ACQ CAREER FLD: Engineering	0.145	0.352	0.285	0.451	0.212	0.409	0.225	0.418
33 ACQ CAREER FLD: Facilities Engineering	0.113	0.317	0.036	0.188	0.078	0.267	0.061	0.239
34 ACQ CAREER FLD: Information Tech	0.046	0.209	0.034	0.181	0.04	0.197	0.043	0.203
35 ACQ CAREER FLD: Life Cycle Logistics	0.159	0.365	0.097	0.296	0.126	0.332	0.11	0.313
36 ACQ CAREER FLD: Other	0.041	0.197	0.02	0.142	0.032	0.175	0.036	0.187
37 ACQ CAREER FLD: Prod, Quality & Manuf	0.09	0.286	0.057	0.231	0.072	0.259	0.07	0.256
38 ACQ CAREER FLD: Program Management	0.078	0.268	0.07	0.255	0.075	0.264	0.072	0.259
39 ACQ CAREER FLD: Test and Eval	0.029	0.167	0.057	0.231	0.045	0.207	0.045	0.207

Balance Factors	Unweighted				Weighted			
	Internal Hire		External Hire		Internal Hire		External Hire	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.082	0.274	0.079	0.27	0.076	0.264	0.08	0.272
41 RETIREMENT PLAN: CSRS	0.198	0.398	0.024	0.154	0.116	0.321	0.107	0.309
42 RETIREMENT PLAN: FERS	0.8	0.4	0.962	0.192	0.876	0.33	0.884	0.321
43 RETIREMENT PLAN: Other	0.002	0.048	0.014	0.117	0.008	0.089	0.009	0.096
44 CAREER LEVEL: Entry-Level	0.212	0.409	0.407	0.491	0.3	0.458	0.328	0.47
45 CAREER LEVEL: Mid-Level	0.699	0.459	0.512	0.5	0.613	0.487	0.589	0.492
46 CAREER LEVEL: Sen/Exec	0.083	0.275	0.065	0.247	0.077	0.266	0.072	0.258
47 CAREER LEVEL: Uncategorized	0.006	0.074	0.015	0.122	0.011	0.103	0.011	0.106
48 COHORT YEAR: 2004	0.402	0.49	0.316	0.465	0.368	0.482	0.352	0.477
49 COHORT YEAR: 2005	0.363	0.481	0.333	0.471	0.344	0.475	0.348	0.476
50 COHORT YEAR: 2007	0.234	0.424	0.35	0.477	0.289	0.453	0.3	0.458
51 YRS TO RET ELIG: <5 Yrs to Go	0.114	0.318	0.037	0.188	0.077	0.267	0.071	0.257
52 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.309	0.462	0.316	0.465	0.317	0.465	0.318	0.466
53 YRS TO RET ELIG: 20+ YRs to Go	0.341	0.474	0.565	0.496	0.438	0.496	0.464	0.499
54 YRS TO RET ELIG: 5-9 Yrs to Go	0.165	0.371	0.073	0.261	0.125	0.33	0.115	0.318
55 YRS TO RET ELIG: Ret Eligible	0.071	0.257	0.009	0.095	0.043	0.202	0.032	0.177
56 PAY PLAN: Broad GS	0.838	0.368	0.719	0.449	0.781	0.413	0.77	0.421
57 PAY PLAN: Demo	0.119	0.323	0.217	0.412	0.163	0.369	0.177	0.381
58 PAY PLAN: NSPS	0.038	0.19	0.05	0.217	0.046	0.209	0.043	0.204
59 PAY PLAN: Other	0.005	0.073	0.014	0.118	0.01	0.099	0.01	0.1
60 HCAP: Handicapped	0.084	0.277	0.073	0.26	0.081	0.273	0.081	0.272
61 HCAP: Not Handicapped	0.916	0.277	0.927	0.26	0.919	0.273	0.919	0.272

Figure D.2.1. Absolute Standard Differences in Means Decrease Substantially After Weighting
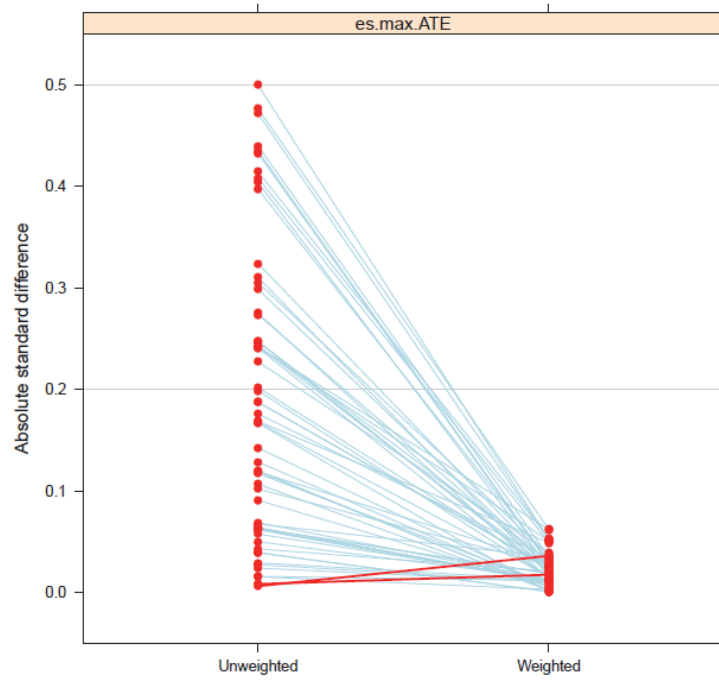
Figure D.2.2. After Weighting, Several Differences in Means are no Longer Statistically Significant
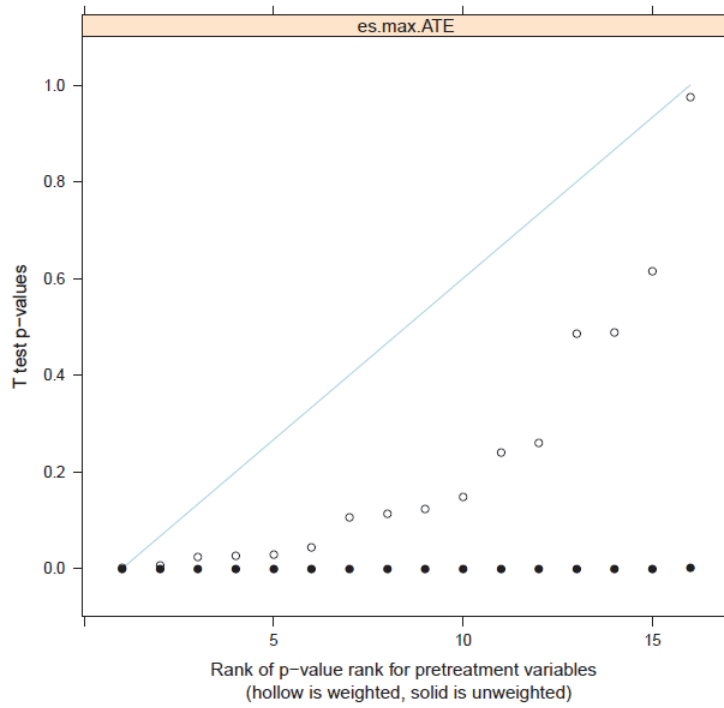
D.3 Combination Pre-Policy Cohort Group

Table D.3.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted				Weighted			
		Internal Hire		External Hire		Internal Hire		External Hire	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	AGE	42.491	10.84	36.909	11.006	40.039	11.253	39.563	11.219
2	LN(COMPENSATION)	10.853	0.314	10.78	0.358	10.825	0.334	10.808	0.342
3	RACE: Other	0.24	0.427	0.212	0.409	0.225	0.418	0.221	0.415
4	RACE: White	0.76	0.427	0.788	0.409	0.775	0.418	0.779	0.415
5	EDUCATION: BA	0.386	0.487	0.545	0.498	0.456	0.498	0.468	0.499
6	EDUCATION: Less than BA	0.432	0.495	0.179	0.383	0.319	0.466	0.3	0.458
7	EDUCATION: More than BA	0.182	0.386	0.276	0.447	0.225	0.418	0.232	0.422
8	DOD ORG: Air Force	0.154	0.361	0.148	0.356	0.157	0.364	0.152	0.359
9	DOD ORG: Army	0.497	0.5	0.361	0.48	0.438	0.496	0.414	0.493
10	DOD ORG: Navy	0.225	0.417	0.374	0.484	0.284	0.451	0.307	0.461
11	DOD ORG: Other	0.124	0.33	0.117	0.322	0.122	0.327	0.127	0.332
12	REGION: East North Central	0.133	0.34	0.097	0.295	0.116	0.32	0.11	0.313
13	REGION: East South Central	0.096	0.294	0.076	0.265	0.084	0.277	0.073	0.26
14	REGION: Mid Atlantic	0.106	0.308	0.111	0.315	0.107	0.309	0.109	0.312
15	REGION: Mountain	0.067	0.25	0.064	0.245	0.067	0.25	0.07	0.255
16	REGION: New England	0.033	0.178	0.042	0.2	0.035	0.183	0.039	0.193
17	REGION: Other or Missing	0.035	0.185	0.018	0.133	0.03	0.17	0.029	0.169
18	REGION: Pacific	0.119	0.324	0.148	0.355	0.13	0.337	0.141	0.348
19	REGION: South Atlantic	0.307	0.461	0.384	0.486	0.344	0.475	0.348	0.476
20	REGION: West North Central	0.018	0.133	0.012	0.107	0.016	0.125	0.015	0.121
21	REGION: West South Central	0.086	0.28	0.049	0.216	0.072	0.258	0.065	0.247
22	GENDER: Female	0.432	0.495	0.278	0.448	0.362	0.481	0.352	0.478
23	GENDER: Male	0.568	0.495	0.722	0.448	0.638	0.481	0.648	0.478
24	POSITION TYPE: Administrative	0.516	0.5	0.265	0.442	0.405	0.491	0.368	0.482
25	POSITION TYPE: Other	0.014	0.116	0.012	0.107	0.013	0.115	0.014	0.117
26	POSITION TYPE: Professional	0.398	0.49	0.69	0.463	0.527	0.499	0.559	0.497
27	POSITION TYPE: Technical	0.072	0.259	0.033	0.18	0.055	0.228	0.059	0.236
28	SUPERVISOR: All Other Positions	0.887	0.316	0.952	0.213	0.915	0.279	0.925	0.264
29	SUPERVISOR: Supvisor/Mngr/Ldr	0.113	0.316	0.048	0.213	0.085	0.279	0.075	0.264
30	ACQ CAREER FLD: Business (CE or FM)	0.116	0.32	0.045	0.207	0.085	0.278	0.085	0.28
31	ACQ CAREER FLD: Contracting	0.121	0.326	0.201	0.401	0.162	0.368	0.169	0.375
32	ACQ CAREER FLD: Engineering	0.173	0.378	0.335	0.472	0.243	0.429	0.26	0.439
33	ACQ CAREER FLD: Facilities Engineering	0.066	0.248	0.036	0.188	0.053	0.224	0.045	0.208
34	ACQ CAREER FLD: Information Tech	0.072	0.259	0.036	0.187	0.057	0.232	0.051	0.219
35	ACQ CAREER FLD: Life Cycle Logistics	0.139	0.346	0.084	0.277	0.111	0.314	0.1	0.3
36	ACQ CAREER FLD: Other	0.046	0.209	0.022	0.146	0.035	0.184	0.044	0.205
37	ACQ CAREER FLD: Prod, Quality & Manuf	0.072	0.259	0.044	0.206	0.058	0.234	0.057	0.232
38	ACQ CAREER FLD: Program Management	0.092	0.289	0.068	0.251	0.082	0.275	0.071	0.256
39	ACQ CAREER FLD: Test and Eval	0.029	0.167	0.066	0.248	0.046	0.209	0.049	0.216

| Balance Factors | Unweighted | | | | Weighted | | | |
| | Internal Hire | | External Hire | | Internal Hire | | External Hire | |
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.074	0.262	0.063	0.244	0.068	0.251	0.068	0.252
41 RETIREMENT PLAN: CSRS	0.265	0.442	0.036	0.185	0.164	0.37	0.142	0.349
42 RETIREMENT PLAN: FERS	0.733	0.443	0.952	0.213	0.829	0.376	0.85	0.357
43 RETIREMENT PLAN: Other	0.002	0.046	0.012	0.11	0.007	0.084	0.008	0.088
44 CAREER LEVEL: Entry-Level	0.19	0.392	0.394	0.489	0.273	0.446	0.307	0.461
45 CAREER LEVEL: Mid-Level	0.722	0.448	0.537	0.499	0.646	0.478	0.619	0.486
46 CAREER LEVEL: Sen/Exec	0.083	0.276	0.054	0.226	0.071	0.257	0.063	0.244
47 CAREER LEVEL: Uncategorized	0.005	0.071	0.015	0.121	0.01	0.098	0.011	0.103
48 COHORT YEAR: 2001	0.181	0.385	0.117	0.322	0.149	0.356	0.133	0.34
49 COHORT YEAR: 2002	0.192	0.394	0.173	0.378	0.177	0.382	0.178	0.383
50 COHORT YEAR: 2003	0.139	0.346	0.171	0.376	0.147	0.354	0.16	0.367
51 COHORT YEAR: 2004	0.196	0.397	0.17	0.376	0.194	0.395	0.188	0.391
52 COHORT YEAR: 2005	0.177	0.382	0.18	0.384	0.179	0.384	0.185	0.388
53 COHORT YEAR: 2007	0.114	0.318	0.189	0.391	0.154	0.361	0.156	0.363
54 YRS TO RET ELIG: <5 Yrs to Go	0.117	0.321	0.037	0.188	0.081	0.273	0.073	0.259
55 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.332	0.471	0.316	0.465	0.331	0.471	0.327	0.469
56 YRS TO RET ELIG: 20+ YRs to Go	0.295	0.456	0.562	0.496	0.404	0.491	0.438	0.496
57 YRS TO RET ELIG: 5-9 Yrs to Go	0.184	0.387	0.075	0.264	0.138	0.344	0.126	0.332
58 YRS TO RET ELIG: Ret Eligible	0.072	0.259	0.01	0.1	0.045	0.208	0.036	0.187
59 PAY PLAN: Broad GS	0.855	0.352	0.72	0.449	0.795	0.404	0.782	0.413
60 PAY PLAN: Demo	0.122	0.328	0.239	0.427	0.171	0.377	0.186	0.389
61 PAY PLAN: NSPS	0.018	0.134	0.027	0.161	0.025	0.156	0.022	0.148
62 PAY PLAN: Other	0.004	0.066	0.014	0.117	0.009	0.093	0.01	0.099
63 HCAP: Handicapped	0.084	0.278	0.081	0.273	0.085	0.279	0.087	0.282
64 HCAP: Not Handicapped	0.916	0.278	0.919	0.273	0.915	0.279	0.913	0.282

Figure D.3.1. Absolute Standard Differences in Means Decrease Substantially after Weighting
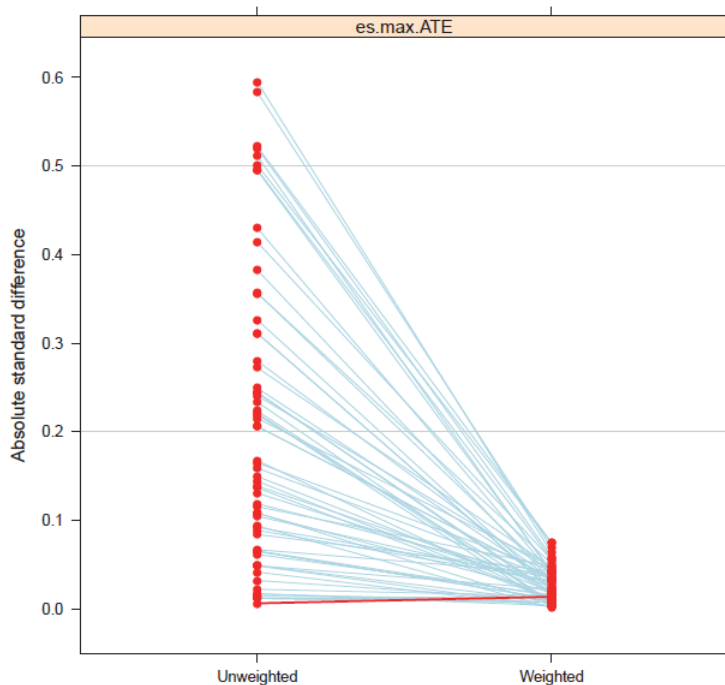
Figure D.3.2. After Weighting, One or Two Differences in Means are no Longer Statistically Significant
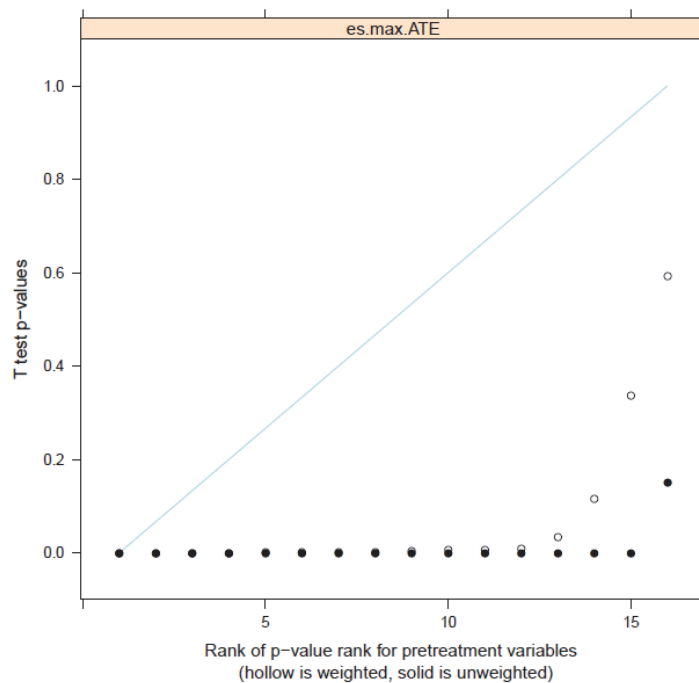
Appendix E. Balance Results for DoD-Experienced External Hires vs. Non-DoD-Experienced External Hires

Sections E.1-E.3 show how the pre-policy cohort groups analyzed in Part I of the retention analysis (see Table E.1, below) balance,[97] in terms of the observable characteristics listed in Table 6.2, before and after propensity-score weight implementation. Tables E.1.1-E.3.1 list the variable means and standard deviations before and after weighting. And the figures illustrate how effectively the propensity-score weights bring the variable means of the two groups (external hires with prior DoD experience vs. those with no prior DoD experience) into balance.

