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# Essays in Organizational Design and Defense Policy

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To the Graduate Council:

I am submitting herewith a dissertation written by Charlton Eli Freeman entitled "Essays in Organizational Design and Defense Policy." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

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# Essays in Organizational Design and Defense Policy

**A Dissertation Presented for the**

**Doctor of Philosophy**

**Degree**

**The University of Tennessee, Knoxville**

**Charlton Eli Freeman**
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The views expressed are those of the author and do not reflect the official policy or position of the US Air Force, Department of Defense, or the US Government.

# DEDICATION

This dissertation is dedicated to my wife Melanie Freeman. You have made countless sacrifices along the way to get us here and I could not have accomplished this without your love, support, and encouragement.

Also to my parents, Dudley and Suk Freeman, who taught me the value of education, a never-say-die attitude, and service to others. You set a shining example that I hope to live up to every day.

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This accomplishment is not mine alone and I am forever indebted to so many people along the way but due to limited space I can only highlight a few here. Specifically, I want to thank my committee members. I would like to thank Dr. Bill Neilson for his mentorship and friendship over the last three years. His dedication to his students will serve as a template for me both as an educator and leader. I would like to thank Dr. Christian Vossler who's attention to detail and technical expertise has now become the stuff of legends. I would also like to thank Dr. Scott Gilpatric. I have never been so happy to receive a 40% on an exam and have become a better economist as a result. Finally, I would like to thank Dr. Lane Morris for his service on my committee. His perspective and experiences have proven invaluable throughout this process.

# ABSTRACT

In the first chapter, we use a laboratory experiment to investigate empirically the influence of various organizational designs on producing welfare-enhancing outcomes for a firm. We find organizational design significantly influences group outcomes without changes to incentive structures, which can be explained by a theory that assumes individuals care not only about their own self-interest but receive disutility when the group outcome deviates from a social norm. We hypothesize that organizational design changes affect individuals through a combination of changing the amount of moral wiggle room available and cognitive energy required to self-deceive, and allowing for individuals to update their beliefs about assumed group preferences through communication.

In chapter two, we consider recent research utilizing Health and Retirement Survey data, which identifies a growing wealth gap between veterans and non-veterans entering retirement age. We survey the literature by exploring institutional factors such as income challenges associated with military service. We conclude that while servicemembers may earn income near parity with their non-veteran peers, they face significant challenges in maintaining dual income households. Similarly, homeownership is much lower among active duty servicemembers and below the American average. A decline in veteran wealth places strains on intergenerational transfers, which may be especially challenging for legacy servicemembers. The literature suggests servicemembers, like most Americans, struggle with financial literacy but seek professional

guidance at higher rates than the national average. Recent retirement changes within the Department of Defense (DOD) present opportunities for behaviorally informed savings programs. Finally, we consider how locus of control influences veteran wealth outcomes.

Finally, our third chapter examines the impact of changing DOD presence on median wages by gender and on occupational crowding. We focus on the implementation of the 2005 Base Realignment and Closure (BRAC). We use the American Communities Survey data linking BRAC actions to county economic outcomes of interest. Our findings indicate heterogeneous impacts on wages by gender resulting from BRAC shocks, primarily associated with military personnel shocks. We find military personnel shocks also significantly affects the wage gap between men and women. However, we find little support for changes in DOD presence materially impacting occupational crowding.

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# CHAPTER 1

# THE ECONOMICS OF ORGANIZATIONAL DESIGN: AN EXPERIMENTAL APPROACH

## 1.1 Introduction

What impact does organizational design have on firm outcomes? Apple Inc. and Valve Corporation are both arguably successful in their respective fields. Innovative products produced by Apple have resulted in the company skyrocketing to the most valuable company in the world (by market capitalization). Since Valve's founding in 1996, Valve has been a disruptor in the video game development and digital distribution space. While each organization has been successful, these organizations have very different approaches to organizational design.

These two organizations tell a compelling story about finding success without a single "optimal" organizational design strategy. Sir Richard Branson describes the late Apple CEO Steve Jobs' leadership style as "autocratic" with a desire to control every detail himself (Branson, 2011). In stark contrast, Valve Corporation describes themselves as a "flat" company (Valve, 2012). In the new employee handbook, Valve even goes so far as to say "…we don't have any management, and nobody 'reports to' anybody else. We do have a founder/president, but even he isn't your manager."

In our study, we use theory and laboratory experiments to study the interplay between organizational design and firm outcomes such as profit maximization. In particular, we investigate a spectrum of organizational structures, ranging from a flat

hierarchy (majority vote) to an autocracy and demonstrate that, without changing monetary incentives, changes in design can significantly influence whether welfare-enhancing outcomes are achieved.

The economics literature on organizational design provides relatively little discussion of strategic group behavior, or ways in which organizational design influences group decision making. Traditionally, this literature falls into three common theoretical approaches: transaction cost economics (see Williamson, 2000), information processing (see Galbraith, 1974; Tushman and Nadler, 1978; Keren and Levhari, 1989; Radner, 1992) and the decentralization of incentives (see Radner, 1992; Colombo and Delmastro, 2008).

Researchers have begun placing increased attention on the interactions of the more traditional monetary incentives and social concerns of workers within firms. For example, Kandel and Lazear (1992) formalize a theory incorporating peer pressure and how it operates within partnerships with profit sharing. Additionally, Rotemberg (1994) provides a framework to rationalize altruistic behavior of supervisors because of strategic complementarity in the workplace. Still others have studied contract implications of other social preferences such as fairness, inequality aversion, and social esteem (Fehr et al., 2007; Englmaier and Wambach, 2010; Ellingsen and Johannesson, 2007). This study is part of a growing body of empirical literature that utilizes experimental methods to gain a better understanding of both within and between-firm behaviors (see Levitt and Neckermann, 2014).

While prior experiments have not focused on organizational design, there are several economics experiments on group decision-making. In a recent survey of the group decision-making literature, Charness and Sutter (2012) document several situations where groups are more likely to fall in line with standard game-theoretic predictions, and by doing so decrease welfare. For example, in the trust game, groups send and return smaller amounts than individuals send and return (Kugler, Bornstein, Kocher, and Sutter, 2007; Song, 2008); in the centipede game, teams defect earlier (Bornstein, Kugler, and Ziegelmeyer, 2004); and in the prisoner's dilemma, groups cooperate at significantly lower levels (Charness, Rigotti, and Rustichini, 2007). These studies rely on three-player groups where subjects equally share the group payoff, and make decisions facing an outgroup.[1]

There are many interesting circumstances in which groups make decisions among alternatives without directly considering an outgroup. These decisions can also result in benefits that are heterogeneous among group members. A department hiring decision, choosing a business strategy, a family deciding where to eat on a special occasion are all examples of cases when it is possible for a group to make a decision without considering an outgroup, and benefits may accrue unevenly to group members. In these cases, the choice of organizational design may promote welfare-maximizing

[1] Charness et al (2007) finds that payoff commonality significantly lowers social efficiency for groups in the prisoner's dilemma when playing against an outgroup player but increases cooperation and social efficiency with ingroup players. In the payoff commonality treatment, subjects received one-third of the payoff sum from other groups members' outcome.

outcomes. We feel this class of problem is understudied in the literature but has meaningful implications for the economics of the firm.

Using three-player groups, we examine four organizational structures inspired by Baron et al. (1996), and Baron and Kreps (1999): engineering model, flat bureaucracy, tall bureaucracy, and autocratic model. In the engineering model, we consider a firm using a majority vote to make decisions thus representing a completely flat organization. A flat bureaucracy represents a firm where two subordinates make independent recommendations to a decision authority. This is similar to our tall bureaucracy, where a subordinate makes a recommendation to a superior but the superior makes his own recommendation to the decision authority. Finally, we consider an autocratic model where the decision authority makes a binding decision without feedback from the group he represents. In the experiment, we frame each of these settings neutrally to avoid priming effects.

Our experiment builds on the work of Engelmann and Strobel (2004, henceforth E&S) who investigate the relative importance of efficiency concerns, maximin preferences, and inequality aversion in distribution experiments. While our paper is not directly about testing these preferences, we find the E&S framework helpful in discussing the impacts of organizational design on group decision making. For example, the E&S framework allows us to cleanly identify efficiency concerns without confounding our results with other motives such as maximin preferences, or inequality aversion. Unlike E&S, we do not rely on role uncertainty and instead randomly assign roles to subjects, which we maintain throughout the experiment.

In each decision round, and depending on what organizational design has been assigned, groups must choose among three payoff allocations. Groups must choose between allocations that increase total group payoffs and/or increase the payoff assigned to the lowest paid player. Additionally, in some cases, a decision authority must also consider allocations that increase his own payoff. We can think of the payoffs in each allocation in many ways. These payoffs can reflect direct monetary payoffs (e.g. bonuses) to employees within a firm for different production or service outcomes. In the case where group payoffs are tied to firm-level profits, allocations that maximize group member payoffs reflect firm profit-maximizing allocations. Payoffs may also represent utility from non-pecuniary drivers. This may be in the form of relative standing within the firm or satisfaction from the recognition of supervisees. For ease of exposition, and to coincide with the related literature, we refer to the "efficient" outcome as one that maximizes group payoffs.