For all three cohort groups analyzed, the applied propensity-score weights significantly improve the balance between the two groups. Figures E.1.1-E.3.1 illustrate that the differences in the variable means between the two groups decrease substantially after weighting. In no cases—post-weighting—is the "Absolute standard difference"[98] in variable means between groups greater than 0.2, which is the threshold referenced in the RAND TWANG (Griffin et al., 2014; Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c).[99]

Figures E.1.2-E.3.2 show that after applying propensity-score weights some of the differences in variable means between groups are no longer statistically significant.

The tables and figures presented in sections E.1-E.3 come from the output of RAND's TWANG (Griffin et al., 2014).

Table E.1. Pre-Policy Cohort Groups Analyzed in Retention Analysis Part I

Cohort Group Name	FY Cohorts Included
Early Pre-policy cohort group	2001-2003
Later pre-policy cohort group	2004, 2005, and 2007
Combination pre-policy cohort group	2001-2005 and 2007

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[97] Griffin and McCaffrey (2015b) and Griffin and McCaffrey (2015a) state that balance assessments should consider differences in variable means and variable distributions between groups. The balance analyses in this study focus on comparing variable means and do not include comparing variable distributions because most of the variables used are categorical—for these variables the means and distributions are essentially the same thing.

[98] This phrase stems from Griffin and McCaffrey (2015c) (p. 28). The phrase is used throughout the following section.

[99] Some researchers use a stricter threshold of 0.1 (Austin and Stuart, 2015).

E.1 Early Pre-Policy Cohort Group

Table E.1.1. Means and Standard Deviations Before and After Propensity-Score Weighting

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 AGE	42.888	8.379	31.77	10.251	37.638	10.669	36.082	10.909
2 LN(COMPENSATION)	10.859	0.345	10.677	0.314	10.78	0.34	10.743	0.336
3 RACE: Other	0.192	0.394	0.235	0.424	0.209	0.407	0.217	0.412
4 RACE: White	0.808	0.394	0.765	0.424	0.791	0.407	0.783	0.412
5 EDUCATION: BA	0.4	0.49	0.691	0.462	0.541	0.498	0.583	0.493
6 EDUCATION: Less than BA	0.28	0.449	0.079	0.27	0.189	0.392	0.156	0.363
7 EDUCATION: More than BA	0.32	0.467	0.23	0.421	0.27	0.444	0.262	0.44
8 DOD ORG: Air Force	0.204	0.403	0.12	0.325	0.17	0.375	0.145	0.352
9 DOD ORG: Army	0.312	0.463	0.318	0.466	0.317	0.465	0.33	0.47
10 DOD ORG: Navy	0.384	0.486	0.497	0.5	0.431	0.495	0.449	0.497
11 DOD ORG: Other	0.1	0.3	0.065	0.246	0.082	0.274	0.075	0.264
12 REGION: East North Central	0.084	0.278	0.084	0.277	0.083	0.277	0.081	0.273
13 REGION: East South Central	0.067	0.25	0.071	0.257	0.065	0.246	0.069	0.253
14 REGION: Mid Atlantic	0.059	0.236	0.116	0.321	0.1	0.3	0.093	0.291
15 REGION: Mountain	0.088	0.283	0.045	0.207	0.063	0.243	0.063	0.244
16 REGION: New England	0.044	0.204	0.051	0.22	0.047	0.211	0.049	0.215
17 REGION: Other or Missing	0.028	0.166	0.007	0.082	0.018	0.133	0.014	0.118
18 REGION: Pacific	0.147	0.354	0.198	0.399	0.161	0.367	0.187	0.39
19 REGION: South Atlantic	0.411	0.492	0.378	0.485	0.402	0.49	0.387	0.487
20 REGION: West North Central	0.013	0.115	0.007	0.085	0.01	0.097	0.009	0.092
21 REGION: West South Central	0.059	0.236	0.043	0.203	0.052	0.222	0.049	0.216
22 GENDER: Female	0.199	0.399	0.311	0.463	0.26	0.439	0.271	0.444
23 GENDER: Male	0.801	0.399	0.689	0.463	0.74	0.439	0.729	0.444
24 POSITION TYPE: Administrative	0.386	0.487	0.107	0.309	0.25	0.433	0.207	0.405
25 POSITION TYPE: Other	0.016	0.125	0.01	0.099	0.015	0.123	0.011	0.106
26 POSITION TYPE: Professional	0.554	0.497	0.868	0.338	0.703	0.457	0.758	0.429
27 POSITION TYPE: Technical	0.044	0.206	0.015	0.122	0.031	0.173	0.024	0.153
28 SUPERVISOR: All Other Positions	0.923	0.267	0.99	0.1	0.955	0.208	0.974	0.158
29 SUPERVISOR: Supvisor/Mngr/Ldr	0.077	0.267	0.01	0.1	0.045	0.208	0.026	0.158
30 ACQ CAREER FLD: Business (CE or FM)	0.044	0.206	0.034	0.182	0.039	0.193	0.04	0.196
31 ACQ CAREER FLD: Contracting	0.208	0.406	0.162	0.369	0.189	0.392	0.179	0.383
32 ACQ CAREER FLD: Engineering	0.256	0.436	0.518	0.5	0.384	0.486	0.421	0.494
33 ACQ CAREER FLD: Facilities Engineering	0.026	0.159	0.046	0.209	0.042	0.2	0.041	0.198
34 ACQ CAREER FLD: Information Tech	0.056	0.229	0.025	0.157	0.04	0.196	0.038	0.192
35 ACQ CAREER FLD: Life Cycle Logistics	0.116	0.32	0.025	0.157	0.068	0.252	0.058	0.233
36 ACQ CAREER FLD: Other	0.032	0.177	0.015	0.121	0.025	0.157	0.023	0.148
37 ACQ CAREER FLD: Prod, Quality & Manuf	0.042	0.2	0.02	0.139	0.03	0.171	0.026	0.158
38 ACQ CAREER FLD: Program Management	0.107	0.308	0.027	0.163	0.074	0.261	0.054	0.226
39 ACQ CAREER FLD: Test and Eval	0.061	0.239	0.09	0.286	0.064	0.244	0.077	0.266

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.054	0.225	0.037	0.189	0.045	0.208	0.045	0.207
41 RETIREMENT PLAN: CSRS	0.094	0.292	0.008	0.088	0.053	0.223	0.029	0.168
42 RETIREMENT PLAN: FERS	0.89	0.313	0.987	0.112	0.937	0.243	0.962	0.19
43 RETIREMENT PLAN: Other	0.016	0.126	0.005	0.071	0.01	0.1	0.008	0.092
44 CAREER LEVEL: Entry-Level	0.183	0.387	0.554	0.497	0.344	0.475	0.411	0.492
45 CAREER LEVEL: Mid-Level	0.722	0.448	0.426	0.494	0.597	0.49	0.551	0.497
46 CAREER LEVEL: Sen/Exec	0.071	0.257	0.014	0.115	0.043	0.204	0.028	0.165
47 CAREER LEVEL: Uncategorized	0.023	0.151	0.007	0.081	0.015	0.121	0.01	0.099
48 COHORT YEAR: 2001	0.259	0.438	0.25	0.433	0.235	0.424	0.258	0.437
49 COHORT YEAR: 2002	0.356	0.479	0.393	0.488	0.379	0.485	0.388	0.487
50 COHORT YEAR: 2003	0.385	0.487	0.357	0.479	0.386	0.487	0.354	0.478
51 YRS TO RET ELIG: <5 Yrs to Go	0.05	0.218	0.025	0.156	0.039	0.193	0.032	0.175
52 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.512	0.5	0.143	0.35	0.333	0.471	0.28	0.449
53 YRS TO RET ELIG: 20+ YRs to Go	0.296	0.456	0.792	0.406	0.534	0.499	0.61	0.488
54 YRS TO RET ELIG: 5-9 Yrs to Go	0.123	0.328	0.036	0.187	0.082	0.274	0.072	0.259
55 YRS TO RET ELIG: Ret Eligible	0.019	0.136	0.004	0.064	0.012	0.109	0.007	0.08
56 PAY PLAN: Broad GS	0.765	0.424	0.682	0.466	0.714	0.452	0.714	0.452
57 PAY PLAN: Demo	0.212	0.408	0.313	0.464	0.271	0.444	0.277	0.448
58 PAY PLAN: Other	0.023	0.151	0.005	0.071	0.015	0.121	0.009	0.092
59 HCAP: Handicapped	0.116	0.32	0.067	0.25	0.092	0.289	0.082	0.275
60 HCAP: Not Handicapped	0.884	0.32	0.933	0.25	0.908	0.289	0.918	0.275

Figure E.1.1. Absolute Standard Differences in Means Decrease Substantially After Weighting

Figure E.1.2. After Weighting, Some Differences in Means are no Longer Statistically Significant
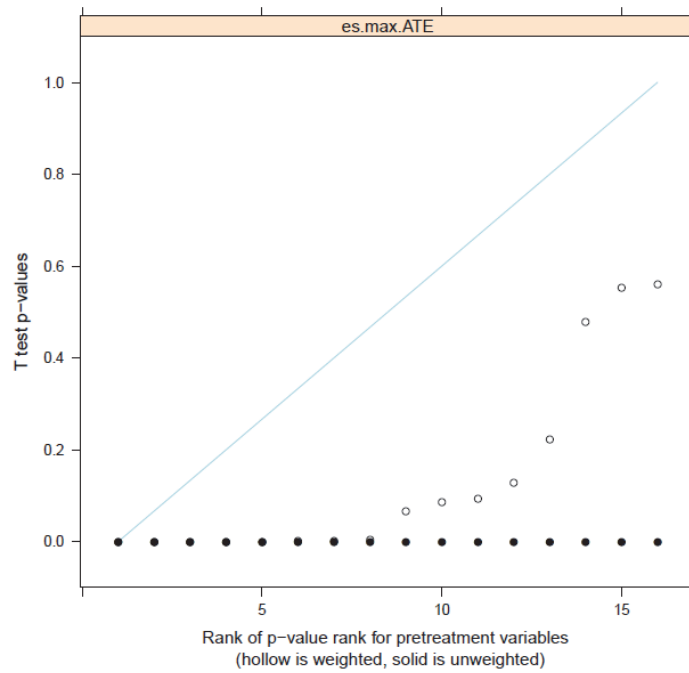
E.2 Later Pre-Policy Cohort Group

Table E.2.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted				Weighted			
		DoD		No DoD		DoD		No DoD	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	AGE	43.306	8.367	31.223	10.017	37.545	10.852	35.875	10.998
2	LN(COMPENSATION)	10.946	0.363	10.665	0.325	10.814	0.37	10.775	0.363
3	RACE: Other	0.206	0.405	0.212	0.409	0.226	0.418	0.203	0.402
4	RACE: White	0.794	0.405	0.788	0.409	0.774	0.418	0.797	0.402
5	EDUCATION: BA	0.371	0.483	0.68	0.466	0.529	0.499	0.573	0.495
6	EDUCATION: Less than BA	0.3	0.458	0.082	0.275	0.196	0.397	0.16	0.367
7	EDUCATION: More than BA	0.329	0.47	0.238	0.426	0.275	0.446	0.267	0.442
8	DOD ORG: Air Force	0.197	0.398	0.089	0.284	0.143	0.35	0.121	0.326
9	DOD ORG: Army	0.387	0.487	0.411	0.492	0.385	0.487	0.401	0.49
10	DOD ORG: Navy	0.282	0.45	0.341	0.474	0.329	0.47	0.327	0.469
11	DOD ORG: Other	0.134	0.34	0.16	0.366	0.143	0.35	0.151	0.358
12	REGION: East North Central	0.102	0.303	0.112	0.315	0.103	0.304	0.106	0.308
13	REGION: East South Central	0.08	0.272	0.083	0.276	0.082	0.275	0.075	0.263
14	REGION: Mid Atlantic	0.064	0.245	0.187	0.39	0.111	0.314	0.138	0.345
15	REGION: Mountain	0.081	0.273	0.048	0.213	0.062	0.241	0.059	0.235
16	REGION: New England	0.036	0.186	0.037	0.189	0.04	0.195	0.038	0.192
17	REGION: Other or Missing	0.031	0.174	0.008	0.09	0.021	0.145	0.017	0.13
18	REGION: Pacific	0.122	0.327	0.128	0.334	0.12	0.325	0.123	0.329
19	REGION: South Atlantic	0.398	0.49	0.357	0.479	0.399	0.49	0.394	0.489
20	REGION: West North Central	0.017	0.129	0.009	0.095	0.012	0.109	0.011	0.106
21	REGION: West South Central	0.068	0.252	0.031	0.173	0.05	0.219	0.038	0.19
22	GENDER: Female	0.211	0.408	0.366	0.482	0.31	0.463	0.318	0.466
23	GENDER: Male	0.789	0.408	0.634	0.482	0.69	0.463	0.682	0.466
24	POSITION TYPE: Administrative	0.444	0.497	0.154	0.361	0.297	0.457	0.25	0.433
25	POSITION TYPE: Other	0.013	0.112	0.009	0.092	0.01	0.099	0.011	0.105
26	POSITION TYPE: Professional	0.487	0.5	0.816	0.387	0.655	0.475	0.705	0.456
27	POSITION TYPE: Technical	0.056	0.231	0.021	0.144	0.039	0.193	0.034	0.181
28	SUPERVISOR: All Other Positions	0.898	0.302	0.99	0.102	0.943	0.233	0.957	0.202
29	SUPERVISOR: Supvisor/Mngr/Ldr	0.102	0.302	0.01	0.102	0.057	0.233	0.043	0.202
30	ACQ CAREER FLD: Business (CE or FM)	0.05	0.219	0.049	0.217	0.055	0.228	0.052	0.221
31	ACQ CAREER FLD: Contracting	0.236	0.425	0.198	0.398	0.224	0.417	0.222	0.416
32	ACQ CAREER FLD: Engineering	0.165	0.371	0.388	0.487	0.277	0.447	0.303	0.459
33	ACQ CAREER FLD: Facilities Engineering	0.027	0.162	0.045	0.207	0.041	0.199	0.039	0.193
34	ACQ CAREER FLD: Information Tech	0.044	0.206	0.025	0.155	0.033	0.179	0.036	0.187
35	ACQ CAREER FLD: Life Cycle Logistics	0.155	0.362	0.047	0.211	0.098	0.297	0.078	0.268
36	ACQ CAREER FLD: Other	0.029	0.169	0.013	0.112	0.021	0.145	0.021	0.143
37	ACQ CAREER FLD: Prod, Quality & Manuf	0.076	0.265	0.04	0.196	0.054	0.226	0.049	0.216
38	ACQ CAREER FLD: Program Management	0.12	0.325	0.027	0.161	0.072	0.258	0.06	0.238
39	ACQ CAREER FLD: Test and Eval	0.05	0.217	0.063	0.242	0.051	0.219	0.058	0.234