To understand better the links between organizational design and individual preferences, we propose a theoretical framework loosely inspired by Rabin (1994), Fehr and Schmidt (1999), and Konow (2000). We model players as facing tradeoffs between self-interested gains and adherence to a social norm, such as efficiency. Players are potentially influenced by the recommendations provided by others. This internal struggle and the resulting disutility is what social psychology refers to as, "cognitive dissonance." In introducing the concept of cognitive dissonance, Leon Festinger (1957) also proposed subjects can reduce cognitive dissonance by decreasing the self-interested behavior or by self-deceiving. We make no concerted efforts to create or reinforce group

identity which itself might lead to increased social welfare maximizing behavior (Chen and Li, 2009). However, our results point to the complimentary nature of group identity and the choice of organizational design itself in promoting efficiency within the firm.

Turning briefly to the results, we find that organizational design significantly influences group outcomes. We see variation across treatments in the proportion of outcomes aligned with motives such as efficiency concerns, maximin motives, and self-interest. Consistent with expectations, as we move from the engineering model to the autocracy, decision makers become less willing to tradeoff own payoffs and payoffs to others. In the flat bureaucracy and tall bureaucracy treatments, we find that recommendations from subordinates significantly influence the importance of group norms. We find statistical evidence that suggests both adherence to social norms of efficiency and maximizing the payoff of the lowest-paid player are important. The latter motive is associated with a higher marginal utility. Moreover, when both maximin and efficiency norms are controlled for, adhering to efficiency norms is no longer statistically significant for the tall bureaucracy and autocratic treatments.

## 1.2 Experimental Design

In the following subsections, we detail our experimental design by first addressing common elements across treatments. We then provide details specific to each of our four treatments: Engineering model firm, Flat Bureaucracy, Tall Bureaucracy, and Autocratic model. We provide the 23 allocations we use across treatments in the Appendix A and the instructions for each treatment in Appendix B.

### *1.2.1 Common Elements Across Treatments*

Each session consists of 23 decision rounds (11 from E&S, 12 of our own design; see Appendix A). Players are randomly assigned to a group of three subjects and a role of Player 1, Player 2, or Player 3. Subjects maintain their group and role assignment throughout the experiment. Each round represents one of 23 choice sets of three different allocations between three persons. We randomize the order of the 23 sets across groups and between sessions. Additionally, we randomize the order the three allocations are presented in each round between sessions. Subjects are told they will not know how many decision rounds there are until the experiment is complete. All decisions are made and recorded via networked computers using z-Tree (Fischbacher, 2007). One of the authors read the instructions aloud and addressed any questions. No practice rounds are provided consistent with E&S.

We make it clear to the subjects that two of the 23 decision rounds are selected at random to be the paid rounds and that each round is equally likely to be selected. There is no feedback at the end of each round. Only the outcomes from the two paid rounds are announced at the conclusion of the experiment.

While each treatment represents a different organizational design, we provide a neutral framing. Our objective is to identify distributional preference changes due to the organizational design. Framing one player as having a formal title with responsibility or authority over the others would potentially introduce unintended experimental demands. Additionally, each session consists of one treatment.

#### *1.2.1.1 E&S Decision Task Themes*

Below, we present Figure 1.1 to illustrate the typical E&S task and then provide descriptions of themes captured in the E&S tasks. We see from this example that Players can choose between allocations "A", "B", or "C." The motives are labeled from Player 3's perspective. We see that Player 3 has no opportunities to choose selfishly because all allocations provide the same payoff to Player 3. However, we see differing levels of efficiency across the choice set. Efficiency is defined as the total payoff of all players in an allocation. In the example below, the sum total of payoffs to each player in allocation "A" is 18. Since allocation "A" results in the highest group payoff, allocation "A" is the efficient allocation. The allocation which maximizes the minimum payoff across the choice set is defined as the "maximin allocation." In the example below, allocation "C" maximizes the minimum payoff for all players and is therefore the maximin allocation. We now distinguish sets of tasks based on their payoff structure.

| | Ex (E&S1.4) | | |
|---|---|---|---|
| | A | B | C |
| Player 3 | 6 | 6 | 6 |
| Player 2 | 10.5 | 8.5 | 6.5 |
| Player 1 | 1.5 | 2 | 2.5 |
| Predictions | | | |
| Selfish | A | B | C |
| Efficiency | A | | |
| Maximin | | | C |

**Figure 1.1 – Example E&S Decision Task**

*Taxation Games (Decision Tasks 1-4)* – This setting is characterized by a "middle income" individual choosing payoffs for a "high income" individual and a "low income" individual. The "middle income" individual is provided with the same payoff

across the three allocations to remove selfish motives. We have arranged the allocations so that Player 3, in our design, is the “middle income” individual.

*Envy Games (Decision Tasks 5-8)* – The envy games are characterized by the ability of the “middle income” individual to reduce the payoff available to the “high income” individuals by simultaneously reducing the payoff available to “low income” individuals. In decision task 5, the payoff to the “middle income” individual, Player 3, is kept constant across the three available options. However, in decision tasks 6, 7, and 8, E&S introduce a selfish motive by providing different payoffs to Player 3 across the three available options. This variation provides insight to the tradeoff individuals are willing to make between selfish concerns or efficiency concerns and maximin preferences.

*Rich and Poor Games (Decision Tasks 9-11)* – In contrast to the prior decision tasks, the rich and poor games are characterized by Player 3 receiving the highest payoff or the lowest payoff respectively. Player 3’s payoff is constant across the three choices for each of the decision tasks. The final decision task provided by E&S, decision task 11, reintroduces the taxation game structure but separates efficiency from all other fairness motives considered by E&S. These structures were chosen by E&S to analyze efficiency, maximin preferences, and inequality aversion. Again, we focus our analysis on efficiency and maximin preferences.

#### *1.2.1.2 HCP Decision Task Themes*

The E&S tasks primarily focus on an environment where Player 3 faces a constant payoff across the choice set. In the Hierarchy Consistent Payoff (HCP) tasks,

we provide variations to Player 3's payoffs to increase the opportunities for selfish behavior. Below, we present Figure 1.2 to illustrate a typical HCP task.

| | HCP1.1 | | |
|---|---|---|---|
| | A | B | C |
| Player 3 | 9 | 9.25 | 8.75 |
| Player 2 | 7.5 | 5 | 6.25 |
| Player 1 | 4.5 | 4 | 5 |
| Predictions | | | |
| Selfish | | B | |
| Efficiency | A | | |
| Maximin | | | C |

**Figure 1.2 – Example HCP Task**

We now see Player 3 has an opportunity to choose selfishly. That is make a choice that will result in a higher payoff for himself. In Figure 1.2, allocation "B" leads to the highest payoff for Player 3 and is therefore the "selfish allocation." Using the same definitions from above, we see here allocation "A" is the efficient allocation and allocation "C" is the maximin allocation. Below we provide a brief description for each of the themes we capture in the HCP tasks.

*HCP1 Series* (Decision Tasks 12-14) – In the HCP1 series of decision tasks we disentangle self-interest from efficiency and maximin preferences. To choose the efficient allocation in T2, T3, and T4, Player 3 must give up some amount of their own payoff. To select the maximin allocation, Player 3 must give up double the amount relative to the amount required to choose the efficient allocation. The cost to achieve an efficient or maximin allocation increases from decision task 12 to decision task 13 and again from decision task 13 to decision task 14.

*HCP2 Series* (Decision Tasks 15-17) – The HCP1 series decision tasks focused on isolating self-interest, efficiency concerns, and maximin preferences. Here we instead focus on self-interest while allowing the efficient and maximin allocation to coincide. This design provides a clear contrast for self-interest against efficiency and maximin preferences.

*HCP3 Series* (Decision Tasks 18-20) – We carry forward elements from the HCP2 series of decision tasks but now hold constant the payoff for Player 2. This adjustment makes Player 2 indifferent between the three allocations in each of the decision tasks with respect to their own payoff. Having Player 2 indifferent between allocations concerning their own payoff reduces the cognitive energy required to self-deceive oneself into choosing the selfish choice. In the HCP2 series of decision tasks, if Player 3 chooses selfishly it is at the expense of both Player 1 and Player 2. This dynamic is no longer present in the HCP3 series since the payoff to Player 2 is constant across allocations. We maintain the alignment of efficiency and maximin predictions to isolate self-interest motives.

*HCP4 Series (Decision Tasks 20-23)* – Finally, we present the HCP4 series of decision task. In the HCP3 series of decision tasks, we focused on the alignment of the maximin preferences and efficiency concerns while isolating selfish motives. In the HCP4 series of decision tasks, we relax the constant payoff across allocations for Player 2 and now align selfish motives with maximin. By doing so, we isolate efficiency concerns and show the influence the efficiency motive when a decision maker is faced with clearly aligned selfish and maximin allocations.

### *1.2.2 Experimental Treatments*

#### *1.2.2.1 Engineering Model (T1)*

In each period, subjects are asked to vote for one of the three available allocations for implementation. The option with a majority is selected for implementation and the decision round ends. As part of the instructions, subjects are informed that if a majority is not reached, which means that each player chose a different allocation, one of the allocations is randomly selected. This ensures no learning occurs within periods through an unanimity rule that may require several iterations to resolve and maintains comparability between treatments.

This setting is characterized by a lack of responsibility accruing to a single decision maker but places pressures on group members to vote for the assumed group norm in order to achieve a majority.

#### *1.2.2.2 Flat Bureaucracy (T2)*

Player 1 and Player 2 provide a recommendation to Player 3. Player 1, Player 2 and Player 3 simultaneously consider the three allocations for the period. Player 1 and Player 2 make a selection to serve as their recommendation to Player 3. Recommendations made by Player 1 and Player 2 are then provided to Player 3. Player 3 then makes a final selection to end the decision round.

While the responsibility for the group payoff now falls solely on the group decision maker, having several sources of information provides potentially strong guidance to the decision maker on which allocation to choose reducing or even eliminating moral wiggle room.

#### *1.2.2.3 Tall Bureaucracy (T3)*

While similar to the Flat Bureaucracy treatment, the Tall Bureaucracy treatment differs in that Player 1 now makes a recommendation to Player 2. Next, Player 2 considers the three allocations for the period and Player 1's recommendation. Player 2 can either confirm Player 1's recommendation by making the same recommendation or deny Player 1's recommendation by making a new recommendation. Only Player 2's recommendation proceeds to Player 3 for consideration. Finally, we provide Player 3 with Player 2's recommendation and the three allocations to consider. Player 3 will make a final selection for implementation for the group and end the decision round.

In this treatment, responsibility for the group payoff still falls solely on the group decision maker. However, the partial nature of the information passed between other group members and the decision maker increases the amount of moral wiggle room available to the decision maker.

#### *1.2.2.4 Autocratic Model (T4)*

In this treatment, Player 1, Player 2, and Player 3 simultaneously consider the three different allocations for the period. As part of the instructions, we make it clear that recommendations from Player 1 and Player 2 will not go forward to Player 3 for consideration. We ask Player 1 and Player 2 to select which allocation they would recommend to Player 3, if they could. Player 3 considers the three different allocations without recommendations and makes a selection to end the decision round.

This setting is characterized by a decision authority that bears the full responsibility for the group payoff and no information is exchanged with the autocrat. The autocrat

can deviate from the assumed group norm but must expend costly cognitive effort to do so.

### *1.2.3 Participants*

A total of 162 University of Tennessee undergraduate students participated in an experiment conducted at the UT experimental Economics Laboratory. These individuals were recruited from a pool of roughly 1,400 students representing a diverse assortment of majors who had previously registered as potential economics experiment participants. Roughly 58% of participants were male with an average age of 21 years. 21% of participants had taken one or no economics courses and 88% had taken fewer than 3. Roughly 53% of participants have participated in a previous (unrelated) experiment. Earnings for this experiment were denominated in US dollars. Each session lasted approximately one hour and subjects earned an average of $16.04. Each subject was paid in private using sealed envelopes at the conclusion of each session. When asked how well subjects understood the instructions in a post-experiment questionnaire, subjects responded with an average 4.80 out of 5. With 5 representing the instructions were understood “very well.”

## 1.3 Theoretical Framework and Testable Hypotheses

Here we provide a theoretical framework, which we will use to inform the data analysis. We consider a model of group decision making shaped by organizational design. In this setting, a group of three players must choose between three allocations. Each individual is motivated to maximize his own self-interest. However, he is also

motivated by social concerns with a changing sensitivity to these social concerns based on his setting. All decision makers are assumed to have a utility function of the form

$$U(\boldsymbol{z}_j) = \beta z_{ji} + C\left[\hat{S} - S(\boldsymbol{z}_j)\right]. \quad (1)$$

Here, $z_{ji}$ is the monetary payoff to player $i$ from allocation $j$, and $\beta$ is the marginal utility from receiving another dollar (i.e. it is the marginal utility of income). Let $S(\boldsymbol{z}_j)$ represent some measure of group welfare, the statistic $S$ can represent total group payoff, average group payoff, the lowest individual payoff in the group, or some measure of equality. Let $\hat{S}$ represent the highest feasible value achievable for all choices of $\boldsymbol{z}_j$.

The coefficient $C$ denotes the individual's sensitivity to changes in the group welfare measure $S$, and it is also the parameter affected by the experimental treatments. The coefficient $C$ is negative if an individual dislikes deviations from $\hat{S}$ and positive otherwise. This sensitivity changes as a result of a "choice-shift" effect proposed by Levinger and Schneider (1969). The choice shift effect occurs when (a) a group member has a preference that might differ from what he believes is the norm, (b) he makes a decision somewhere between his own ideal choice and the assumed norm, (c) some information from other group members reveals the group norm is much closer to (or further away from) his own preference. This information is used to update the decision maker's actual choice. We assume individuals care about adhering to the social norm, and view deviations as a "bad." Thus, $C$ is most likely negative.

Our model bears resemblances to the one proposed by Fehr and Schmidt (1999). In their model, as in ours, utility has two components. They hypothesize that individuals gain utility from their own payoffs, but they lose utility whenever their payoffs

differ from those of others. Thus, their "norm" is based on perfectly equitable payoffs, and any deviations from that reduce utility. In our model the norm could take other forms besides reflecting inequity, and could be based on efficiency or the payoff to the lowest-paid individual in the group. In this way our model has greater flexibility than the Fehr-Schmidt model, while retaining its basic, two-component structure. The flexibility of our model also allows us to add multiple social norms for consideration similar to that proposed by Charness and Rabin (2002). In their model, an individuals payoff is defined by weighted sum of the individual's own-payoff, concern for the worst-off person (maximin), and maximizing the social surplus (efficiency).

We hypothesize that $C$ depends on factors such as responsibility, availability of moral wiggle room, and cognitive effort, and thus we expect that the relative importance of norms will depend on organizational structure. We suspect that, under the Engineering Model, group members will rely most heavily on the assumed group norm when casting votes in an effort to reach a consensus. At the other extreme, in the Autocratic Model treatment, the decision maker makes a choice behind a veil of ignorance, and thus can easily rationalize a more selfish choice. In the bureaucracy treatments, when subordinates recommend allocations that suggest group norms, this should influence the decision maker towards welfare-enhancing choices. In the Flat Bureaucracy, this influence should be strongest when both subordinates recommend the same welfare-enhancing allocation. Overall, holding the marginal utility of self-interest ($\beta$) constant, we expect $C$ to be largest (in absolute value) with the Engineering

Model, the smallest with the Autocratic Model, with the bureaucracy treatments in-between. We provide our expectations in the form of three hypotheses:

*Hypothesis 1.* The relative importance of motives (selfish, efficiency, and maximin) will differ across treatments.

*Hypothesis 2.* The relative importance of adhering to the efficiency or maximin norms will be highest in the Engineering model, followed by the two bureaucracy treatments, and then the Autocratic Setting.

*Hypothesis 3.* In the Flat Bureaucracy and Tall Bureaucracy treatments, the decision maker places more importance on adhering to the efficiency (maximin) norm when subordinates recommend the efficient (maximin) outcome.

Ultimately, however, the influence of social norms in the context of organizational designs is an empirical question, and one can make contrasting arguments. For instance, under the Engineering Model, people have equal say and thus if someone else prefers a different allocation then they have the chance to say so. This may lead to selfish choices. In contrast, in the autocratic setting, the decision maker may empathize with those who have no say in the outcome and thus seek out what they perceive to be desirable outcome from the group. In the bureaucracy treatments, providing information to a decision maker introduces the possibility of moral wiggle room. If a decision maker is provided with information from some group members that is closer to her own preferred allocation, but further away from the assumed group norm, the decision maker can now wiggle away from the assumed norm.

## 1.4 Experimental Results

Throughout this section, we provide several different approaches to provide insight on the above hypotheses. We begin by visually analyzing the data to show at a

high level that organizational design clearly influences group outcomes. Additionally, we include a comparison to a random decision-making process. With our experimental design, random decision-making results in the allocation associated with self-interest, efficiency or maximin preferences being chosen one-third of the time. These results are presented in Figure 1.3 and Figure 1.4.