	Balance Factors	Unweighted				Weighted			
		DoD		No DoD		DoD		No DoD	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
40	ACQ CAREER FLD: Unknown/Missing	0.048	0.213	0.106	0.308	0.074	0.262	0.082	0.275
41	RETIREMENT PLAN: CSRS	0.048	0.214	0.004	0.063	0.027	0.161	0.015	0.121
42	RETIREMENT PLAN: FERS	0.932	0.252	0.987	0.112	0.96	0.195	0.972	0.164
43	RETIREMENT PLAN: Other	0.02	0.141	0.009	0.093	0.013	0.114	0.013	0.113
44	CAREER LEVEL: Entry-Level	0.184	0.387	0.6	0.49	0.383	0.486	0.435	0.496
45	CAREER LEVEL: Mid-Level	0.675	0.469	0.372	0.483	0.532	0.499	0.498	0.5
46	CAREER LEVEL: Sen/Exec	0.122	0.328	0.016	0.126	0.07	0.256	0.054	0.226
47	CAREER LEVEL: Uncategorized	0.019	0.137	0.011	0.107	0.014	0.118	0.012	0.11
48	COHORT YEAR: 2004	0.301	0.459	0.329	0.47	0.322	0.467	0.334	0.472
49	COHORT YEAR: 2005	0.348	0.476	0.321	0.467	0.346	0.476	0.323	0.468
50	COHORT YEAR: 2007	0.351	0.477	0.35	0.477	0.332	0.471	0.343	0.475
51	YRS TO RET ELIG: <5 Yrs to Go	0.052	0.221	0.024	0.152	0.038	0.191	0.034	0.182
52	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.53	0.499	0.132	0.338	0.336	0.472	0.279	0.449
53	YRS TO RET ELIG: 20+ YRs to Go	0.283	0.451	0.808	0.394	0.537	0.499	0.614	0.487
54	YRS TO RET ELIG: 5-9 Yrs to Go	0.119	0.324	0.034	0.18	0.079	0.27	0.066	0.248
55	YRS TO RET ELIG: Ret Eligible	0.016	0.124	0.004	0.06	0.01	0.099	0.007	0.082
56	PAY PLAN: Broad GS	0.723	0.448	0.716	0.451	0.713	0.452	0.722	0.448
57	PAY PLAN: Demo	0.186	0.389	0.244	0.429	0.224	0.417	0.223	0.417
58	PAY PLAN: NSPS	0.072	0.259	0.03	0.171	0.049	0.216	0.043	0.202
59	PAY PLAN: Other	0.019	0.135	0.01	0.1	0.014	0.116	0.012	0.107
60	HCAP: Handicapped	0.099	0.298	0.051	0.22	0.076	0.265	0.068	0.253
61	HCAP: Not Handicapped	0.901	0.298	0.949	0.22	0.924	0.265	0.932	0.253

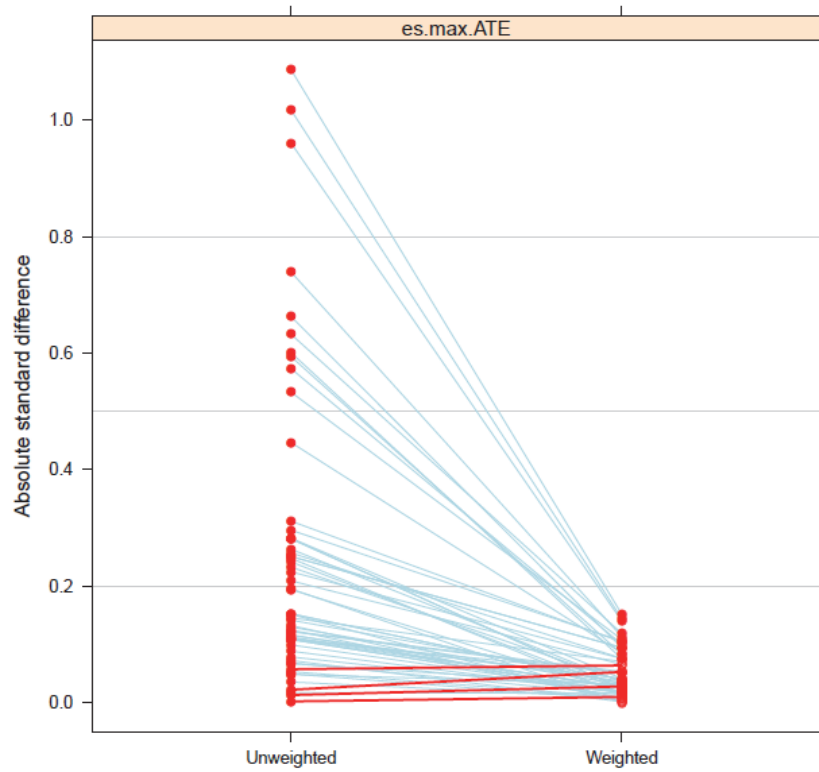**Figure E.2.1. Absolute Standard Differences in Means Decrease Substantially After Weighting**
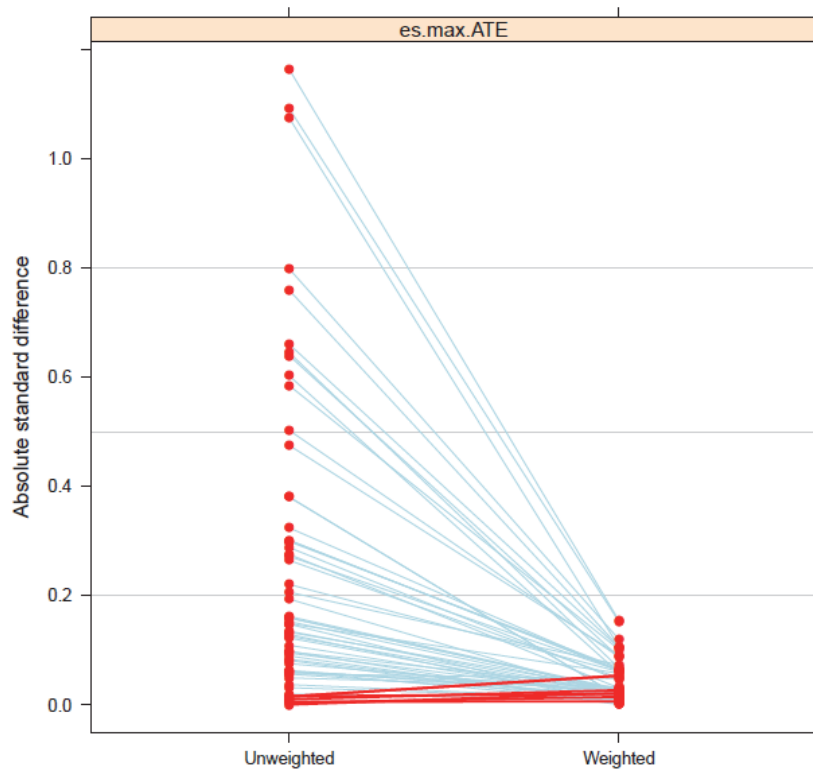
Figure E.2.2. After Weighting, Several Differences in Means are no Longer Statistically Significant
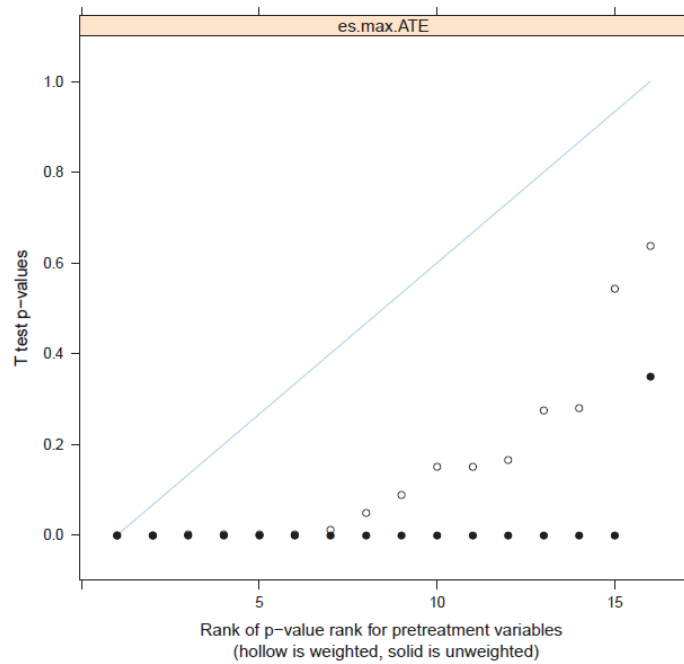
E.3 Combination Pre-Policy Cohort Group

Table E.3.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted				Weighted			
		DoD		No DoD		DoD		No DoD	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	AGE	43.111	8.375	31.473	10.128	37.417	10.844	36.145	10.984
2	LN(COMPENSATION)	10.905	0.357	10.67	0.32	10.798	0.353	10.765	0.352
3	RACE: Other	0.2	0.4	0.223	0.416	0.22	0.414	0.21	0.408
4	RACE: White	0.8	0.4	0.777	0.416	0.78	0.414	0.79	0.408
5	EDUCATION: BA	0.385	0.486	0.685	0.465	0.541	0.498	0.574	0.495
6	EDUCATION: Less than BA	0.291	0.454	0.081	0.273	0.187	0.39	0.161	0.368
7	EDUCATION: More than BA	0.325	0.468	0.234	0.423	0.272	0.445	0.265	0.441
8	DOD ORG: Air Force	0.2	0.4	0.103	0.304	0.152	0.359	0.134	0.34
9	DOD ORG: Army	0.352	0.478	0.369	0.482	0.357	0.479	0.37	0.483
10	DOD ORG: Navy	0.33	0.47	0.412	0.492	0.379	0.485	0.38	0.485
11	DOD ORG: Other	0.118	0.323	0.116	0.321	0.112	0.315	0.116	0.321
12	REGION: East North Central	0.094	0.292	0.099	0.299	0.094	0.292	0.095	0.294
13	REGION: East South Central	0.074	0.262	0.078	0.267	0.076	0.265	0.072	0.258
14	REGION: Mid Atlantic	0.062	0.241	0.155	0.362	0.106	0.308	0.116	0.32
15	REGION: Mountain	0.084	0.278	0.046	0.21	0.061	0.24	0.062	0.242
16	REGION: New England	0.039	0.195	0.043	0.204	0.043	0.202	0.043	0.202
17	REGION: Other or Missing	0.03	0.171	0.008	0.087	0.019	0.138	0.018	0.132
18	REGION: Pacific	0.133	0.34	0.16	0.367	0.138	0.345	0.153	0.36
19	REGION: South Atlantic	0.404	0.491	0.366	0.482	0.401	0.49	0.389	0.488
20	REGION: West North Central	0.015	0.123	0.008	0.09	0.011	0.103	0.01	0.1
21	REGION: West South Central	0.064	0.245	0.036	0.187	0.05	0.218	0.042	0.201
22	GENDER: Female	0.205	0.404	0.341	0.474	0.291	0.454	0.295	0.456
23	GENDER: Male	0.795	0.404	0.659	0.474	0.709	0.454	0.705	0.456
24	POSITION TYPE: Administrative	0.417	0.493	0.132	0.339	0.27	0.444	0.235	0.424
25	POSITION TYPE: Other	0.014	0.119	0.009	0.095	0.011	0.103	0.011	0.102
26	POSITION TYPE: Professional	0.518	0.5	0.84	0.367	0.685	0.465	0.726	0.446
27	POSITION TYPE: Technical	0.051	0.219	0.018	0.134	0.034	0.182	0.029	0.167
28	SUPERVISOR: All Other Positions	0.91	0.286	0.99	0.101	0.949	0.219	0.963	0.188
29	SUPERVISOR: Supvisor/Mngr/Ldr	0.09	0.286	0.01	0.101	0.051	0.219	0.037	0.188
30	ACQ CAREER FLD: Business (CE or FM)	0.048	0.213	0.042	0.202	0.047	0.213	0.045	0.208
31	ACQ CAREER FLD: Contracting	0.223	0.416	0.181	0.385	0.205	0.404	0.205	0.404
32	ACQ CAREER FLD: Engineering	0.207	0.405	0.448	0.497	0.335	0.472	0.353	0.478
33	ACQ CAREER FLD: Facilities Engineering	0.027	0.161	0.045	0.208	0.043	0.202	0.039	0.194
34	ACQ CAREER FLD: Information Tech	0.05	0.217	0.025	0.156	0.035	0.185	0.038	0.19
35	ACQ CAREER FLD: Life Cycle Logistics	0.137	0.344	0.037	0.189	0.082	0.274	0.072	0.258
36	ACQ CAREER FLD: Other	0.031	0.173	0.014	0.116	0.022	0.146	0.021	0.142
37	ACQ CAREER FLD: Prod, Quality & Manuf	0.06	0.237	0.031	0.173	0.042	0.201	0.038	0.191
38	ACQ CAREER FLD: Program Management	0.114	0.318	0.027	0.162	0.072	0.259	0.059	0.235
39	ACQ CAREER FLD: Test and Eval	0.055	0.227	0.075	0.264	0.057	0.231	0.066	0.249

Balance Factors	Unweighted				Weighted			
	DoD		No DoD		DoD		No DoD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40 ACQ CAREER FLD: Unknown/Missing	0.05	0.219	0.075	0.263	0.059	0.236	0.064	0.244
41 RETIREMENT PLAN: CSRS	0.07	0.255	0.006	0.075	0.038	0.191	0.028	0.165
42 RETIREMENT PLAN: FERS	0.912	0.283	0.987	0.112	0.951	0.217	0.961	0.195
43 RETIREMENT PLAN: Other	0.018	0.134	0.007	0.083	0.012	0.107	0.012	0.107
44 CAREER LEVEL: Entry-Level	0.183	0.387	0.579	0.494	0.371	0.483	0.418	0.493
45 CAREER LEVEL: Mid-Level	0.697	0.46	0.397	0.489	0.558	0.497	0.526	0.499
46 CAREER LEVEL: Sen/Exec	0.099	0.298	0.015	0.121	0.057	0.232	0.045	0.206
47 CAREER LEVEL: Uncategorized	0.021	0.144	0.009	0.096	0.014	0.118	0.011	0.106
48 COHORT YEAR: 2001	0.121	0.326	0.114	0.318	0.11	0.313	0.12	0.325
49 COHORT YEAR: 2002	0.166	0.372	0.18	0.384	0.176	0.381	0.178	0.383
50 COHORT YEAR: 2003	0.179	0.384	0.163	0.37	0.179	0.384	0.164	0.37
51 COHORT YEAR: 2004	0.161	0.367	0.179	0.383	0.172	0.377	0.179	0.384
52 COHORT YEAR: 2005	0.186	0.389	0.174	0.379	0.185	0.388	0.173	0.379
53 COHORT YEAR: 2007	0.187	0.39	0.19	0.393	0.178	0.383	0.185	0.388
54 YRS TO RET ELIG: <5 Yrs to Go	0.051	0.22	0.024	0.154	0.038	0.191	0.033	0.179
55 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.522	0.5	0.137	0.343	0.33	0.47	0.283	0.451
56 YRS TO RET ELIG: 20+ YRs to Go	0.289	0.453	0.8	0.4	0.543	0.498	0.601	0.49
57 YRS TO RET ELIG: 5-9 Yrs to Go	0.121	0.326	0.035	0.184	0.079	0.27	0.075	0.263
58 YRS TO RET ELIG: Ret Eligible	0.017	0.13	0.004	0.062	0.011	0.104	0.007	0.085
59 PAY PLAN: Broad GS	0.743	0.437	0.7	0.458	0.708	0.455	0.72	0.449
60 PAY PLAN: Demo	0.198	0.399	0.275	0.447	0.252	0.434	0.247	0.431
61 PAY PLAN: NSPS	0.038	0.192	0.016	0.127	0.026	0.16	0.022	0.148
62 PAY PLAN: Other	0.021	0.143	0.008	0.088	0.014	0.117	0.01	0.101
63 HCAP: Handicapped	0.107	0.309	0.058	0.235	0.083	0.275	0.077	0.267
64 HCAP: Not Handicapped	0.893	0.309	0.942	0.235	0.917	0.275	0.923	0.267

Figure E.3.1. Absolute Standard Differences in Means Decrease Substantially After Weighting
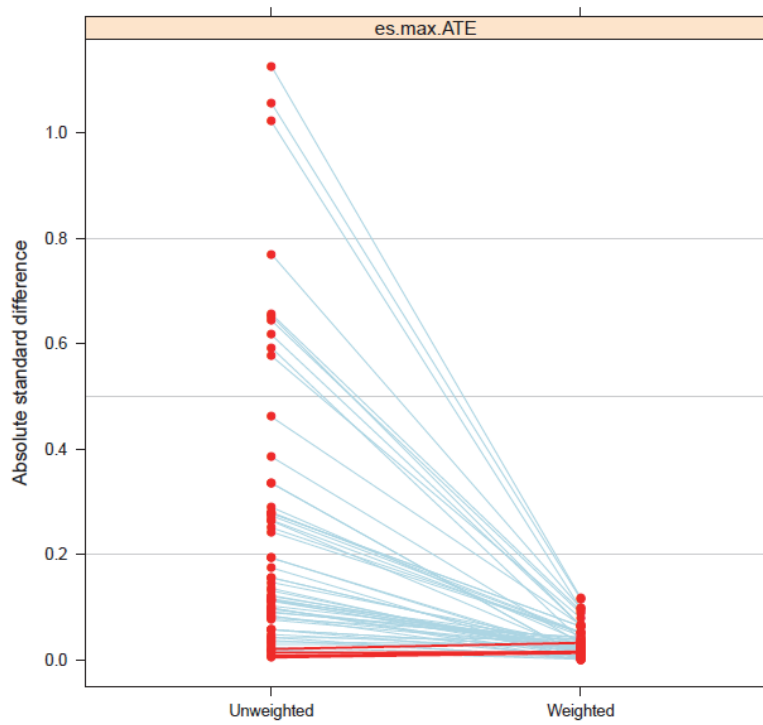
Figure E.3.2. After Weighting, Some Differences in Means are no Longer Statistically Significant
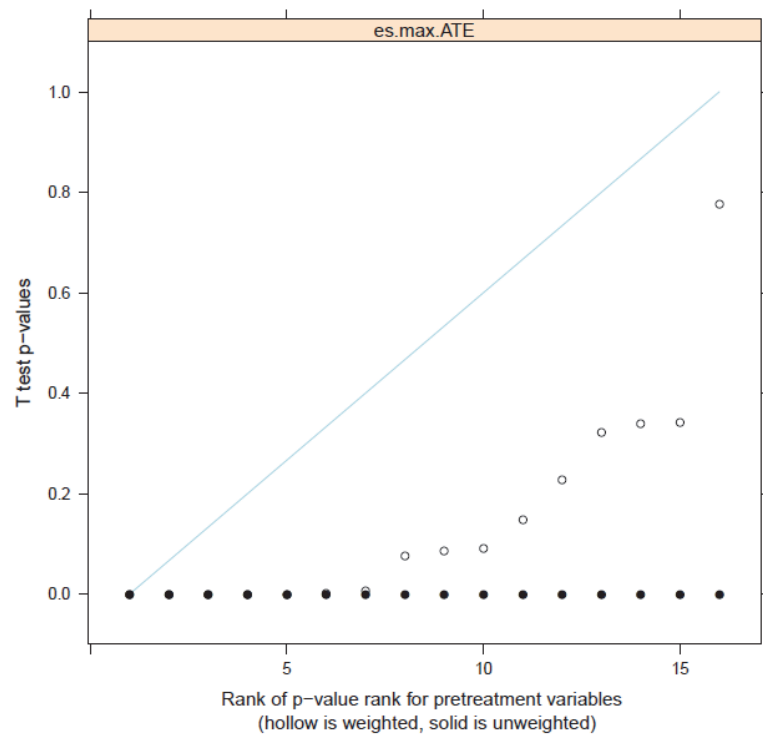
Appendix F. Retention Analysis Part I: Additional Results

Table F.1. Internal Hires Have a Lower Hazard of Separating From the Wider DoD Civilian Workforce Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	27224	28643	55867
Degrees of Freedom	27223	28642	55866
Estimation	-0.086	-0.140	-0.107
Hazard Ratio	0.918	0.869	0.899
Standard Error	0.035	0.030	0.021
p-value	0.0141	<.0001	<.0001

Appendix G. The Creation of the Synthetic Cohort Groups

This analysis uses propensity score weights (using RAND's TWANG (Griffin et al., 2014)) to create the synthetic cohort groups used in Part II of the retention analysis. Table G.1 gives an overview of the synthetic cohort groups created.