Next, we analyze the distribution of group decisions by treatment in each decision tasks. We conduct a two-tailed t-test with unequal variance for equal mean outcome of motives across treatments. We make a pairwise comparison of observed outcomes in each treatment and statistically test whether they come from the same data generating process. We present these results in Table 1.1 through Table 1.10.

Finally, we consider how organizational design influences group decision making at the individual level. We utilize McFadden's Random Utility Maximization framework to analyze individual choices to determine the influence of organizational design on individual decision making. We present these results in Table 1.11 through Table 1.16.

### *1.4.1 Visual Inspection of the Data*

We begin by summarizing results suggesting organizational design influences group decision making. In particular, for each treatment, we display in Figure 1.3 the proportion of realized allocations that coincide with pure self-interest, efficiency or maximin preferences. We include a dotted line to represent the random choice outcome. For T2, T3 and T4, these percentages coincide with choices from Player 3, the decision maker. For T1, percentages for the efficiency and maximin choices coincide with the group preference (which may be randomly determined). For an

apples-to-apples comparison, the self-interest percentage is based on the choice of Player 3.

We note that for some tasks the three motives are not mutually exclusive in our design. For example, it might be the case Option A in a particular task may align with both efficiency concerns and selfish motives. For this reason, the three percentages for a particular treatment sum to over 100%. We include all decision tasks in calculating the proportion of available efficiency outcomes achieved. However, in calculating the proportion of available maximin outcomes achieved, we exclude E&S decision task 10 due to all three allocations maximizing the minimum payoff. Finally, we only include the 15 decision tasks where Player 3 has the opportunity to choose selfishly in the sense that there is variation in own payoff across allocations.

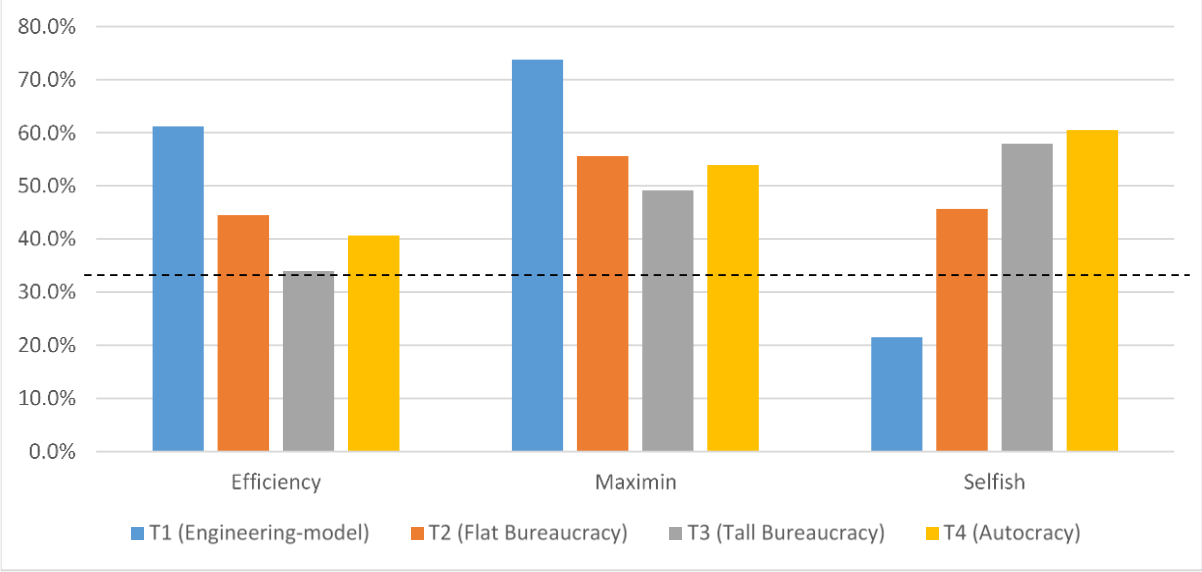



**Figure 1.3 – Average Proportion of Motive Achieved by Group by Treatment.**

If organizational design had no influence on group decision making, we should see a lack of variation across treatments in each motive. However, instead there

appears to be meaningful differences. Further, choices are not simply “random”. The starkest differences are between T1 and the other treatments. The highest percentage of either efficiency (61%) or maximin (74%) choices occur in T1, and the lowest percentage of selfish choices (22%). For the other treatments, the percentage associated with self-interest climbs as high as 61% in the case of T4, and social welfare outcomes are lowest in T3 (34% and 49% for efficiency and maximum, respectively). There is only moderate variation across T2, T3 and T4, with the exception of the selfish motive.

By design, the 11 decision tasks provided by E&S are predominantly defined by indifference with respect to own payoff for Player 3 across allocations. In our 12 Hierarchy Consistent Payoff (HCP) allocations, we provide an opportunity for Player 3 to trade off self-interest, efficiency, and/or maximin allocations. In Figure 1.4 we separate the outcomes across the two sets of tasks.

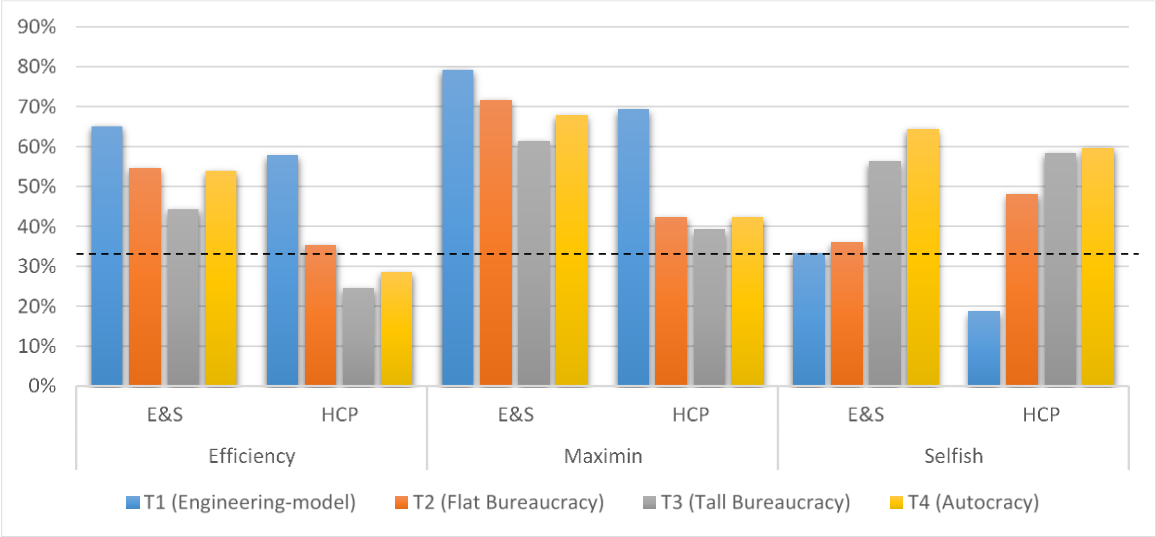



**Figure 1.4 – Average Proportion of Motive Achieved by Treatment and Decision Task Series**

In Figure 1.4, it becomes clear the availability of self-interested allocations influences group decision making but to differing degrees by organizational design. For example, we see T4 is essentially equal to T2 in generating efficiency maximizing outcomes in the E&S tasks but underperforms T2 in the HCP tasks. Similarly, T2 leads to more Maximin outcomes in E&S tasks than T4, but reaches near parity in HCP tasks. We now turn to a statistical analysis.

### *1.4.2 Testing the Importance of Motives across Treatments*

In Table 1.1, we present results from various pairwise treatment comparisons, using t-tests (allowing for unequal variances). In each entry in Table 1.1, we provide the p-value corresponding with the null hypothesis that the proportion of choices associated with a particular motive are equal across two treatments. For instance, the p-value 0.08 for the cell corresponding to T2 (row), T3 (column) and the efficiency motive suggests that the proportion of choices corresponding this motive are (weakly) statistically different between the two bureaucracy treatments.

**Table 1.1 – Test for Equal Motives, All Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.00 | | | |
| | Efficiency | 0.01 | | | |
| | Maximin | 0.00 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.00 | 0.08 | | |
| | Efficiency | 0.00 | 0.04 | | |
| | Maximin | 0.00 | 0.13 | | |
| T4 – Autocracy (N=14) | Selfish | 0.00 | 0.17 | 0.87 | |
| | Efficiency | 0.01 | 0.62 | 0.21 | |
| | Maximin | 0.00 | 0.80 | 0.21 | |
| Number of Group Decisions | | 299 | 299 | 322 | 322 |

At a basic level, these tests suggest that organizational design matters. This provides evidence in favor of Hypothesis 1. Interestingly, the most prominent differences occur when comparing T1 to any of the treatments. This is consistent with our earlier visual inspection. We summarize results of the statistical tests as Result 1.