Table G.1. Synthetic Cohort Groups Created for Retention Analysis Part II

Cohort Group...	Weighted to Look Like...	Creates the...
Policy Cohort Group	Early Pre-Policy Cohort Group	Synthetic Early Pre-Policy Cohort Group
Policy Cohort Group	Later Pre-Policy Cohort Group	Synthetic Later Pre-Policy Cohort Group
Policy Cohort Group	Combination Pre-Policy Cohort Group	Synthetic Combination Pre-Policy Cohort Group
Early Pre-Policy Cohort Group	Policy Cohort Group	Synthetic Policy Cohort Group 1
Later Pre-Policy Cohort Group	Policy Cohort Group	Synthetic Policy Cohort Group 2
Combination Pre-Policy Cohort Group	Policy Cohort Group	Synthetic Policy Cohort Group 3

The prior-career-profile descriptors and all characteristics listed in Table 6.2, with the exception of Cohort Year and LN(Compensation), are used to create the synthetic cohort groups. Cohort Year is not included because it is impossible to weight one cohort group to match the cohort year distribution of another cohort group. LN(Compensation) is not included because, in general, nominal compensation levels tend to increase over time, so it is inaccurate to weight one cohort group to match the compensation distribution of another cohort group. The Pay Plan categories are adjusted for the creation of the synthetic cohorts, the "Broad GS" Pay Plan group and the "NSPS" Pay Plan group are combined into one, which is called the "Broad GS or NSPS" Pay Plan group.

To illustrate how the weighting process works, the following explanation uses the creation of the synthetic later pre-policy cohort group as an example. The same general process holds for the creation of all synthetic cohort groups.

To create the synthetic later pre-policy cohort group, RAND's TWANG compares the policy cohort group with the later pre-policy cohort group and assigns each observation (i.e., each civilian DAW entrant) in these groups with a propensity score.[100] In this case, the propensity score, *p(x)*, is the probability that that individual is in the later pre-policy cohort, given his or her

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[100] The descriptions of propensity-score-based-weighting presented in this study are based on the explanations from Griffin and McCaffrey (2015b), Griffin and McCaffrey (2015a), and McCaffrey, Ridgeway and Morral (2004).

observable characteristics (as seen in Equation B.4 in Appendix B) (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004). In general, the observations in the later pre-policy cohort group should receive higher propensity scores (Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a; McCaffrey, Ridgeway and Morral, 2004). Then, RAND's TWANG applies weights to the policy cohort group only, based on these propensity scores, such that the propensity score distribution for the observations in the policy cohort group looks more like that of the later pre-policy cohort group. Specifically, each observation (i) in the policy cohort group (c) will receive a weight that equals that observation's propensity score divided by one minus that observation's propensity score (see Equation G.1). Observations in the later pre-policy cohort group do not receive a weight (McCaffrey, Ridgeway and Morral, 2004; Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a).

Equation G.1. Applied weights for creating synthetic cohorts[101]

$$w_{ic} = \frac{p_i(x)}{(1 - p_i(x))}$$

Observations in the policy cohort group with higher propensity scores will receive higher weights, while those with lower propensity scores will receive lower weights (McCaffrey, Ridgeway and Morral, 2004; Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a). This policy cohort group with weights (weighted to resemble the later pre-policy cohort group) is called the synthetic later pre-policy cohort group.

Sections G.1-G.6, below, show the results from the weighting process for the creation of all six synthetic cohorts. In general, the results show that applied propensity-score weights are effective. None of the variables used has an "Absolute standard difference" [102] in means between the synthetic cohort group and the actual cohort group it is weighted to resemble greater than 0.2, which is the threshold referenced in the RAND TWANG (Griffin et al., 2014; Griffin and McCaffrey, 2015d; Griffin and McCaffrey, 2015c).[103] In fact, after weighting, there are no cases where the absolute standard difference in means is greater than 0.1.

The t-tests show that some of the differences in the variable means between the synthetic cohort group and the actual cohort group are no longer statistically significant after weighting. Some differences remain statistically significant. This statistical significance is likely due to the

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[101] This equation stems from McCaffrey, Ridgeway and Morral (2004) (pp. 405-406), Griffin and McCaffrey (2015b), and Griffin and McCaffrey (2015a) (p. 44). This is the weighting scheme used when implementing weights to estimate the average treatment effect on the treated (ATT) (McCaffrey, Ridgeway and Morral, 2004, pp. 405-406; Griffin and McCaffrey, 2015b; Griffin and McCaffrey, 2015a, p. 44). In this case, the later pre-policy cohort group is the quasi-treatment group, so the policy cohort group is weighted to look like the later pre-policy cohort group.

[102] This phrase stems from Griffin and McCaffrey (2015c) (p. 28). The phrase is used throughout the following section.

[103] Some researchers use a stricter threshold of 0.1 (Austin and Stuart, 2015).

large number of observations included; with so many observations, a small difference in means is likely to be statistically significant.

The tables and figures presented in sections G.1-C.6 come from the output of RAND's TWANG (Griffin et al., 2014).

G.1 Creating the Synthetic Early Pre-Policy Cohort Group from the Policy Cohort Group

Table G.1.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted					Weighted		
		Early Pre-Policy Cohort Group		Policy Cohort Group			Weighted Policy Cohort Group (Synthetic Early Pre-Policy Cohort Group)		
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.107	0.309	0.177	0.382	0.226	0.111	0.314	0.013
2	PRIOR CAREER PRFL: AD+DoDCiv	0.085	0.279	0.083	0.276	0.006	0.089	0.285	0.015
3	PRIOR CAREER PRFL: AD+MilDAW	0.027	0.161	0.05	0.219	0.148	0.028	0.165	0.009
4	PRIOR CAREER PRFL: DoDCiv	0.396	0.489	0.164	0.371	0.473	0.36	0.48	0.074
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.119	0.324	0.074	0.261	0.14	0.126	0.331	0.019
6	PRIOR CAREER PRFL: No DoD Exp	0.242	0.428	0.412	0.492	0.398	0.26	0.439	0.042
7	PRIOR CAREER PRFL: Other DoD Exp	0.024	0.153	0.038	0.192	0.093	0.026	0.16	0.014
8	AGE	40.347	11.006	39.372	11.638	0.089	40.179	11.205	0.015
9	RACE: Other	0.23	0.421	0.21	0.407	0.048	0.225	0.417	0.013
10	RACE: White	0.77	0.421	0.79	0.407	0.048	0.775	0.417	0.013
11	EDUCATION: BA	0.454	0.498	0.477	0.499	0.045	0.459	0.498	0.01
12	EDUCATION: Less than BA	0.331	0.471	0.241	0.427	0.193	0.324	0.468	0.015
13	EDUCATION: More than BA	0.215	0.411	0.283	0.45	0.166	0.217	0.412	0.005
14	DOD ORG: Air Force	0.151	0.358	0.191	0.393	0.111	0.147	0.355	0.011
15	DOD ORG: Army	0.413	0.492	0.323	0.468	0.181	0.385	0.487	0.056
16	DOD ORG: Navy	0.342	0.475	0.332	0.471	0.023	0.366	0.482	0.049
17	DOD ORG: Other	0.094	0.292	0.154	0.361	0.207	0.102	0.302	0.027
18	REGION: East North Central	0.105	0.306	0.135	0.342	0.099	0.109	0.312	0.015
19	REGION: East South Central	0.084	0.278	0.092	0.289	0.027	0.079	0.269	0.02
20	REGION: Mid Atlantic	0.1	0.3	0.086	0.281	0.046	0.094	0.292	0.02
21	REGION: Mountain	0.065	0.247	0.053	0.224	0.049	0.064	0.245	0.003
22	REGION: New England	0.04	0.196	0.035	0.185	0.025	0.04	0.195	0.002
23	REGION: Other or Missing	0.029	0.169	0.023	0.149	0.039	0.026	0.16	0.019
24	REGION: Pacific	0.151	0.358	0.127	0.333	0.066	0.153	0.36	0.006
25	REGION: South Atlantic	0.339	0.473	0.375	0.484	0.077	0.361	0.48	0.046
26	REGION: West North Central	0.014	0.116	0.012	0.107	0.017	0.012	0.111	0.01
27	REGION: West South Central	0.073	0.26	0.061	0.24	0.044	0.061	0.24	0.043
28	GENDER: Female	0.36	0.48	0.325	0.468	0.073	0.351	0.477	0.02
29	GENDER: Male	0.64	0.48	0.675	0.468	0.073	0.649	0.477	0.02
30	POSITION TYPE: Administrative	0.4	0.49	0.405	0.491	0.012	0.383	0.486	0.034
31	POSITION TYPE: Other	0.014	0.117	0.009	0.093	0.043	0.018	0.132	0.034
32	POSITION TYPE: Professional	0.536	0.499	0.535	0.499	0.001	0.553	0.497	0.034
33	POSITION TYPE: Technical	0.051	0.22	0.051	0.219	0.003	0.047	0.211	0.02
34	SUPERVISOR: All Other Positions	0.919	0.273	0.932	0.252	0.048	0.931	0.253	0.045
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.081	0.273	0.068	0.252	0.048	0.069	0.253	0.045

	Balance Factors	Unweighted					Weighted		
		Early Pre-Policy Cohort Group		Policy Cohort Group			Weighted Policy Cohort Group (Synthetic Early Pre-Policy Cohort Group)		
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
36	ACQ CAREER FLD: Business (CE or FM)	0.088	0.284	0.075	0.264	0.046	0.081	0.273	0.026
37	ACQ CAREER FLD: Contracting	0.151	0.358	0.199	0.399	0.134	0.16	0.366	0.024
38	ACQ CAREER FLD: Engineering	0.289	0.453	0.213	0.409	0.168	0.305	0.46	0.036
39	ACQ CAREER FLD: Facilities Engineering	0.028	0.165	0.063	0.242	0.209	0.03	0.17	0.01
40	ACQ CAREER FLD: Information Tech	0.071	0.257	0.053	0.224	0.07	0.061	0.24	0.038
41	ACQ CAREER FLD: Life Cycle Logistics	0.096	0.295	0.141	0.348	0.152	0.096	0.295	0.002
42	ACQ CAREER FLD: Other	0.038	0.192	0.026	0.159	0.065	0.042	0.2	0.019
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.044	0.205	0.062	0.242	0.09	0.043	0.202	0.006
44	ACQ CAREER FLD: Program Management	0.087	0.281	0.092	0.29	0.021	0.078	0.269	0.03
45	ACQ CAREER FLD: Test and Eval	0.051	0.219	0.039	0.195	0.051	0.052	0.223	0.008
46	ACQ CAREER FLD: Unknown/Missing	0.057	0.232	0.036	0.186	0.092	0.052	0.221	0.024
47	RETIREMENT PLAN: CSRS	0.201	0.401	0.035	0.184	0.414	0.163	0.37	0.094
48	RETIREMENT PLAN: FERS	0.793	0.405	0.955	0.207	0.4	0.832	0.374	0.096
49	RETIREMENT PLAN: Other	0.006	0.075	0.01	0.099	0.055	0.005	0.069	0.012
50	CAREER LEVEL: Entry-Level	0.265	0.441	0.295	0.456	0.07	0.283	0.451	0.042
51	CAREER LEVEL: Mid-Level	0.663	0.473	0.597	0.49	0.138	0.65	0.477	0.026
52	CAREER LEVEL: Sen/Exec	0.064	0.244	0.099	0.299	0.145	0.059	0.236	0.018
53	CAREER LEVEL: Uncategorized	0.009	0.095	0.008	0.09	0.01	0.007	0.085	0.02
54	YRS TO RET ELIG: <5 Yrs to Go	0.082	0.274	0.068	0.252	0.049	0.08	0.271	0.008
55	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.337	0.473	0.302	0.459	0.073	0.325	0.468	0.025
56	YRS TO RET ELIG: 20+ YRs to Go	0.392	0.488	0.487	0.5	0.195	0.412	0.492	0.041
57	YRS TO RET ELIG: 5-9 Yrs to Go	0.145	0.352	0.111	0.315	0.094	0.139	0.346	0.016
58	YRS TO RET ELIG: Ret Eligible	0.045	0.207	0.031	0.173	0.068	0.045	0.206	0.002
59	PAY PLAN: Broad GS or NSPS	0.802	0.398	0.847	0.36	0.113	0.794	0.405	0.022
60	PAY PLAN: Demo	0.19	0.392	0.139	0.346	0.13	0.2	0.4	0.027
61	PAY PLAN: Other	0.008	0.09	0.014	0.117	0.064	0.006	0.078	0.023
62	HCAP: Handicapped	0.087	0.282	0.082	0.275	0.018	0.086	0.281	0.003
63	HCAP: Not Handicapped	0.913	0.282	0.918	0.275	0.018	0.914	0.281	0.003

Figure G.1.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting

Figure G.1.2. After Weighting, Some Differences in Means are No Longer Statistically Significant
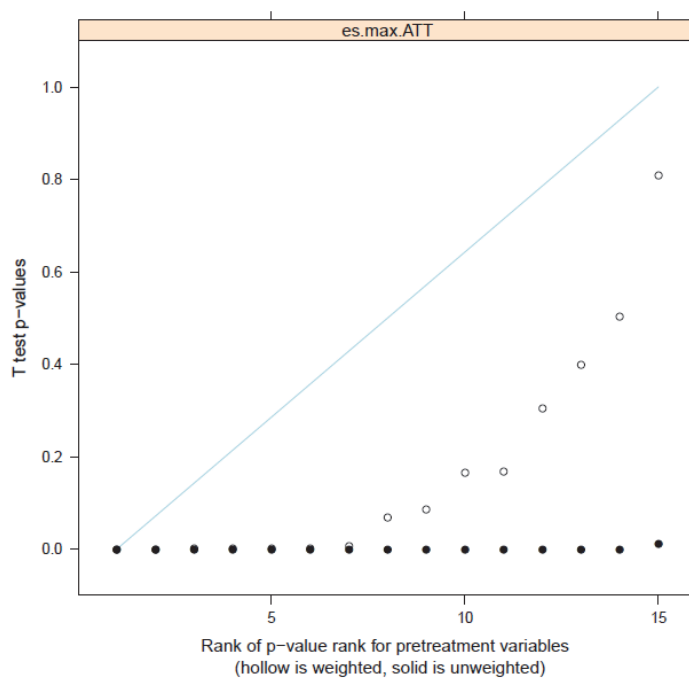
G.2 Creating the Synthetic Later Pre-Policy Cohort Group from the Policy Cohort Group

Table G.2.1. Means and Standard Deviations Before and After Propensity-Score Weighting

| | Balance Factors | Unweighted | | | | | Weighted | | |
| | | Later Pre-Policy Cohort Group | | Policy Cohort Group | | | Weighted Policy Cohort Group (Synthetic Later Pre-Policy Cohort Group) | | |
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.124	0.329	0.177	0.382	0.162	0.128	0.334	0.012
2	PRIOR CAREER PRFL: AD+DoDCiv	0.1	0.299	0.083	0.276	0.054	0.104	0.305	0.015
3	PRIOR CAREER PRFL: AD+MilDAW	0.042	0.2	0.05	0.219	0.044	0.041	0.199	0.001
4	PRIOR CAREER PRFL: DoDCiv	0.312	0.463	0.164	0.371	0.318	0.295	0.456	0.036
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.117	0.322	0.074	0.261	0.136	0.117	0.321	0.002
6	PRIOR CAREER PRFL: No DoD Exp	0.273	0.446	0.412	0.492	0.312	0.281	0.449	0.017
7	PRIOR CAREER PRFL: Other DoD Exp	0.033	0.177	0.038	0.192	0.033	0.034	0.182	0.009
8	AGE	39.257	11.492	39.372	11.638	0.01	39.228	11.536	0.002
9	RACE: Other	0.223	0.416	0.21	0.407	0.031	0.221	0.415	0.005
10	RACE: White	0.777	0.416	0.79	0.407	0.031	0.779	0.415	0.005
11	EDUCATION: BA	0.471	0.499	0.477	0.499	0.011	0.473	0.499	0.005
12	EDUCATION: Less than BA	0.289	0.453	0.241	0.427	0.107	0.284	0.451	0.011
13	EDUCATION: More than BA	0.24	0.427	0.283	0.45	0.1	0.243	0.429	0.006
14	DOD ORG: Air Force	0.151	0.358	0.191	0.393	0.112	0.152	0.359	0.002
15	DOD ORG: Army	0.449	0.497	0.323	0.468	0.252	0.433	0.496	0.031
16	DOD ORG: Navy	0.254	0.435	0.332	0.471	0.179	0.268	0.443	0.032
17	DOD ORG: Other	0.147	0.354	0.154	0.361	0.021	0.147	0.355	0.002
18	REGION: East North Central	0.126	0.332	0.135	0.342	0.028	0.125	0.331	0.002
19	REGION: East South Central	0.088	0.283	0.092	0.289	0.014	0.089	0.285	0.004
20	REGION: Mid Atlantic	0.117	0.321	0.086	0.281	0.094	0.117	0.321	0
21	REGION: Mountain	0.066	0.249	0.053	0.224	0.054	0.065	0.246	0.005
22	REGION: New England	0.034	0.182	0.035	0.185	0.006	0.035	0.183	0.003
23	REGION: Other or Missing	0.025	0.155	0.023	0.149	0.013	0.025	0.156	0.001
24	REGION: Pacific	0.116	0.32	0.127	0.333	0.037	0.116	0.321	0.003
25	REGION: South Atlantic	0.349	0.477	0.375	0.484	0.056	0.352	0.478	0.006
26	REGION: West North Central	0.016	0.126	0.012	0.107	0.036	0.014	0.117	0.018
27	REGION: West South Central	0.064	0.245	0.061	0.24	0.011	0.063	0.242	0.006
28	GENDER: Female	0.354	0.478	0.325	0.468	0.06	0.355	0.478	0.002
29	GENDER: Male	0.646	0.478	0.675	0.468	0.06	0.645	0.478	0.002
30	POSITION TYPE: Administrative	0.39	0.488	0.405	0.491	0.031	0.396	0.489	0.012
31	POSITION TYPE: Other	0.011	0.106	0.009	0.093	0.024	0.011	0.104	0.005
32	POSITION TYPE: Professional	0.543	0.498	0.535	0.499	0.015	0.538	0.499	0.009
33	POSITION TYPE: Technical	0.056	0.23	0.051	0.219	0.023	0.055	0.228	0.004
34	SUPERVISOR: All Other Positions	0.918	0.274	0.932	0.252	0.05	0.922	0.269	0.012
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.082	0.274	0.068	0.252	0.05	0.078	0.269	0.012
36	ACQ CAREER FLD: Business (CE or FM)	0.075	0.263	0.075	0.264	0.003	0.077	0.266	0.008

	Balance Factors	Unweighted					Weighted		
		Later Pre-Policy Cohort Group		Policy Cohort Group			Weighted Policy Cohort Group (Synthetic Later Pre-Policy Cohort Group)		
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
37	ACQ CAREER FLD: Contracting	0.168	0.374	0.199	0.399	0.083	0.176	0.381	0.022
38	ACQ CAREER FLD: Engineering	0.216	0.412	0.213	0.409	0.008	0.221	0.415	0.012
39	ACQ CAREER FLD: Facilities Engineering	0.074	0.262	0.063	0.242	0.044	0.062	0.24	0.048
40	ACQ CAREER FLD: Information Tech	0.04	0.195	0.053	0.224	0.069	0.041	0.197	0.005
41	ACQ CAREER FLD: Life Cycle Logistics	0.127	0.333	0.141	0.348	0.041	0.129	0.335	0.005
42	ACQ CAREER FLD: Other	0.03	0.171	0.026	0.159	0.026	0.033	0.18	0.018
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.073	0.26	0.062	0.242	0.04	0.076	0.265	0.011
44	ACQ CAREER FLD: Program Management	0.074	0.261	0.092	0.29	0.071	0.074	0.262	0.001
45	ACQ CAREER FLD: Test and Eval	0.043	0.203	0.039	0.195	0.017	0.044	0.205	0.004
46	ACQ CAREER FLD: Unknown/Missing	0.08	0.272	0.036	0.186	0.164	0.068	0.252	0.046
47	RETIREMENT PLAN: CSRS	0.109	0.312	0.035	0.184	0.239	0.094	0.292	0.048
48	RETIREMENT PLAN: FERS	0.882	0.322	0.955	0.207	0.226	0.897	0.304	0.046
49	RETIREMENT PLAN: Other	0.008	0.091	0.01	0.099	0.017	0.008	0.091	0.001
50	CAREER LEVEL: Entry-Level	0.312	0.463	0.295	0.456	0.035	0.321	0.467	0.021
51	CAREER LEVEL: Mid-Level	0.604	0.489	0.597	0.49	0.014	0.594	0.491	0.02
52	CAREER LEVEL: Sen/Exec	0.074	0.261	0.099	0.299	0.097	0.077	0.266	0.011
53	CAREER LEVEL: Uncategorized	0.01	0.101	0.008	0.09	0.022	0.008	0.088	0.026
54	YRS TO RET ELIG: <5 Yrs to Go	0.075	0.263	0.068	0.252	0.024	0.073	0.26	0.006
55	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.312	0.463	0.302	0.459	0.022	0.313	0.464	0.001
56	YRS TO RET ELIG: 20+ YRs to Go	0.455	0.498	0.487	0.5	0.065	0.46	0.498	0.009
57	YRS TO RET ELIG: 5-9 Yrs to Go	0.118	0.323	0.111	0.315	0.021	0.115	0.319	0.011
58	YRS TO RET ELIG: Ret Eligible	0.04	0.195	0.031	0.173	0.045	0.04	0.196	0.001
59	PAY PLAN: Broad GS or NSPS	0.821	0.383	0.847	0.36	0.068	0.826	0.379	0.013
60	PAY PLAN: Demo	0.169	0.375	0.139	0.346	0.08	0.166	0.372	0.007
61	PAY PLAN: Other	0.01	0.098	0.014	0.117	0.042	0.008	0.087	0.022
62	HCAP: Handicapped	0.078	0.269	0.082	0.275	0.014	0.079	0.27	0.003
63	HCAP: Not Handicapped	0.922	0.269	0.918	0.275	0.014	0.921	0.27	0.003

Figure G.2.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting
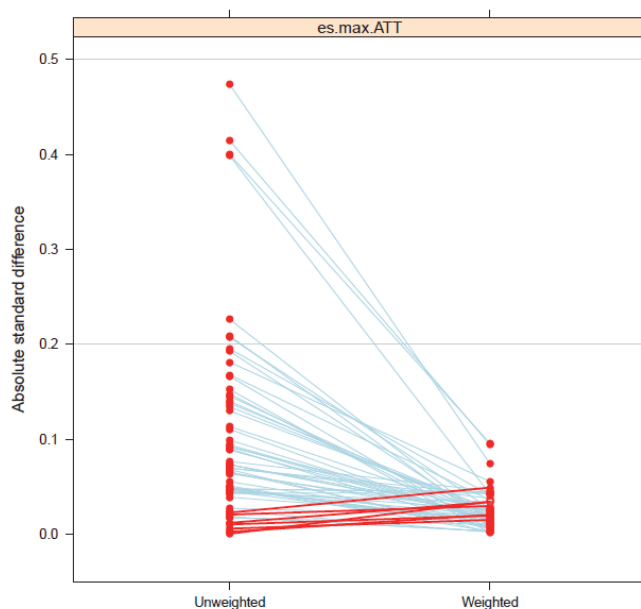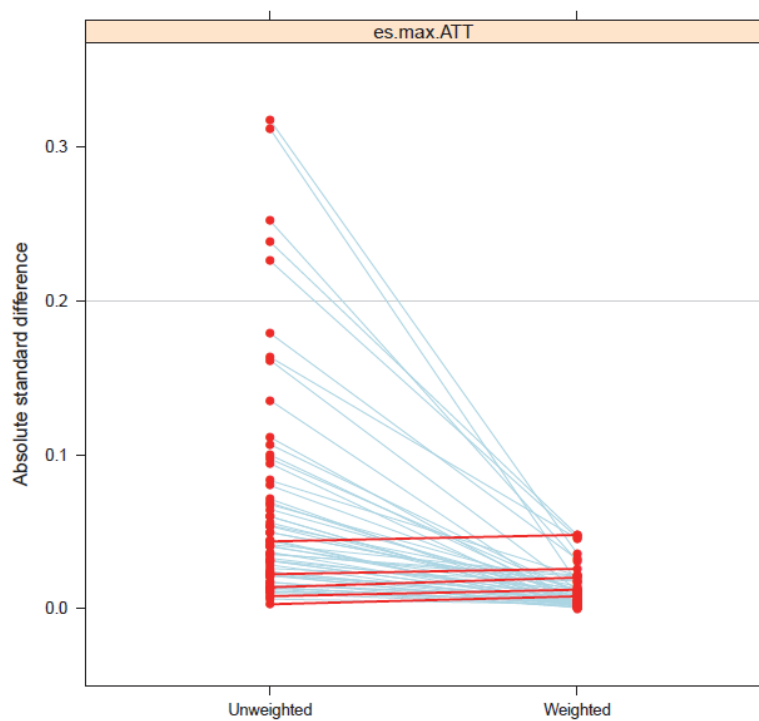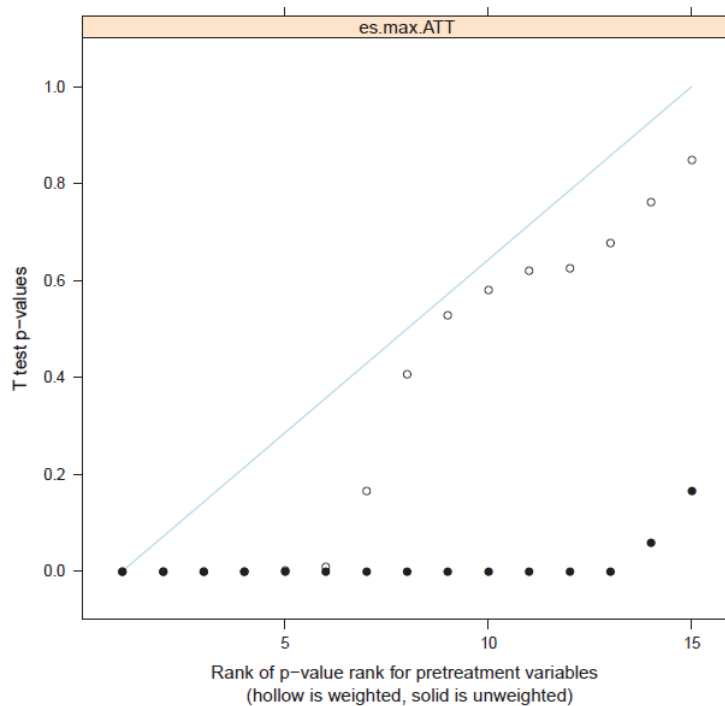

Figure G.2.2. After Weighting, Some Differences in Means are No Longer Statistically Significant

G.3 Creating the Synthetic Combination Pre-Policy Cohort Group from the Policy Cohort Group

Table G.3.1. Means and Standard Deviations Before and After Propensity-Score Weighting

		Unweighted					Weighted		
		Combination Pre-Policy Cohort Group		Policy Cohort Group			Weighted Policy Cohort Group (Synthetic Combination Pre-Policy Cohort Group)		
	Balance Factors	Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.116	0.32	0.177	0.382	0.192	0.121	0.326	0.015
2	PRIOR CAREER PRFL: AD+DoDCiv	0.092	0.29	0.083	0.276	0.031	0.095	0.293	0.008
3	PRIOR CAREER PRFL: AD+MilDAW	0.034	0.182	0.05	0.219	0.089	0.036	0.187	0.01
4	PRIOR CAREER PRFL: DoDCiv	0.353	0.478	0.164	0.371	0.394	0.33	0.47	0.047
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.118	0.323	0.074	0.261	0.138	0.118	0.323	0.001
6	PRIOR CAREER PRFL: No DoD Exp	0.258	0.438	0.412	0.492	0.353	0.27	0.444	0.026
7	PRIOR CAREER PRFL: Other DoD Exp	0.028	0.166	0.038	0.192	0.06	0.031	0.173	0.014
8	AGE	39.788	11.271	39.372	11.638	0.037	39.664	11.384	0.011
9	RACE: Other	0.226	0.418	0.21	0.407	0.039	0.223	0.416	0.008
10	RACE: White	0.774	0.418	0.79	0.407	0.039	0.777	0.416	0.008
11	EDUCATION: BA	0.463	0.499	0.477	0.499	0.028	0.468	0.499	0.011
12	EDUCATION: Less than BA	0.31	0.462	0.241	0.427	0.149	0.305	0.46	0.011
13	EDUCATION: More than BA	0.228	0.419	0.283	0.45	0.132	0.227	0.419	0.001
14	DOD ORG: Air Force	0.151	0.358	0.191	0.393	0.111	0.147	0.354	0.011
15	DOD ORG: Army	0.431	0.495	0.323	0.468	0.218	0.413	0.492	0.037
16	DOD ORG: Navy	0.297	0.457	0.332	0.471	0.076	0.316	0.465	0.043
17	DOD ORG: Other	0.121	0.326	0.154	0.361	0.102	0.124	0.329	0.009
18	REGION: East North Central	0.116	0.32	0.135	0.342	0.061	0.12	0.324	0.013
19	REGION: East South Central	0.086	0.28	0.092	0.289	0.02	0.085	0.278	0.005
20	REGION: Mid Atlantic	0.109	0.311	0.086	0.281	0.072	0.106	0.308	0.008
21	REGION: Mountain	0.066	0.248	0.053	0.224	0.052	0.064	0.245	0.005
22	REGION: New England	0.037	0.189	0.035	0.185	0.009	0.037	0.189	0.001
23	REGION: Other or Missing	0.027	0.162	0.023	0.149	0.026	0.025	0.157	0.011
24	REGION: Pacific	0.133	0.339	0.127	0.333	0.016	0.133	0.34	0.001
25	REGION: South Atlantic	0.344	0.475	0.375	0.484	0.066	0.357	0.479	0.027
26	REGION: West North Central	0.015	0.121	0.012	0.107	0.027	0.013	0.113	0.017
27	REGION: West South Central	0.068	0.252	0.061	0.24	0.027	0.06	0.238	0.031
28	GENDER: Female	0.357	0.479	0.325	0.468	0.066	0.354	0.478	0.007
29	GENDER: Male	0.643	0.479	0.675	0.468	0.066	0.646	0.478	0.007
30	POSITION TYPE: Administrative	0.395	0.489	0.405	0.491	0.022	0.388	0.487	0.013
31	POSITION TYPE: Other	0.013	0.111	0.009	0.093	0.034	0.012	0.107	0.008
32	POSITION TYPE: Professional	0.539	0.498	0.535	0.499	0.008	0.547	0.498	0.016
33	POSITION TYPE: Technical	0.054	0.225	0.051	0.219	0.013	0.053	0.224	0.003
34	SUPERVISOR: All Other Positions	0.919	0.273	0.932	0.252	0.049	0.924	0.264	0.021
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.081	0.273	0.068	0.252	0.049	0.076	0.264	0.021
36	ACQ CAREER FLD: Business (CE or FM)	0.081	0.273	0.075	0.264	0.022	0.08	0.271	0.006