**Result 1.** (1) For each of the three motives, the Engineering Model leads to statistically different outcomes from every other treatment; in particular, there are higher proportions of efficiency and maximin outcomes but fewer selfish outcomes. (2) The Tall Bureaucracy leads to greater selfish outcomes, lower efficiency outcomes, but no difference in maximin outcomes when compared to the Flat Bureaucracy. (3) The Autocratic Model leads to outcomes that fall between those for the Tall and Flat Bureaucracy treatments, but are statistically indistinguishable from either.

To explore further, we present t-test results of our data broken down by both E&S tasks and our own HCP tasks. Below we present Table 1.2, which presents the results from our t-test analysis specific to the 11 E&S tasks. Table 1.3, Table 1.4, and Table 1.5 present the results of our t-test analysis broken down by the three types of decision tasks developed by E&S. Following the E&S tasks, we transition to the HCP tasks. Table 1.6 presents the results from the 12 HCP tasks of our own design. Table 1.7 through Table 1.10 present the results of the t-test analysis broken down by the four themes we designed for this experiment. Each table is interpreted the in the same way as Table 1.1

Table 1.1 provided strong statistical support for differences in outcomes between T1 and all other treatments. However, when we focus only on E&S tasks, in many cases these differences are no longer statistically significant. For example, in Table 1.1, the observed group decisions in T1 (column) compared to observed group decisions in T2 (row) show strong statistical support for differences in outcomes. In Table 1.2, for the

same cell, we cannot reject the null hypothesis that any of the mean outcomes by motive are the same.

**Table 1.2 – Test for Equal Motives, E&S Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.34 | | | |
| | Efficiency | 0.14 | | | |
| | Maximin | 0.23 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.00 | 0.01 | | |
| | Efficiency | 0.00 | 0.19 | | |
| | Maximin | 0.00 | 0.06 | | |
| T4 - Autocracy (N=14) | Selfish | 0.00 | 0.01 | 0.68 | |
| | Efficiency | 0.17 | 0.94 | 0.30 | |
| | Maximin | 0.09 | 0.61 | 0.18 | |
| Number of Group Decisions | | 299 | 299 | 322 | 322 |

In other areas, we now find that there are statistical differences within particular sets of tasks, although there were no differences in the aggregate. For example, In Table 1.1, the observed group decisions in T2 (column) compared to observed group decisions in T4 (row) showed statistically insignificant differences in mean outcomes for the Selfish motive. When the analysis is restricted to E&S tasks, for the same cell, we can now reject the null hypothesis the mean outcomes are the same at the 0.01 significance level.

*Taxation Games (Decision Tasks 1-4)* – Table 1.3 presents the results of our t-test for equal mean outcomes by motive and by treatment for Taxation Games. We find that in this subset of decision tasks, we find no statistical differences between treatments.

**Table 1.3 – Test for Equal Motives, Taxation Games**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | - | | | |
| | Efficiency | 0.56 | | | |
| | Maximin | 0.85 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | - | - | | |
| | Efficiency | 0.47 | 0.96 | | |
| | Maximin | 0.55 | 0.43 | | |
| T4 - Autocracy (N=14) | Selfish | - | - | - | |
| | Efficiency | 0.70 | 0.39 | 0.33 | |
| | Maximin | 0.69 | 0.55 | 0.84 | |
| Number of Group Decisions | | 52 | 52 | 56 | 56 |

*Envy Games (Decision Tasks 5-8)* – Table 1.4 presents the results of our t-test for equal mean outcomes by motive and by treatment for Envy Games. We find that in this subset of decision tasks, T1 is statistically different from the other treatments a majority of the time across motives. In a setting described by the Envy Games, the t-test results point to statistically insignificant differences between T3 and T4.

*Rich and Poor Games (Decision Tasks 9-11)* – Table 1.5 presents the results of our t-test for equal mean outcomes by motive and by treatment for Rich and Poor Games. We find that in this subset of decision tasks, in any pairwise comparison cross treatments, we fail to reject the null hypothesis that the observed mean outcomes are equal. In other words, we cannot statistically say that on average these treatments achieve different motive outcomes.

The prior 11 decision tasks focused primarily on cases where Player 3 maintains a fixed payoff across the three allocations for each decision task. Only decision tasks 7-

**Table 1.4 – Test for Equal Motives, Envy Games**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.34 | | | |
| | Efficiency | 0.03 | | | |
| | Maximin | 0.03 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.01 | 0.02 | | |
| | Efficiency | 0.00 | 0.01 | | |
| | Maximin | 0.00 | 0.00 | | |
| T4 - Autocracy (N=14) | Selfish | 0.01 | 0.02 | 0.71 | |
| | Efficiency | 0.00 | 0.09 | 0.52 | |
| | Maximin | 0.00 | 0.19 | 0.22 | |
| Number of Group Decisions | | 52 | 52 | 56 | 56 |

**Table 1.5 – Test for Equal Motives, Rich and Poor Games**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | - | | | |
| | Efficiency | 0.47 | | | |
| | Maximin | 0.63 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | - | - | | |
| | Efficiency | 0.36 | 0.90 | | |
| | Maximin | 0.66 | 0.98 | | |
| T4 - Autocracy (N=14) | Selfish | - | - | - | |
| | Efficiency | 0.99 | 0.52 | 0.43 | |
| | Maximin | 0.32 | 0.19 | 0.21 | |
| Number of Group Decisions | | 39 | 39 | 42 | 42 |

9 provide an opportunity for self-interest. In the following 12 decision tasks, the Hierarchy Consistent Payoff (HCP) tasks, we expand on this and provide variation across player 3's payoff in the three allocations for each decision task introducing larger incentives for selfish behavior. Table 1.6 reports results for our t-test analysis subject to isolating our data to the 12 HCP decision tasks.

From Table 1.6, we see again that when comparing T1 (column) to any treatment (row), we can reject the null hypothesis of equality of the mean outcome by motive. This is not as clear cut in other treatments. We find we can only reject the null hypothesis of the t-test for the equal mean Efficiency outcomes between T2 (column) and T3 (row) at any reasonable significance level.

*Hierarchy Consistent Payoff Task Series1* (Decision Tasks 12-14) – Table 1.7 presents the results of our t-test for equal mean outcomes by motive and by treatment for HCP Series 1. We find that in this subset of decision tasks, T1 (column) results in statistically insignificant differences in Efficiency outcomes across treatments. However, T1 (column) does result in statistically different mean outcomes of both Selfish and Maximin motives across treatments. We find few statistically different outcomes across treatments T2 through T4.

*HCP2 Series* (Decision Tasks 15-17) – Table 1.8 presents the results of our t-test for equal mean outcomes by motive and by treatment for HCP Series 2. We find that in this subset of decision tasks, T1 (column) results in statistically significant differences in outcomes across all treatments. However, the remaining treatments result in statistically insignificant differences in outcomes across treatments.

**Table 1.6 – Test for Equal Motives, HCP Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.00 | | | |
| | Efficiency | 0.00 | | | |
| | Maximin | 0.00 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.00 | 0.15 | | |
| | Efficiency | 0.00 | 0.04 | | |
| | Maximin | 0.00 | 0.39 | | |
| T4 - Autocracy (N=14) | Selfish | 0.00 | 0.32 | 0.78 | |
| | Efficiency | 0.00 | 0.46 | 0.33 | |
| | Maximin | 0.00 | 1.00 | 0.45 | |
| Number of Group Decisions | | 299 | 299 | 322 | 322 |

**Table 1.7 – Test for Equal Motives, HCP1 Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.00 | | | |
| | Efficiency | 1.00 | | | |
| | Maximin | 0.00 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.00 | 0.22 | | |
| | Efficiency | 0.18 | 0.16 | | |
| | Maximin | 0.02 | 0.52 | | |
| T4 - Autocracy (N=14) | Selfish | 0.00 | 0.27 | 1.00 | |
| | Efficiency | 0.10 | 0.09 | 0.68 | |
| | Maximin | 0.11 | 0.29 | 0.62 | |
| Number of Group Decisions | | 39 | 39 | 42 | 42 |

**Table 1.8 – Test for Equal Motives, HCP2 Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.10 | | | |
| | Efficiency | 0.02 | | | |
| | Maximin | 0.02 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.02 | 0.23 | | |
| | Efficiency | 0.00 | 0.22 | | |
| | Maximin | 0.00 | 0.14 | | |
| T4 - Autocracy (N=14) | Selfish | 0.01 | 0.12 | 0.69 | |
| | Efficiency | 0.00 | 0.36 | 0.74 | |
| | Maximin | 0.01 | 0.60 | 0.44 | |
| Number of Group Decisions | | 39 | 39 | 42 | 42 |

*HCP3 Series* (Decision Tasks 18-20) – Table 1.9 presents the results of our t-test for equal mean outcomes by motive and by treatment for HCP Series 3. We find here again T1 (column) results in statistically significant differences in outcomes across all treatments. However, the remaining treatments result in statistically insignificant differences in outcomes across treatments.

*HCP4 Series (Decision Tasks 20-23)* – Table 1.10 presents the results of our t-test for equal mean outcomes by motive and by treatment for HCP Series 4. We find in this setting T1 (column) results in statistically significant differences in the Maximin outcome when compared to T3 (row). The remaining treatments result in statistically insignificant differences in outcomes across treatments.

**Result 2.** (1) We find no statistical differences across treatments within the following sets of decision tasks: Taxation games (tasks: 1-4), Rich and Poor games (tasks: 9-11), and Hierarchy Consistent Payoffs Series 4 (tasks: 20-23).[2] (2) We find statistical differences across treatments in Envy Games (tasks:5-8) and Hierarchy Consistent Payoffs (Series 1, 2, and 3 (tasks 12-19) with the Engineering Model generally leading to more efficiency and maximin outcomes, and fewer selfish outcomes.

### *1.4.3 Importance of Self-Interest and Social Welfare Motives*

Having shown both visually and statistically that organizational design matters, we now use the data to estimate parameters of the theoretical model. We do so using a conditional logit model, following McFadden's random utility maximization (RUM) model framework (see e.g. Wooldridge, 2002). This framework allows us to quantify the relative importance of motives. It is important to note that in the conditional logit analysis

[2] We can only reject the test for equal maximin motive outcomes between T1 and T3 in Hierarchy Consistent Payoffs Series 4 (tasks: 20-23).

**Table 1.9 – Test for Equal Motives, HCP3 Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.00 | | | |
| | Efficiency | 0.00 | | | |
| | Maximin | 0.00 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.00 | 0.30 | | |
| | Efficiency | 0.00 | 0.50 | | |
| | Maximin | 0.00 | 0.37 | | |
| T4 - Autocracy (N=14) | Selfish | 0.00 | 0.70 | 0.58 | |
| | Efficiency | 0.00 | 1.00 | 0.51 | |
| | Maximin | 0.00 | 0.77 | 0.28 | |
| Number of Group Decisions | | 39 | 39 | 42 | 42 |

**Table 1.10 – Test for Equal Motives, HCP4 Tasks**

| Two sample t-Test (p-values) | | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| T1 - Engineering Model (N=13) | Selfish | | | | |
| | Efficiency | | | | |
| | Maximin | | | | |
| T2 - Flat Bureaucracy (N=13) | Selfish | 0.21 | | | |
| | Efficiency | 0.42 | | | |
| | Maximin | 0.21 | | | |
| T3 - Tall Bureaucracy (N=14) | Selfish | 0.20 | 0.89 | | |
| | Efficiency | 0.71 | 0.83 | | |
| | Maximin | 0.07 | 0.50 | | |
| T4 - Autocracy (N=14) | Selfish | 0.49 | 0.65 | 0.59 | |
| | Efficiency | 0.49 | 0.20 | 0.38 | |
| | Maximin | 0.16 | 0.74 | 0.83 | |
| Number of Group Decisions | | 39 | 39 | 42 | 42 |

we focus solely on the selections made by Player 3 in each of the treatments. This ensures that we make a consistent comparison across the treatments when we consider the impact organizational design has on individual decision making.

### *1.4.3 Importance of Self-Interest and Social Welfare Motives*

Having shown both visually and statistically that organizational design matters, we now use the data to estimate parameters of the theoretical model. We do so using a conditional logit model, following McFadden's random utility maximization (RUM) model framework (see e.g. Wooldridge, 2002). This framework allows us to quantify the relative importance of motives. It is important to note that in the conditional logit analysis we focus solely on the selections made by Player 3 in each of the treatments. This ensures that we make a consistent comparison across the treatments when we consider the impact organizational design has on individual decision making.

Here we present a model of self-interest and efficiency concerns.[3] For each allocation $j \in \{A, B, C\}$ that individual $i$ can choose we provide the following explanatory variables where $x_{jk}$ is the payoff to person $k$ for allocation $j$:

$$Self_{ij} = x_{ji},$$

$$Eff_{ij} = \sum_{k=1}^{3} x_{jk},$$

$$\widehat{Eff} = \max\left\{\sum_{k=1}^{3} x_{jk}, j = A, B, C\right\},$$

[3] Later we consider the maximin outcome as an alternative group norm.

$$DeltaEff_{ij} = \widehat{Eff} - Eff_{ij},$$

$$DeltaEff_{ij,1star} = \left(DeltaEff_{ij}\right) * 1star,$$

$where$

$$1star = \begin{cases} 1, & Player\ 1\ OR\ player\ 2\ recommend\ the\ \widehat{Eff}\ allocation\ (in\ treatment\ T2\ or\ T3) \\ 0, & Otherwise \end{cases}$$

$$DeltaEff_{ij,2star} = \left(DeltaEff_{ij}\right) * 2star,$$

$where$

$$2star = \begin{cases} 1, & Player\ 1\ AND\ player\ 2\ recommend\ the\ \widehat{Eff}\ allocation\ (in\ treatment\ T2) \\ 0, & Otherwise \end{cases}$$

In order to isolate the influence of organizational design on decision making we interact our explanatory variable with indicator variables for the respective treatments. This allows us to pool the data from all treatments – which helps facilitate hypothesis tests - without placing any restrictions on the estimated utility function parameters. Below we provide an example for the Engineering model treatment, T1, but treatment indicators for T2, T3, and T4 follow the same convention:

$$T1 = \begin{cases} 1, & if\ observation\ belongs\ to\ the\ T1\ treatment \\ 0, & Otherwise \end{cases}$$

We now have a pooled utility specification function of the form:

$$\begin{aligned} V_{ij} = {} & \beta_1\left(Self_{ij} * T1_i\right) + \beta_2\left(Self_{ij} * T2_i\right) + \beta_3\left(Self_{ij} * T3_i\right) + \beta_4\left(Self_{ij} * T4_i\right) \\ & + C_{T1}\left(DeltaEff_{ij} * T1_i\right) + C_{T2}\left(DeltaEff_{ij} * T2_i\right) \\ & + C_{T2^*}\left(DeltaEff_{ij,1star} * T2_i\right) + C_{T2^{**}}\left(DeltaEff_{ij,2star} * T2_i\right) \\ & + C_{T3}\left(DeltaEff_{ij} * T3_i\right) + C_{T3^*}\left(DeltaEff_{ij,1star} * T3_i\right) \\ & + C_{T4}\left(DeltaEff_{ij} * T4_i\right) + u_{ij} \end{aligned}$$

With the assumption that the error, $u_{ij}$, follows a Type 1 extreme value distribution, and that individuals pick the allocation that maximizes utility, the probability that person $i$ chooses allocation $j$ is:

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{g \in \{A,B,C\}} \exp(V_{ig})}$$

Estimation proceeds using maximum likelihood estimation.

In Table 1.11, we present the results from a restricted version of the above model, where we do not allow heterogeneous effects due to messaging, i.e. $C_{T2^*} = C_{T2^{**}} = C_{T3^*} = 0$. Coefficients are directly interpretable as marginal utilities. In most cases, as expected, the marginal utility of own payoff is positive, and the marginal utility of deviating from the efficiency norm is negative.

The Wald test results presented in Table 1.11 for equality of the coefficients across all four treatments (for self-interest and for treatment coefficients separately) beyond the 1% significance level. This is consistent with our prior results.

In Section 1.3 we hypothesized that the relative importance of the group norm will be highest in T1 and lowest in T4 (Hypothesis 2). To examine this, note that the ratio $\beta/C_T$ can be interpreted as the marginal rate of substitution (MRS) between self-interest and efficiency. If the marginal rate of substitution is positive, Player 3 is willing to take less for himself in exchange for *increasing* the deviation from the efficient allocation. Conversely, a negative marginal rate of substitution is interpreted as Player 3's willingness to forgo money to himself in exchange for *decreasing* the deviation from the efficient allocation.

**Table 1.11 – Estimated Coefficients for the Conditional Logit Model with Self-interest and Efficiency (N=3,726)**

| Log likelihood = -1243.7521 | | | |
|---|---|---|---|
| | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | -0.083 | 0.202 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.400 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 0.667 | <0.001 |
| $\beta_4$ | $Self_{ij} * T4$ | 0.399 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.349 | <0.001 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | -0.352 | <0.001 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.189 | <0.001 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | -0.135 | 0.008 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | 0.006 |
| Wald $C_{T1} = C_{T2}$ | | | 0.971 |
| Wald $C_{T3} = C_{T4}$ | | | 0.466 |

In T4, the MRS is $\beta_4/C_{T4} = -2.96$, suggesting that Player 3 is willing to forego $1 to himself in exchange for decreasing the deviation from the efficient allocation by $2.96. The ratio is statistically zero for T1, is near 1:1 in T2 and approximately 3:1 for T3 and T4. Overall, the relative importance of self-interest increases as we move from T1 to T4. All pairwise comparisons of the MRS produce statistical differences, except when comparing T3 and T4. These results largely lend support to Hypothesis 2. We summarize these findings as Result 3.