	Balance Factors	Unweighted					Weighted		
		Combination Pre-Policy Cohort Group		Policy Cohort Group			Weighted Policy Cohort Group (Synthetic Combination Pre-Policy Cohort Group)		
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
37	ACQ CAREER FLD: Contracting	0.16	0.366	0.199	0.399	0.108	0.168	0.374	0.024
38	ACQ CAREER FLD: Engineering	0.251	0.434	0.213	0.409	0.089	0.261	0.439	0.023
39	ACQ CAREER FLD: Facilities Engineering	0.052	0.221	0.063	0.242	0.05	0.047	0.211	0.022
40	ACQ CAREER FLD: Information Tech	0.055	0.228	0.053	0.224	0.008	0.051	0.22	0.019
41	ACQ CAREER FLD: Life Cycle Logistics	0.112	0.315	0.141	0.348	0.092	0.114	0.318	0.007
42	ACQ CAREER FLD: Other	0.034	0.182	0.026	0.159	0.046	0.035	0.183	0.002
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.059	0.235	0.062	0.242	0.015	0.061	0.239	0.009
44	ACQ CAREER FLD: Program Management	0.08	0.271	0.092	0.29	0.046	0.076	0.266	0.013
45	ACQ CAREER FLD: Test and Eval	0.047	0.211	0.039	0.195	0.034	0.048	0.214	0.007
46	ACQ CAREER FLD: Unknown/Missing	0.069	0.254	0.036	0.186	0.131	0.059	0.235	0.041
47	RETIREMENT PLAN: CSRS	0.154	0.361	0.035	0.184	0.33	0.129	0.335	0.07
48	RETIREMENT PLAN: FERS	0.839	0.368	0.955	0.207	0.316	0.865	0.342	0.071
49	RETIREMENT PLAN: Other	0.007	0.083	0.01	0.099	0.034	0.006	0.079	0.009
50	CAREER LEVEL: Entry-Level	0.289	0.453	0.295	0.456	0.014	0.302	0.459	0.029
51	CAREER LEVEL: Mid-Level	0.633	0.482	0.597	0.49	0.073	0.623	0.485	0.019
52	CAREER LEVEL: Sen/Exec	0.069	0.253	0.099	0.299	0.12	0.068	0.252	0.003
53	CAREER LEVEL: Uncategorized	0.01	0.098	0.008	0.09	0.017	0.007	0.082	0.03
54	YRS TO RET ELIG: <5 Yrs to Go	0.078	0.268	0.068	0.252	0.037	0.076	0.265	0.007
55	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.324	0.468	0.302	0.459	0.047	0.317	0.465	0.015
56	YRS TO RET ELIG: 20+ YRs to Go	0.424	0.494	0.487	0.5	0.127	0.437	0.496	0.025
57	YRS TO RET ELIG: 5-9 Yrs to Go	0.131	0.338	0.111	0.315	0.058	0.128	0.334	0.009
58	YRS TO RET ELIG: Ret Eligible	0.042	0.201	0.031	0.173	0.057	0.042	0.199	0.004
59	PAY PLAN: Broad GS or NSPS	0.812	0.391	0.847	0.36	0.09	0.808	0.394	0.009
60	PAY PLAN: Demo	0.179	0.383	0.139	0.346	0.105	0.186	0.389	0.017
61	PAY PLAN: Other	0.009	0.094	0.014	0.117	0.052	0.006	0.078	0.031
62	HCAP: Handicapped	0.083	0.275	0.082	0.275	0.002	0.082	0.275	0.001
63	HCAP: Not Handicapped	0.917	0.275	0.918	0.275	0.002	0.918	0.275	0.001

Figure G.3.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting
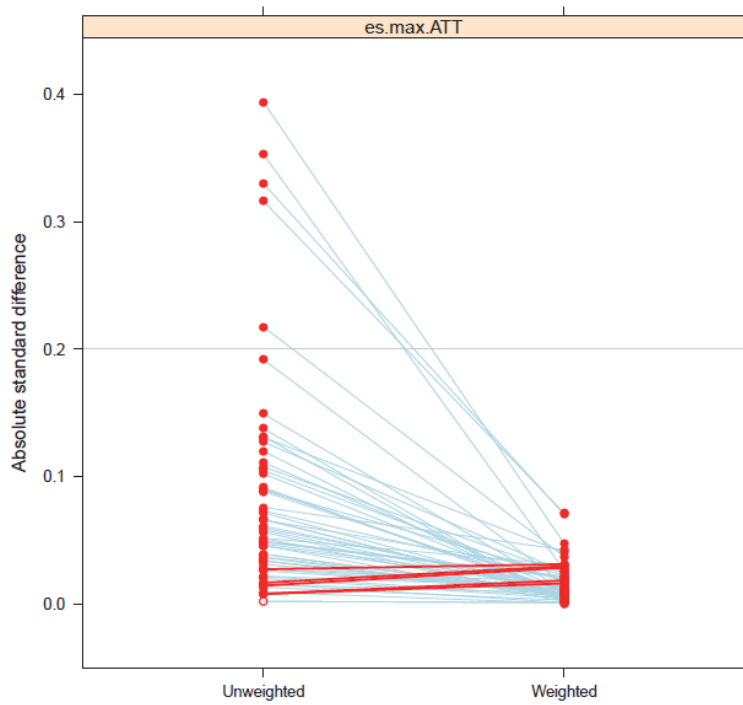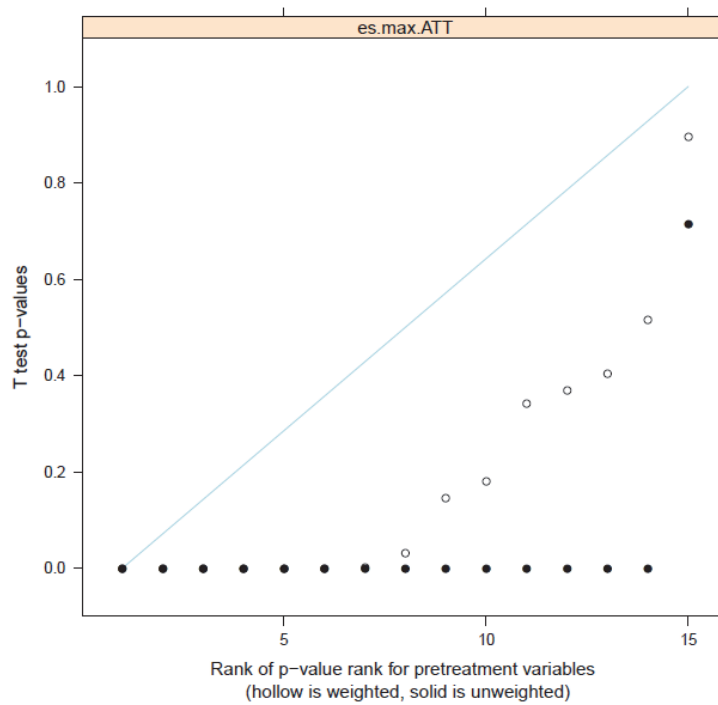

Figure G.3.2. After Weighting, Some Differences in Means are No Longer Statistically Significant

G.4 Creating the Synthetic Policy Cohort Group from the Early Pre-Policy Cohort Group

Table G.4.1. Means and Standard Deviations Before and After Propensity-Score Weighting

	Balance Factors	Unweighted					Weighted		
		Policy Cohort Group		Early Pre-Policy Cohort Group			Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 1)		
		Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.177	0.382	0.107	0.309	0.183	0.175	0.38	0.005
2	PRIOR CAREER PRFL: AD+DoDCiv	0.083	0.276	0.085	0.279	0.006	0.09	0.286	0.023
3	PRIOR CAREER PRFL: AD+MilDAW	0.05	0.219	0.027	0.161	0.109	0.055	0.229	0.022
4	PRIOR CAREER PRFL: DoDCiv	0.164	0.371	0.396	0.489	0.625	0.17	0.376	0.015
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.074	0.261	0.119	0.324	0.174	0.074	0.262	0.002
6	PRIOR CAREER PRFL: No DoD Exp	0.412	0.492	0.242	0.428	0.347	0.394	0.489	0.038
7	PRIOR CAREER PRFL: Other DoD Exp	0.038	0.192	0.024	0.153	0.074	0.042	0.2	0.017
8	AGE	39.372	11.638	40.347	11.006	0.084	39.308	11.513	0.005
9	RACE: Other	0.21	0.407	0.23	0.421	0.049	0.211	0.408	0.003
10	RACE: White	0.79	0.407	0.77	0.421	0.049	0.789	0.408	0.003
11	EDUCATION: BA	0.477	0.499	0.454	0.498	0.045	0.483	0.5	0.014
12	EDUCATION: Less than BA	0.241	0.427	0.331	0.471	0.212	0.236	0.425	0.011
13	EDUCATION: More than BA	0.283	0.45	0.215	0.411	0.152	0.281	0.449	0.005
14	DOD ORG: Air Force	0.191	0.393	0.151	0.358	0.101	0.186	0.389	0.013
15	DOD ORG: Army	0.323	0.468	0.413	0.492	0.191	0.321	0.467	0.004
16	DOD ORG: Navy	0.332	0.471	0.342	0.475	0.023	0.358	0.479	0.056
17	DOD ORG: Other	0.154	0.361	0.094	0.292	0.167	0.135	0.342	0.054
18	REGION: East North Central	0.135	0.342	0.105	0.306	0.089	0.13	0.336	0.016
19	REGION: East South Central	0.092	0.289	0.084	0.278	0.026	0.076	0.266	0.053
20	REGION: Mid Atlantic	0.086	0.281	0.1	0.3	0.049	0.087	0.282	0.003
21	REGION: Mountain	0.053	0.224	0.065	0.247	0.054	0.055	0.228	0.009
22	REGION: New England	0.035	0.185	0.04	0.196	0.026	0.037	0.188	0.007
23	REGION: Other or Missing	0.023	0.149	0.029	0.169	0.044	0.022	0.145	0.008
24	REGION: Pacific	0.127	0.333	0.151	0.358	0.07	0.127	0.333	0
25	REGION: South Atlantic	0.375	0.484	0.339	0.473	0.075	0.396	0.489	0.043
26	REGION: West North Central	0.012	0.107	0.014	0.116	0.019	0.011	0.102	0.011
27	REGION: West South Central	0.061	0.24	0.073	0.26	0.047	0.059	0.236	0.008
28	GENDER: Female	0.325	0.468	0.36	0.48	0.075	0.319	0.466	0.014
29	GENDER: Male	0.675	0.468	0.64	0.48	0.075	0.681	0.466	0.014
30	POSITION TYPE: Administrative	0.405	0.491	0.4	0.49	0.012	0.389	0.488	0.033
31	POSITION TYPE: Other	0.009	0.093	0.014	0.117	0.054	0.006	0.08	0.025
32	POSITION TYPE: Professional	0.535	0.499	0.536	0.499	0.001	0.554	0.497	0.038
33	POSITION TYPE: Technical	0.051	0.219	0.051	0.22	0.003	0.05	0.219	0.001
34	SUPERVISOR: All Other Positions	0.932	0.252	0.919	0.273	0.052	0.933	0.25	0.004
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.068	0.252	0.081	0.273	0.052	0.067	0.25	0.004
36	ACQ CAREER FLD: Business (CE or FM)	0.075	0.264	0.088	0.284	0.049	0.079	0.27	0.014

	Balance Factors	Unweighted					Weighted		
		Policy Cohort Group		Early Pre-Policy Cohort Group		Abs Std Diff	Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 1)		Abs Std Diff
		Mean	SD	Mean	SD		Mean	SD	
37	ACQ CAREER FLD: Contracting	0.199	0.399	0.151	0.358	0.12	0.212	0.409	0.033
38	ACQ CAREER FLD: Engineering	0.213	0.409	0.289	0.453	0.186	0.225	0.417	0.03
39	ACQ CAREER FLD: Facilities Engineering	0.063	0.242	0.028	0.165	0.143	0.068	0.252	0.022
40	ACQ CAREER FLD: Information Tech	0.053	0.224	0.071	0.257	0.08	0.047	0.211	0.029
41	ACQ CAREER FLD: Life Cycle Logistics	0.141	0.348	0.096	0.295	0.129	0.135	0.341	0.018
42	ACQ CAREER FLD: Other	0.026	0.159	0.038	0.192	0.079	0.025	0.156	0.005
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.062	0.242	0.044	0.205	0.076	0.058	0.233	0.019
44	ACQ CAREER FLD: Program Management	0.092	0.29	0.087	0.281	0.02	0.084	0.278	0.028
45	ACQ CAREER FLD: Test and Eval	0.039	0.195	0.051	0.219	0.057	0.04	0.197	0.005
46	ACQ CAREER FLD: Unknown/Missing	0.036	0.186	0.057	0.232	0.114	0.027	0.161	0.049
47	RETIREMENT PLAN: CSRS	0.035	0.184	0.201	0.401	0.904	0.038	0.191	0.015
48	RETIREMENT PLAN: FERS	0.955	0.207	0.793	0.405	0.783	0.955	0.207	0
49	RETIREMENT PLAN: Other	0.01	0.099	0.006	0.075	0.042	0.007	0.084	0.027
50	CAREER LEVEL: Entry-Level	0.295	0.456	0.265	0.441	0.067	0.31	0.463	0.033
51	CAREER LEVEL: Mid-Level	0.597	0.49	0.663	0.473	0.133	0.593	0.491	0.008
52	CAREER LEVEL: Sen/Exec	0.099	0.299	0.064	0.244	0.119	0.088	0.283	0.039
53	CAREER LEVEL: Uncategorized	0.008	0.09	0.009	0.095	0.011	0.009	0.093	0.006
54	YRS TO RET ELIG: <5 Yrs to Go	0.068	0.252	0.082	0.274	0.054	0.064	0.244	0.018
55	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.302	0.459	0.337	0.473	0.075	0.31	0.463	0.018
56	YRS TO RET ELIG: 20+ YRs to Go	0.487	0.5	0.392	0.488	0.191	0.484	0.5	0.007
57	YRS TO RET ELIG: 5-9 Yrs to Go	0.111	0.315	0.145	0.352	0.105	0.114	0.318	0.008
58	YRS TO RET ELIG: Ret Eligible	0.031	0.173	0.045	0.207	0.082	0.028	0.166	0.015
59	PAY PLAN: Broad GS or NSPS	0.847	0.36	0.802	0.398	0.126	0.847	0.36	0
60	PAY PLAN: Demo	0.139	0.346	0.19	0.392	0.147	0.143	0.351	0.014
61	PAY PLAN: Other	0.014	0.117	0.008	0.09	0.049	0.009	0.096	0.039
62	HCAP: Handicapped	0.082	0.275	0.087	0.282	0.019	0.084	0.278	0.007
63	HCAP: Not Handicapped	0.918	0.275	0.913	0.282	0.019	0.916	0.278	0.007

Figure G.4.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting
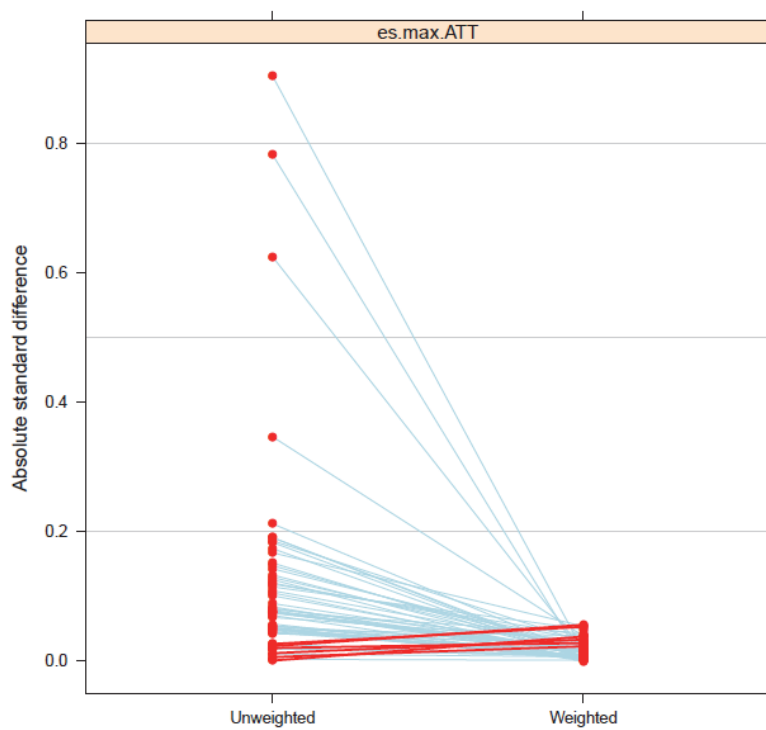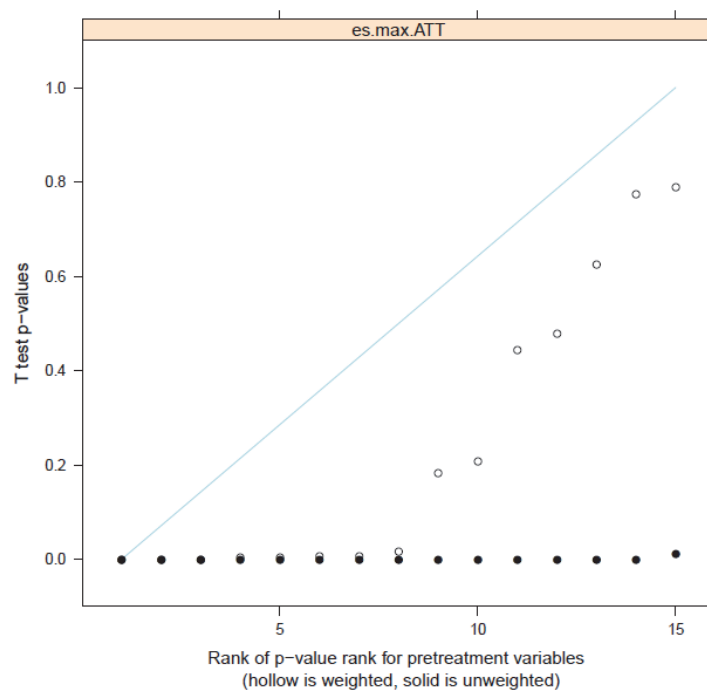

Figure G.4.2. After Weighting, Some Differences in Means are No Longer Statistically Significant

G.5 Creating the Synthetic Policy Cohort Group from the Later Pre-Policy Cohort Group

Table G.5.1. Means and Standard Deviations Before and After Propensity-Score Weighting