**Result 3.** Organizational design alters preferences for both self-interest and efficiency concerns. The relative preference for efficient outcomes is strongest under the Engineering Model, and weakest for the Tall Bureaucracy and Autocratic Model treatments.

To explore the effects of messaging in the two bureaucracy treatments, in Table 1.12, we present the results of the full model specification. With this model, the coefficient $C_{T2}$ is the marginal disutility from deviating from efficiency norm in the case

**Table 1.12 – Estimated Coefficients for the Conditional Logit Model with Self-interest and Efficiency, Includes Recommendation Coefficients (N=3,726)**

| Log likelihood = -1211.7572 | | | |
|---|---|---|---|
| | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | -0.083 | 0.202 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.386 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 0.638 | <0.001 |
| $\beta_4$ | $Self_{ij} * T4$ | 0.399 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.349 | <0.001 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | 0.134 | 0.254 |
| $C_{T2^*}$ | $DeltaEff_{ij,1star} * T2$ | -0.369 | 0.009 |
| $C_{T2^{**}}$ | $DeltaEff_{ij,2star} * T2$ | -1.331 | <0.001 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | 0.025 | 0.796 |
| $C_{T3^*}$ | $DeltaEff_{ij,1star} * T3$ | -0.292 | 0.009 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | -0.135 | 0.008 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | <0.001 |
| Wald $C_{T2^*} = C_{T2^{**}}$ | | | <0.001 |

where neither Player 1 nor Player 2 recommends the efficient outcome. Interestingly, this coefficient is insignificant, suggesting no preference for the social norm. The coefficients $C_{T2^{*}}$ and $C_{T2^{**}}$ measure the disutility (relative to the above case), when one or both players, respectively, recommend the efficient allocation. Both these coefficients are negative and significant, emphasizing the role of messaging. Further, we reject the null hypothesis that these coefficients are equal at the 95% confidence level. In terms of magnitudes, if only one subordinate recommends the efficient allocation, at the margin Player 3 is willing to forego $1 to himself if it decreases the deviation from the efficiency norm by $1.64. However, if there is agreement among subordinates to choose the efficient allocation, we see Player 3 is willing to forgo $1 to himself if it decreases the deviation from the efficient choice by $0.32. Overall, when neither player recommends the efficient outcome, Player 3 choices look more like those from T4, whereas when both players recommend the efficient outcome choices are similar to those in T1.

Similar results arise for T3: when Player 2 does not recommend the efficient allocation, Player 3 receives no disutility from deviating from the efficient choice; on the other hand, when Player 2 recommends the efficient allocation, Player 3 experiences significant disutility from deviating from this. Overall, the results are consistent with Hypothesis 3. We summarize the results from the bureaucracy treatments as Result 4.

**Result 4.** Decision makers are much more sensitive to deviations from efficiency maximizing allocations when subordinates recommend this allocation. In the Flat Bureaucracy treatment, greater disutility arises when both subordinates recommend the efficient allocation, as compared to when only one subordinate does.

Our hypotheses focus on the influence of organizational design on decision makers but does so across all decision tasks. In Figure 1.4, we presented the average

proportion of motives achieved by group decisions broken down by decision task series and treatment. In Table 1.13, we estimate utility parameters for each treatment, separately by E&S and HCP tasks.

From Table 1.13, we find that the decision makers in T3 and T4 are the least sensitive to deviations from the efficiency maximizing allocations in both the E&S and HCP. In fact, the disutility parameter is statistically zero in both cases for the HCP tasks. For T1 and T2, in the E&S tasks, Player 3 places little weight on own payoffs. This is perhaps not surprising as there is no variation in Player 3 payoffs in most tasks. For both treatments, deviations from the efficiency norm do matter. For HCP tasks, surprisingly, the model suggests that Player 3 in T1 experiences *disutility* from own payoffs while not caring about the efficiency norm on average. This is counterintuitive, and may suggest that for HCP tasks the theoretical model is poorly equipped to describe behavior in this treatment.

In Table 1.14, we allow for the effects of messaging in the bureaucracy treatments. For the Flat Bureaucracy treatment, in both sets of tasks we find decision makers are most sensitive to deviations from the efficiency maximizing allocation when there is agreement between subordinates. For example, in the E&S setting, when there is agreement among subordinates we see the MRS equals -0.21. In other words, Player 3 is willing to forgo $1 to himself in order to decrease the deviation from the efficient allocation by $0.21. In comparison, the MRS equals -0.87 when there is only one subordinate recommending the efficient allocation. We see a similar pattern in the HCP decision tasks setting. Interestingly, in the Tall Bureaucracy treatment,

**Table 1.13 – Estimated Coefficients for the Conditional Logit Model with Self-interest and Efficiency Concerns by E&S (N=1,782) and HCP Tasks (N=1,944)**

| E&S Tasks | | | | HCP Task | | | |
|---|---|---|---|---|---|---|---|
| Log likelihood = -569.93009 | | | | Log likelihood = -647.44446 | | | |
| | Variable | Coefficient | Significance (p-value) | | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | 0.197 | 0.761 | $\beta_1$ | $Self_{ij} * T1$ | -0.175 | 0.009 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.360 | 0.059 | $\beta_2$ | $Self_{ij} * T2$ | 0.356 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 2.730 | <0.001 | $\beta_3$ | $Self_{ij} * T3$ | 0.541 | <0.001 |
| $\beta_4$ | $Self_{ij} * T3$ | 2.330 | <0.001 | $\beta_4$ | $Self_{ij} * T3$ | 0.262 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.521 | <0.001 | $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.069 | 0.452 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | -0.411 | <0.001 | $C_{T2}$ | $DeltaEff_{ij} * T2$ | -0.244 | 0.012 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.299 | <0.001 | $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.031 | 0.770 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | -0.282 | <0.001 | $C_{T4}$ | $DeltaEff_{ij} * T4$ | 0.121 | 0.205 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 | Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | 0.102 | Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | 0.065 |
| Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4} = 0$ | | | <0.001 | Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4} = 0$ | | | 0.075 |

**Table 1.14 – Estimated Coefficients for the Conditional Logit Model with Self-interest and Efficiency Concerns by E&S (N=1,782) and HCP Tasks, with recommendation coefficients (N=1,944)**

| E&S Tasks | | | | HCP Task | | | |
|---|---|---|---|---|---|---|---|
| Log likelihood = -553.79482 | | | | Log likelihood = -631.25633 | | | |
| | Variable | Coefficient | Significance (p-value) | | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | 0.197 | 0.761 | $\beta_1$ | $Self_{ij} * T1$ | -0.175 | 0.009 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.231 | 0.206 | $\beta_2$ | $Self_{ij} * T2$ | 0.411 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 2.791 | <0.001 | $\beta_3$ | $Self_{ij} * T3$ | 0.536 | <0.001 |
| $\beta_4$ | $Self_{ij} * T3$ | 2.330 | <0.001 | $\beta_4$ | $Self_{ij} * T3$ | 0.262 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.521 | <0.001 | $C_{T1}$ | $DeltaEff_{ij} * T1$ | 0.069 | 0.452 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | 0.065 | 0.669 | $C_{T2}$ | $DeltaEff_{ij} * T2$ | 0.256 | 0.185 |
| $C_{T2^*}$ | $DeltaEff_{ij,1star} * T2$ | -0.331 | 0.080 | $C_{T2^*}$ | $DeltaEff_{ij,1star} * T2$ | -0.465 | 0.034 |
| $C_{T2^{**}}$ | $DeltaEff_{ij,2star} * T2$ | -1.142 | <0.001 | $C_{T2^{**}}$ | $DeltaEff_{ij,2star} * T2$ | -1.631 | <0.001 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.006 | 0.963 | $C_{T3}$ | $DeltaEff_{ij} * T3$ | 0.047 | 0.763 |
| $C_{T3^*}$ | $DeltaEff_{ij,1star} * T3$ | -0.406 | 0.011 | $C_{T3^*}$ | $DeltaEff_{ij,1star} * T3$ | -0.124 | 0.486 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | -0.282 | <0.001 | $C_{T4}$ | $DeltaEff_{ij} * T4$ | 0.121 | 0.205 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 | Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $C_{T2^*} = C_{T2^{**}}$ | | | 0.002 | Wald $C_{T2^*} = C_{T2^{**}}$ | | | <0.001 |

recommendations only influence Player 3 choices within E&S tasks. As before, when no efficiency allocations are recommended, Player 3 experiences no disutility from deviating from the efficient allocation.