		Unweighted					Weighted		
		Policy Cohort Group		Later Pre-Policy Cohort Group			Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 2)		
	Balance Factors	Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.177	0.382	0.124	0.329	0.139	0.183	0.387	0.016
2	PRIOR CAREER PRFL: AD+DoDCiv	0.083	0.276	0.1	0.299	0.059	0.088	0.283	0.017
3	PRIOR CAREER PRFL: AD+MilDAW	0.05	0.219	0.042	0.2	0.04	0.055	0.228	0.021
4	PRIOR CAREER PRFL: DoDCiv	0.164	0.371	0.312	0.463	0.397	0.166	0.372	0.005
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.074	0.261	0.117	0.322	0.167	0.075	0.264	0.006
6	PRIOR CAREER PRFL: No DoD Exp	0.412	0.492	0.273	0.446	0.283	0.39	0.488	0.045
7	PRIOR CAREER PRFL: Other DoD Exp	0.038	0.192	0.033	0.177	0.03	0.042	0.201	0.019
8	AGE	39.372	11.638	39.257	11.492	0.01	39.176	11.517	0.017
9	RACE: Other	0.21	0.407	0.223	0.416	0.032	0.216	0.412	0.016
10	RACE: White	0.79	0.407	0.777	0.416	0.032	0.784	0.412	0.016
11	EDUCATION: BA	0.477	0.499	0.471	0.499	0.011	0.481	0.5	0.01
12	EDUCATION: Less than BA	0.241	0.427	0.289	0.453	0.113	0.246	0.431	0.012
13	EDUCATION: More than BA	0.283	0.45	0.24	0.427	0.095	0.273	0.445	0.022
14	DOD ORG: Air Force	0.191	0.393	0.151	0.358	0.102	0.177	0.381	0.036
15	DOD ORG: Army	0.323	0.468	0.449	0.497	0.268	0.332	0.471	0.018
16	DOD ORG: Navy	0.332	0.471	0.254	0.435	0.166	0.337	0.473	0.012
17	DOD ORG: Other	0.154	0.361	0.147	0.354	0.021	0.155	0.362	0.001
18	REGION: East North Central	0.135	0.342	0.126	0.332	0.028	0.128	0.334	0.021
19	REGION: East South Central	0.092	0.289	0.088	0.283	0.013	0.082	0.274	0.035
20	REGION: Mid Atlantic	0.086	0.281	0.117	0.321	0.108	0.091	0.287	0.016
21	REGION: Mountain	0.053	0.224	0.066	0.249	0.06	0.056	0.231	0.015
22	REGION: New England	0.035	0.185	0.034	0.182	0.006	0.036	0.186	0.003
23	REGION: Other or Missing	0.023	0.149	0.025	0.155	0.013	0.024	0.152	0.007
24	REGION: Pacific	0.127	0.333	0.116	0.32	0.035	0.124	0.329	0.011
25	REGION: South Atlantic	0.375	0.484	0.349	0.477	0.055	0.39	0.488	0.029
26	REGION: West North Central	0.012	0.107	0.016	0.126	0.042	0.011	0.104	0.006
27	REGION: West South Central	0.061	0.24	0.064	0.245	0.011	0.059	0.236	0.008
28	GENDER: Female	0.325	0.468	0.354	0.478	0.061	0.322	0.467	0.006
29	GENDER: Male	0.675	0.468	0.646	0.478	0.061	0.678	0.467	0.006
30	POSITION TYPE: Administrative	0.405	0.491	0.39	0.488	0.031	0.396	0.489	0.02
31	POSITION TYPE: Other	0.009	0.093	0.011	0.106	0.027	0.009	0.096	0.006
32	POSITION TYPE: Professional	0.535	0.499	0.543	0.498	0.015	0.543	0.498	0.015
33	POSITION TYPE: Technical	0.051	0.219	0.056	0.23	0.024	0.052	0.222	0.007
34	SUPERVISOR: All Other Positions	0.932	0.252	0.918	0.274	0.054	0.925	0.263	0.028
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.068	0.252	0.082	0.274	0.054	0.075	0.263	0.028
36	ACQ CAREER FLD: Business (CE or FM)	0.075	0.264	0.075	0.263	0.003	0.077	0.266	0.006

| Balance Factors | Unweighted | | | | | Weighted | | |
| | Policy Cohort Group | | Later Pre-Policy Cohort Group | | | Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 2) | | |
	Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
37 ACQ CAREER FLD: Contracting	0.199	0.399	0.168	0.374	0.078	0.208	0.406	0.022
38 ACQ CAREER FLD: Engineering	0.213	0.409	0.216	0.412	0.008	0.214	0.41	0.003
39 ACQ CAREER FLD: Facilities Engineering	0.063	0.242	0.074	0.262	0.047	0.055	0.228	0.032
40 ACQ CAREER FLD: Information Tech	0.053	0.224	0.04	0.195	0.06	0.049	0.216	0.019
41 ACQ CAREER FLD: Life Cycle Logistics	0.141	0.348	0.127	0.333	0.039	0.141	0.348	0
42 ACQ CAREER FLD: Other	0.026	0.159	0.03	0.171	0.028	0.026	0.16	0.003
43 ACQ CAREER FLD: Prod, Quality & Manuf	0.062	0.242	0.073	0.26	0.043	0.067	0.249	0.017
44 ACQ CAREER FLD: Program Management	0.092	0.29	0.074	0.261	0.064	0.085	0.279	0.025
45 ACQ CAREER FLD: Test and Eval	0.039	0.195	0.043	0.203	0.018	0.04	0.197	0.005
46 ACQ CAREER FLD: Unknown/Missing	0.036	0.186	0.08	0.272	0.239	0.038	0.192	0.013
47 RETIREMENT PLAN: CSRS	0.035	0.184	0.109	0.312	0.406	0.037	0.189	0.012
48 RETIREMENT PLAN: FERS	0.955	0.207	0.882	0.322	0.352	0.955	0.208	0.002
49 RETIREMENT PLAN: Other	0.01	0.099	0.008	0.091	0.016	0.008	0.089	0.018
50 CAREER LEVEL: Entry-Level	0.295	0.456	0.312	0.463	0.036	0.316	0.465	0.045
51 CAREER LEVEL: Mid-Level	0.597	0.49	0.604	0.489	0.014	0.584	0.493	0.026
52 CAREER LEVEL: Sen/Exec	0.099	0.299	0.074	0.261	0.085	0.093	0.29	0.022
53 CAREER LEVEL: Uncategorized	0.008	0.09	0.01	0.101	0.025	0.007	0.085	0.01
54 YRS TO RET ELIG: <5 Yrs to Go	0.068	0.252	0.075	0.263	0.025	0.064	0.246	0.015
55 YRS TO RET ELIG: 10 to 19 Yrs to Go	0.302	0.459	0.312	0.463	0.022	0.311	0.463	0.019
56 YRS TO RET ELIG: 20+ YRs to Go	0.487	0.5	0.455	0.498	0.064	0.486	0.5	0.002
57 YRS TO RET ELIG: 5-9 Yrs to Go	0.111	0.315	0.118	0.323	0.022	0.11	0.313	0.003
58 YRS TO RET ELIG: Ret Eligible	0.031	0.173	0.04	0.195	0.051	0.028	0.165	0.016
59 PAY PLAN: Broad GS or NSPS	0.847	0.36	0.821	0.383	0.072	0.848	0.359	0.001
60 PAY PLAN: Demo	0.139	0.346	0.169	0.375	0.087	0.144	0.351	0.014
61 PAY PLAN: Other	0.014	0.117	0.01	0.098	0.035	0.009	0.092	0.045
62 HCAP: Handicapped	0.082	0.275	0.078	0.269	0.014	0.082	0.274	0.001
63 HCAP: Not Handicapped	0.918	0.275	0.922	0.269	0.014	0.918	0.274	0.001

Figure G.5.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting
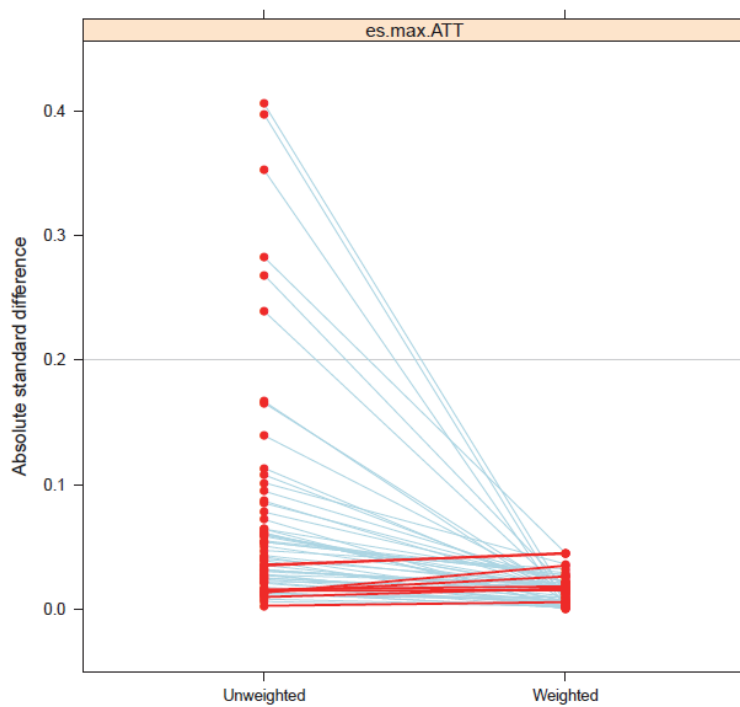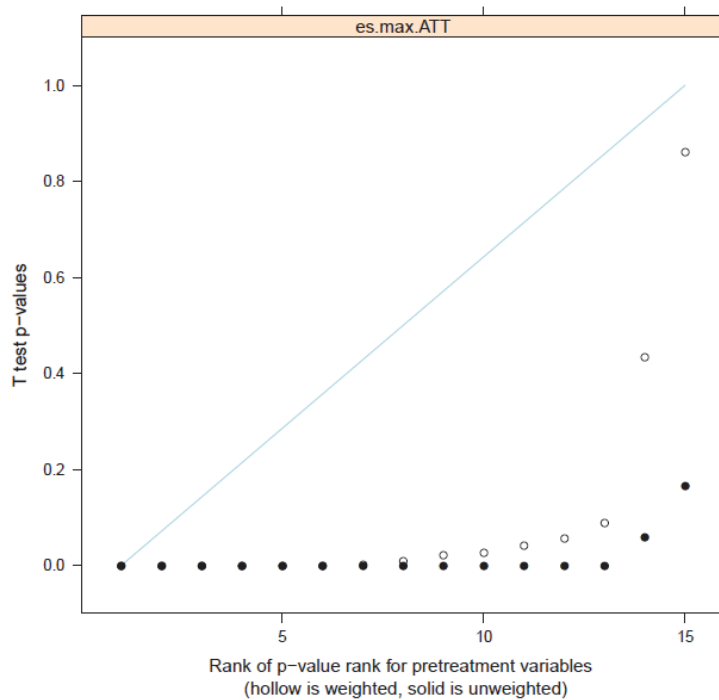

Figure G.5.2. After Weighting, Most Differences in Means are Still Statistically Significant

G.6 Creating the Synthetic Policy Cohort Group from the Combination Pre-Policy Cohort Group

Table G.6.1. Means and Standard Deviations Before and After Propensity-Score Weighting

		Unweighted					Weighted		
		Policy Cohort Group		Combination Pre-Policy Cohort Group			Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 3)		
	Balance Factors	Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
1	PRIOR CAREER PRFL: AD	0.177	0.382	0.116	0.32	0.161	0.18	0.384	0.006
2	PRIOR CAREER PRFL: AD+DoDCiv	0.083	0.276	0.092	0.29	0.033	0.086	0.281	0.01
3	PRIOR CAREER PRFL: AD+MilDAW	0.05	0.219	0.034	0.182	0.074	0.054	0.226	0.017
4	PRIOR CAREER PRFL: DoDCiv	0.164	0.371	0.353	0.478	0.508	0.167	0.373	0.006
5	PRIOR CAREER PRFL: DoDCiv+CivDAW	0.074	0.261	0.118	0.323	0.17	0.077	0.266	0.011
6	PRIOR CAREER PRFL: No DoD Exp	0.412	0.492	0.258	0.438	0.314	0.396	0.489	0.034
7	PRIOR CAREER PRFL: Other DoD Exp	0.038	0.192	0.028	0.166	0.052	0.041	0.198	0.012
8	AGE	39.372	11.638	39.788	11.271	0.036	39.262	11.583	0.009
9	RACE: Other	0.21	0.407	0.226	0.418	0.04	0.212	0.409	0.006
10	RACE: White	0.79	0.407	0.774	0.418	0.04	0.788	0.409	0.006
11	EDUCATION: BA	0.477	0.499	0.463	0.499	0.028	0.481	0.5	0.009
12	EDUCATION: Less than BA	0.241	0.427	0.31	0.462	0.161	0.243	0.429	0.005
13	EDUCATION: More than BA	0.283	0.45	0.228	0.419	0.122	0.276	0.447	0.015
14	DOD ORG: Air Force	0.191	0.393	0.151	0.358	0.101	0.18	0.384	0.027
15	DOD ORG: Army	0.323	0.468	0.431	0.495	0.23	0.328	0.469	0.01
16	DOD ORG: Navy	0.332	0.471	0.297	0.457	0.074	0.341	0.474	0.021
17	DOD ORG: Other	0.154	0.361	0.121	0.326	0.092	0.151	0.358	0.01
18	REGION: East North Central	0.135	0.342	0.116	0.32	0.057	0.131	0.337	0.012
19	REGION: East South Central	0.092	0.289	0.086	0.28	0.02	0.083	0.276	0.03
20	REGION: Mid Atlantic	0.086	0.281	0.109	0.311	0.079	0.089	0.285	0.01
21	REGION: Mountain	0.053	0.224	0.066	0.248	0.057	0.055	0.228	0.01
22	REGION: New England	0.035	0.185	0.037	0.189	0.01	0.036	0.186	0.003
23	REGION: Other or Missing	0.023	0.149	0.027	0.162	0.028	0.023	0.15	0.002
24	REGION: Pacific	0.127	0.333	0.133	0.339	0.016	0.125	0.331	0.007
25	REGION: South Atlantic	0.375	0.484	0.344	0.475	0.065	0.386	0.487	0.023
26	REGION: West North Central	0.012	0.107	0.015	0.121	0.031	0.011	0.104	0.006
27	REGION: West South Central	0.061	0.24	0.068	0.252	0.029	0.06	0.238	0.004
28	GENDER: Female	0.325	0.468	0.357	0.479	0.068	0.32	0.467	0.01
29	GENDER: Male	0.675	0.468	0.643	0.479	0.068	0.68	0.467	0.01
30	POSITION TYPE: Administrative	0.405	0.491	0.395	0.489	0.022	0.398	0.489	0.016
31	POSITION TYPE: Other	0.009	0.093	0.013	0.111	0.04	0.009	0.093	0.001
32	POSITION TYPE: Professional	0.535	0.499	0.539	0.498	0.008	0.543	0.498	0.015
33	POSITION TYPE: Technical	0.051	0.219	0.054	0.225	0.014	0.051	0.22	0.001
34	SUPERVISOR: All Other Positions	0.932	0.252	0.919	0.273	0.053	0.93	0.256	0.01
35	SUPERVISOR: Supvisor/Mngr/Ldr	0.068	0.252	0.081	0.273	0.053	0.07	0.256	0.01
36	ACQ CAREER FLD: Business (CE or FM)	0.075	0.264	0.081	0.273	0.023	0.075	0.264	0

		Unweighted					Weighted		
		Policy Cohort Group		Combination Pre-Policy Cohort Group			Weighted Pre-Policy Cohort Group (Synthetic Policy Cohort Group 3)		
	Balance Factors	Mean	SD	Mean	SD	Abs Std Diff	Mean	SD	Abs Std Diff
37	ACQ CAREER FLD: Contracting	0.199	0.399	0.16	0.366	0.099	0.206	0.405	0.018
38	ACQ CAREER FLD: Engineering	0.213	0.409	0.251	0.434	0.095	0.212	0.408	0.003
39	ACQ CAREER FLD: Facilities Engineering	0.063	0.242	0.052	0.221	0.045	0.06	0.238	0.011
40	ACQ CAREER FLD: Information Tech	0.053	0.224	0.055	0.228	0.008	0.047	0.213	0.026
41	ACQ CAREER FLD: Life Cycle Logistics	0.141	0.348	0.112	0.315	0.083	0.143	0.35	0.007
42	ACQ CAREER FLD: Other	0.026	0.159	0.034	0.182	0.053	0.026	0.16	0.002
43	ACQ CAREER FLD: Prod, Quality & Manuf	0.062	0.242	0.059	0.235	0.015	0.066	0.249	0.016
44	ACQ CAREER FLD: Program Management	0.092	0.29	0.08	0.271	0.043	0.087	0.282	0.019
45	ACQ CAREER FLD: Test and Eval	0.039	0.195	0.047	0.211	0.037	0.04	0.196	0.004
46	ACQ CAREER FLD: Unknown/Missing	0.036	0.186	0.069	0.254	0.178	0.036	0.187	0.003
47	RETIREMENT PLAN: CSRS	0.035	0.184	0.154	0.361	0.649	0.037	0.19	0.014
48	RETIREMENT PLAN: FERS	0.955	0.207	0.839	0.368	0.562	0.954	0.209	0.006
49	RETIREMENT PLAN: Other	0.01	0.099	0.007	0.083	0.029	0.009	0.092	0.014
50	CAREER LEVEL: Entry-Level	0.295	0.456	0.289	0.453	0.014	0.313	0.464	0.04
51	CAREER LEVEL: Mid-Level	0.597	0.49	0.633	0.482	0.072	0.586	0.493	0.023
52	CAREER LEVEL: Sen/Exec	0.099	0.299	0.069	0.253	0.102	0.093	0.29	0.021
53	CAREER LEVEL: Uncategorized	0.008	0.09	0.01	0.098	0.018	0.008	0.087	0.006
54	YRS TO RET ELIG: <5 Yrs to Go	0.068	0.252	0.078	0.268	0.039	0.065	0.247	0.013
55	YRS TO RET ELIG: 10 to 19 Yrs to Go	0.302	0.459	0.324	0.468	0.048	0.306	0.461	0.008
56	YRS TO RET ELIG: 20+ YRs to Go	0.487	0.5	0.424	0.494	0.126	0.487	0.5	0.001
57	YRS TO RET ELIG: 5-9 Yrs to Go	0.111	0.315	0.131	0.338	0.062	0.114	0.318	0.007
58	YRS TO RET ELIG: Ret Eligible	0.031	0.173	0.042	0.201	0.066	0.029	0.167	0.012
59	PAY PLAN: Broad GS or NSPS	0.847	0.36	0.812	0.391	0.098	0.851	0.357	0.009
60	PAY PLAN: Demo	0.139	0.346	0.179	0.383	0.116	0.14	0.347	0.004
61	PAY PLAN: Other	0.014	0.117	0.009	0.094	0.042	0.009	0.096	0.04
62	HCAP: Handicapped	0.082	0.275	0.083	0.275	0.002	0.085	0.279	0.011
63	HCAP: Not Handicapped	0.918	0.275	0.917	0.275	0.002	0.915	0.279	0.011

Figure G.6.1. All Absolute Standard Differences in Means are Below 0.1 After Weighting
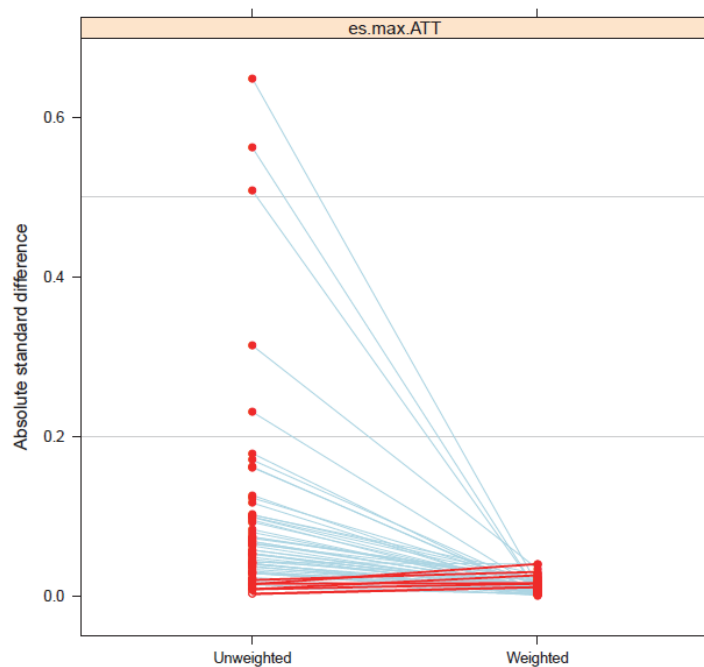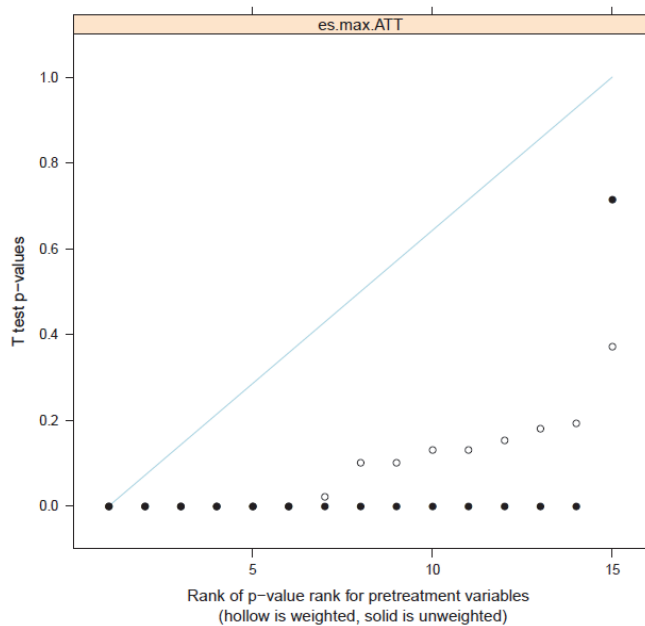

Figure G.6.2. After Weighting, Some Differences in Means are No Longer Statistically Significant

Appendix H. Sensitivity Analysis: Lags Instances Not Included in Civilian DAW Cohorts

The goal of this sensitivity analysis is to understand whether any of the retention test results are sensitive to the inclusion of the "lag instances" in the civilian DAW cohorts.[104] Each test described in Chapters 8 and 9 (and Appendix F) is run without including the lag instances, and this Appendix presents the results. If the "sensitivity" test results presented in this Appendix are similar to the "original" test results described in Chapters 8 and 9 (and Appendix F), then one would conclude that the tests are not sensitive to the inclusion of the lag instances.

Section H.1, below, displays the sensitivity test results for retention analysis Part I. The results are displayed in Tables H.1.1-H.1.7. There are two instances where the original analysis finds a statistically significant relationship and the sensitivity analysis fails to find a statistically significant relationship at a 10 percent level of significance.

4. The original analysis on the early pre-policy cohort group finds that external hires with the Active Duty + Military DAW prior career profile are significantly more likely (at a 10 percent level of significance) to substantively transfer out of or separate from the civilian DAW in any given year compared to external hires with no prior DoD experience (see Table 8.7). The sensitivity test on the early pre-policy cohort group finds no statistically significant difference in retention between these two groups (see Table H.1.7).

5. The original analysis on the later pre-policy cohort group finds that external hires with the Active Duty + Military DAW prior career profile are significantly less likely (at a five percent level of significance) to substantively transfer out of or separate from the civilian DAW in any given year compared to external hires with no prior DoD experience (see Table 8.7). The sensitivity test on the later pre-policy cohort group finds no statistically significant difference in retention trends between these two groups (see Table H.1.7).

These two differences suggest that these particular tests are slightly sensitive to the inclusion of the lag instances. However, the other sensitivity tests presented in Section H.1 show results that are similar to those from the original analysis. The overall findings from retention analysis Part I do not appear to be sensitive to the inclusion of the lag instances in the civilian DAW cohorts.

Section H.2 shows the sensitivity test results for retention analysis Part II. Tables H.2.1 and H.2.2 show that the results are similar to those from the original analysis.

In the end, except for the two instances described above, this sensitivity analysis shows that the retention tests presented in this study are not particularly sensitive to the inclusion of the lag instances in the civilian DAW cohorts. The overall findings from retention analyses Parts I and II hold regardless of whether the lag instances are included.

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[104] The "lag instances" are defined in Chapter 6. Figure 6.2 shows the number of lag instances included in each FY cohort.

H.1 Sensitivity Tests for Retention Analysis Part I

Table H.1.1. There is No Evidence Suggesting that Entrants with prior DoD Experience Have a Lower Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to Entrants with No Prior DoD Experience

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	25718	27971	53689
Degrees of Freedom	25717	27970	53688
Estimation	-0.010	0.033	0.008
Hazard Ratio	0.990	1.034	1.008
Standard Error	0.054	0.045	0.037
p-value	0.8517	0.4642	0.8271

Table H.1.2. There is Some Evidence Suggesting that Internal Hires Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	25718	27971	53689
Degrees of Freedom	25717	27970	53688
Estimation	-0.015	0.072	0.036
Hazard Ratio	0.986	1.075	1.037
Standard Error	0.037	0.028	0.021
p-value	0.6936	0.0091	0.0832

Table H.1.3. Internal Hires Have a Greater Hazard of Substantively Transferring Out of the Civilian DAW Relative to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	Later	Combination
N	25718	27971	53689
Degrees of Freedom	25717	27970	53688
Estimation	0.243	0.359	0.294
Hazard Ratio	1.276	1.432	1.342
Standard Error	0.062	0.047	0.039
p-value	<.0001	<.0001	<.0001

Table H.1.4. Internal Hires Have a Lower Hazard of Separating From the Civilian DAW Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	Later	Combination
N	25718	27971	53689
Degrees of Freedom	25717	27970	53688
Estimation	-0.156	-0.127	-0.123
Hazard Ratio	0.856	0.881	0.885
Standard Error	0.048	0.035	0.027
p-value	0.0012	0.0003	<.0001

Table H.1.5. Internal Hires Have a Lower Hazard of Separating from the Wider DoD Civilian Workforce Compared to External Hires

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	Later	Combination
N	25718	27971	53689
Degrees of Freedom	25717	27970	53688
Estimation	-0.128	-0.142	-0.126
Hazard Ratio	0.879	0.867	0.881
Standard Error	0.042	0.030	0.022
p-value	0.0023	<.0001	<.0001

Table H.1.6. Among External Hires, Those with Prior DoD Experience Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to Those with No Prior DoD Experience

Doubly Robust Cox PH	Pre-Policy Cohort Group		
	Early	**Later**	**Combination**
N	10965	13906	24871
Degrees of Freedom	10964	13905	24870
Estimation	0.109	0.151	0.124
Hazard Ratio	1.115	1.164	1.132
Standard Error	0.054	0.054	0.040
p-value	0.0449	0.0053	0.0017

Table H.1.7. In General, External Hires with a Prior Career Profile that Includes DoD Experience (With the Exception of the Active Duty + Military DAW Prior Career Profile) Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Compared to External Hires with No Prior DoD Experience

Cox PH with Controls	Hazard Ratio Estimation (ref="no prior DoD experience")					
	Early		Later		Combination	
Prior Career Profile	% External Hires	Estimate	% External Hires	Estimate	% External Hires	Estimate
DoD Civ	7.85	***1.198	5.79	**1.152	6.7	***1.178
DoD Civ + Civ DAW	6.17	1.045	4.16	**1.166	5.05	*1.094
Active Duty	23.01	***1.154	23.7	***1.135	23.4	***1.14
Active Duty + DoD Civ	1.88	**1.257	1.62	***1.367	1.73	***1.325
Other DoD Experience	1.81	***1.461	2.13	***1.394	1.99	***1.415
Active Duty + Mil DAW	5.98	1.123	7.87	0.93	7.04	1.008

p-value < *0.1, **0.05, ***0.01

H.2 Sensitivity Tests for Retention Analysis Part II

Table H.2.1. Individuals in the Synthetic Pre-Policy Cohort Groups Have a Greater Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Relative to Individuals in the Policy Cohort Group

Cox PH	Synthetic Early Pre-Policy Cohort Group[a]	Synthetic Later Pre-Policy Cohort Group[b]	Synthetic Combination Pre-Policy Cohort Group[c]
N	115136	115136	115136
Estimation	0.123	0.099	0.114
Hazard Ratio	1.131	1.104	1.120
Standard Error	0.019	0.014	0.015
p-value	<.0001	<.0001	<.0001

[a] The policy cohort group weighted to look like the early pre-policy cohort group
[b] The policy cohort group weighted to look like the later pre-policy cohort group
[c] The policy cohort group weighted to look like the combination pre-policy cohort group

Table H.2.2. Individuals in the Synthetic Policy Cohort Groups Have a Lower Hazard of Substantively Transferring Out of or Separating From the Civilian DAW Relative to Individuals in the Pre-Policy Cohort Groups

Cox PH	Synthetic Policy Cohort Group 1[a]	Synthetic Policy Cohort Group 2[b]	Synthetic Policy Cohort Group 3[c]
N	51436	55942	107378
Estimation	-0.054	-0.077	-0.068
Hazard Ratio	0.947	0.926	0.934
Standard Error	0.018	0.015	0.011
p-value	0.0026	<.0001	<.0001

[a] The early pre-policy cohort group weighted to look like the policy cohort group
[b] The later pre-policy cohort group weighted to look like the policy cohort group
[c] The combination pre-policy cohort group weighted to look like the policy cohort group

Appendix I. External Hires and Internal Hires

"External hires" are defined as civilian DAW entrants who are either in the active-duty military (in a DAW position or otherwise) or not in the DoD at all in the FY prior to them joining the civilian DAW. "Internal hires" are defined as entrants who appear in a wider non-DAW DoD civilian position in the FY prior to them joining the civilian DAW. These two terms ("external hires" and "internal hires") are similar to the two groups of entrants included in a civilian DAW cohort, namely "new hires" "substantive transfers," which are defined in the Defining a Cohort section in Chapter 6. However, the "external hire" and "internal hire" definitions are based on the past-work-experience characterization (specifically, which workforce each entrant was in in the FY prior to him or her joining the civilian DAW), which adjusts for "double-count" years (FYs in which one individual appears in both the active-duty data file and the DoD civilian data file), as outlined in Chapter 6. Therefore, some individuals who are included in a cohort as a transfer are actually counted as external hires. This, however, is not common. Table I.1, below, shows the number of civilian DAW entrants in FY cohorts 2000-2014, breaking each cohort up (1) by new hires and substantive transfers and (2) by external hires and internal hires. The table shows that there are only 10 individuals who are included in a civilian DAW cohort as a transfer but are counted as an external hire. In all other cases, those who are included in a cohort as a transfer are counted as an internal hire and those who are included in a cohort as a new hire are counted as an external hire.

Table I.1. For Several Cohorts, a Few Individuals Who are Included in the Cohort as a Transfer are Counted as an External Hire

FY Cohort	New Hire (A)	Transfer (B)	External Hire (C)	Internal Hire (D)	TOTAL ENTRANTS	C-A	D-B
2000	2271	2162	2271	2162	4433	0	0
2001	3238	5249	3238	5249	8487	0	0
2002	4779	5577	4779	5577	10356	0	0
2003	4912	4054	4912	4054	8966	0	0
2004	4975	5742	4978	5739	10717	3	-3
2005	5052	5168	5052	5168	10220	0	0
2006	4691	3353	4692	3352	8044	1	-1
2007	5309	3371	5310	3370	8680	1	-1
2008	8231	4217	8233	4215	12448	2	-2
2009	12975	4333	12976	4332	17308	1	-1

FY Cohort	New Hire (A)	Transfer (B)	External Hire (C)	Internal Hire (D)	TOTAL ENTRANTS	C-A	D-B
2010	14814	4259	14816	4257	19073	2	-2
2011	8675	4168	8675	4168	12843	0	0
2012	6053	3685	6053	3685	9738	0	0
2013	4750	3269	4750	3269	8019	0	0
2014	5052	3204	5052	3204	8256	0	0

Appendix J. Career Level Definitions

RAND researchers created the career-level descriptors as a way to have approximate uniform workforce levels across different pay plans (Guo, Hall-Partyka and Gates, 2014). The career levels and the pay plans, grades, and steps that make up each career level are listed in a 2012 RAND Project Memorandum that is not cleared for open publication (Gates et al., 2012, pp. 31-32). Below is an excerpt from that Project Memorandum that defines the career levels:

> **Entry level** includes GS (and related) 1-8; WG, WD, WY, XF, WK 1-8; YA, YB, YP, YD, YE,YH, YI, YK, YL, YM, DR 1; NM 2; DA, DB, DE, DJ, DP, ND, NH, NJ, NK, NO, NP, NR, NT 1-2; DK 1-3. For the TP pay-plan workers are coded by grade and step. Entry-level includes all AA workers, and steps 1-5 for the C*, D*, E*, and F* grades. In addition, all WT workers and workers in the NH and DR pay-plan are at grade 0.

> **Mid level** includes: GS (and related) 9-13; WG, WD, WY, XF, WK 9-15; WL, XG, WR 1-7, WS, WJ, WQ, XH, WA 1-7; YC, YF, YJ, YN -1; YA, YB, YD, YE, YH, YI, YK, YL, YM, DR -2; YB, YE, YL, DB, DE, DJ, DP, NH, NK, NO, NP, NM-3; DK-4; DA, ND, NJ, NR, NT 3-4; IA-2-3. For the TP pay-plan workers are coded by grade and step. Mid-level includes steps 6-10 for the C*, D*, E*, and F* grades.

> **Senior level** includes GS (and related) 14-15; WL, XG, WR, WS, WJ, WQ, XH, WA 8 and above; YC, YF, YJ, YN 2 and 3; YA, YD, YH, YI, YK, YM 3; YB, YE, YL, DB, NH, NP 4; DE, DJ, IA, NO, NM 4-5, DR 3-4; DP, NR, ND 5; DA, NT 5-6; IP (all). We have also tentative coded all members of the YJ (Medical supervisors) and YG (Medical physicians/dentists) as senior pending further input. For the TP pay-plan workers are coded by grade and step. Senior-level includes steps 11 and above for the C*, D*, E*, and F* grades, as well as all steps for the L*, O*, and P* grades.

> **Executive** includes: ES (all); DB 5-6; ND 6; NP 5; IE (all); For the TP pay-plan we include those in the-K* grade.

> These categories may be improved based on feedback from FCMs. Uncategorized employees either have a grade-level that is not included in our career-level definitions or are in a pay plan for which we do not have career-level information (AD, CA, DG, DS, DT, ED, EE, EF, EG, EH, EI, EX, NC, NG, SL, SR, ST, WB, WM, WN, WO, WU, XP, ZZ) (Gates et al., 2012, pp. 31-32).

For this study, an entrant's "Career Level Upon Entrance," as listed in Table 6.2, is the career level an entrant is recorded in in his or her civilian DAW cohort year (for that particular instance, as some individuals are in multiple civilian DAW cohorts).

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