### *1.4.4 Maximin, an Alternative Group Norm*

We now analyze the data using instead the maximin allocation as the group norm. Table 1.15 presents the efficiency and maximin-based specifications in adjacent panels. As evident from the value of the log-likelihood functions at solution, the maximin specification provides a better fit for the data. Moreover, all coefficients are statistically significant and have the expected sign. Similar to the efficiency-based model, we find that relative preferences for minimizing deviations from the social norm are strongest in T1. For this treatment, Player 3 is willing to give up $1 to decrease the deviation from the group norm by $0.39. In the other treatments, Player 3 is only willing to give up $1 if it results in a bigger reduction. The MRS is -1.20 for T2, -1.81 for T3 and -1.48 for T4.

Finding support for a maximin group norm is not altogether surprising. In their own analysis, E&S show maximin preferences greatly influence allocation decisions. However, finding a maximin motive is not simply an artifact of our shared experimental design or unique to our setting. Kamada et al. (2016) provide a neuroeconomics approach to distributive justice and risky decision making to find "…the 'maximin' concern (maximizing the minimum possible payoff) operates as a strong cognitive anchor in both distributive decisions for others and economics decisions for self" and is associated with specific regions of the brain. Our paper suggests that organizational design can help to overcome this "cognitive anchor" by encouraging decision makers to choose welfare enhancing allocations.

**Table 1.15 – Estimated Coefficients for the Conditional Logit Model Efficiency and Separately Maximin for the Social Welfare Statistic (N=3,726)**

| Efficiency | | | | Maximin | | | |
|---|---|---|---|---|---|---|---|
| Log likelihood = -1243.7521 | | | | Log likelihood = -1119.9524 | | | |
| | Variable | Coefficient | Significance (p-value) | | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | -0.083 | 0.202 | $\beta_1$ | $Self_{ij} * T1$ | 0.315 | 0.001 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.400 | <0.001 | $\beta_2$ | $Self_{ij} * T2$ | 0.969 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 0.667 | <0.001 | $\beta_3$ | $Self_{ij} * T3$ | 1.167 | <0.001 |
| $\beta_4$ | $Self_{ij} * T4$ | 0.399 | <0.001 | $\beta_4$ | $Self_{ij} * T4$ | 0.823 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.349 | <0.001 | $C_{T1}$ | $DeltaMM_{ij} * T1$ | -0.799 | <0.001 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | -0.352 | <0.001 | $C_{T2}$ | $DeltaMM_{ij} * T2$ | -0.808 | <0.001 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.189 | <0.001 | $C_{T3}$ | $DeltaMM_{ij} * T3$ | -0.646 | <0.001 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | -0.135 | 0.008 | $C_{T4}$ | $DeltaMM_{ij} * T4$ | -0.557 | <0.001 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 | Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | 0.006 | Wald $C_{T1} = C_{T2} = C_{T3} = C_{T4}$ | | | 0.104 |
| Wald $C_{T1} = C_{T2}$ | | | 0.971 | Wald $C_{T1} = C_{T2}$ | | | 0.939 |
| Wald $C_{T3} = C_{T4}$ | | | 0.466 | Wald $C_{T3} = C_{T4}$ | | | 0.464 |

Last, similar to the theory model of Charness and Rabin (2002), we allow the possibility that players are influenced by both efficiency and maximin norms. In doing so, we must be careful about interpreting utility parameters as interpretation differs from the prior models. Here, $\beta$ is the marginal utility associated with own payoff, holding constant deviations from both the efficiency and maximin norms. As a result, the coefficient on self-interest must be interpreted as a transfer from a player who is not receiving the minimum payoff. Similarly, a one-dollar increase in the deviation from the efficiency maximizing allocation cannot reduce own payoff or the maximin payoff. This suggests that we must interpret the deviation from the efficient allocation as a reduction of another player's payoff who is not oneself nor the player receiving the minimum payoff. Finally, the coefficient on deviations from the maximin motive must be interpreted as decreasing the minimum players payoff without changes to own payoff or the Efficiency. This suggests that we must interpret the deviation from the maximin allocation as a transfer from the player with the lowest payoff to another player (not oneself). presents the results from our conditional logit analysis jointly estimating the

effect of self-interest, deviations from the efficient allocation, and deviations from the maximin allocation.

Estimation results are presented in Table 1.16. Similar to the model that only considers maximin preferences, we find that players care about self-interest and the maximin norm in all treatments. In fact, the coefficients are nearly identical across the two models, suggesting similar tradeoffs. Once maximin preferences are controlled for, deviations from the efficiency norm no longer matter statistically for T3 and T4. While significant and negative for T1 and T2, the coefficients are small in magnitude. This lends qualified support of efficiency norms, while providing additional evidence that deviations from maximin norms are more important.

**Result 5.** Experimental evidence suggests that allocation choices are better explained by a theory where individuals experience disutility from deviating from the maximin outcome.

## 1.5 Conclusions

This study utilizes a laboratory experiment to test the influence of various organizational designs on group decision making. We show that organizational design has a significant influence on the ability of groups to achieve welfare-maximizing outcomes without changes to the incentive structure. Our analysis considers the possible influence of efficiency and/or maximin motives. In either case, our findings suggest that if a firm can establish a norm around the firm's preferred objective, organizational design can be used to help achieve this goal. In particular, when the objective is to either maximize surplus (which may coincide with firm profits) or maximize the payoff of the lowest-paid group member, our results suggest that an

**Table 1.16 – Jointly Estimated Coefficients for the Conditional Logit Model using Efficiency and Maximin for the Social Welfare Statistic (N=3,726)**

| Combined Efficiency & Maximin | | | |
|---|---|---|---|
| Log likelihood = -1106.717 | | | |
| | Variable | Coefficient | Significance (p-value) |
| $\beta_1$ | $Self_{ij} * T1$ | 0.345 | <0.001 |
| $\beta_2$ | $Self_{ij} * T2$ | 0.969 | <0.001 |
| $\beta_3$ | $Self_{ij} * T3$ | 1.167 | <0.001 |
| $\beta_4$ | $Self_{ij} * T4$ | 0.827 | <0.001 |
| $C_{T1}$ | $DeltaEff_{ij} * T1$ | -0.249 | <0.001 |
| $C_{T2}$ | $DeltaEff_{ij} * T2$ | -0.225 | 0.001 |
| $C_{T3}$ | $DeltaEff_{ij} * T3$ | -0.007 | 0.907 |
| $C_{T4}$ | $DeltaEff_{ij} * T4$ | 0.027 | 0.658 |
| $C_{T1_{MM}}$ | $DeltaMM_{ij} * T1$ | -0.738 | <0.001 |
| $C_{T2_{MM}}$ | $DeltaMM_{ij} * T2$ | -0.721 | <0.001 |
| $C_{T3_{MM}}$ | $DeltaMM_{ij} * T3$ | -0.641 | <0.001 |
| $C_{T4_{MM}}$ | $DeltaMM_{ij} * T4$ | -0.573 | <0.001 |
| Wald $\beta_1 = \beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $\beta_2 = \beta_3 = \beta_4$ | | | <0.001 |
| Wald $\beta_2 = \beta_3$ | | | 0.266 |
| Wald $\beta_2 = \beta_4$ | | | 0.379 |
| Wald $\beta_3 = \beta_4$ | | | 0.042 |
| Wald $C_{T1} = C_{T1_{MM}}$ | | | <0.001 |
| Wald $C_{T2} = C_{T2_{MM}}$ | | | <0.001 |
| Wald $C_{T3} = C_{T3_{MM}}$ | | | <0.001 |
| Wald $C_{T4} = C_{T4_{MM}}$ | | | <0.001 |

Engineering Model, where people have equal say, is most likely to lead to the desired outcome. An Autocratic Model, which characterizes a decision maker who does not consult others, is much less likely to be desirable. The same holds true for a Tall Hierarchy, especially when the direct advisor to the boss makes a recommendation inconsistent with the firm's objective.

Within a hierarchical structure, the results emphasize that advisors play an important role. In our Tall Bureaucracy treatment, if the advisor does not provide the recommendation to adhere to the welfare-enhancing norm, the decision maker now has moral wiggle room and is more likely to make choices that conflict with the norm. However, when the advisor suggests the welfare-enhancing allocation, the decision maker finds it much harder to deviate from this recommendation. This effect is even greater when there is agreement between two subordinates in recommending the welfare-enhancing allocation, as we found in the Flat Bureaucracy treatment.

We find real world examples of firms making concerted efforts to address these tendencies either by accident or by design. For example, a passage from U.S. Air Force Officer training materials states, "Service Before Self – …A leader unwilling to sacrifice individual goals for the good of the unit cannot convince other members to do so" (U.S. Air Force ROTC, 2014). This type of statement serves to influence directly both a self-interest motive as well as efficiency concerns. Additionally, it influences how receptive individuals are to recommendations from others and *which* recommendations are put forth.

This study provides initial insights to the influence organizational design itself has on encouraging surplus maximizing concerns. However, there are many possible extensions of this research that may help provide a richer understanding of how organizational design influences firm outcomes. A growing body of research is concerned with how groups make decisions over risky prospects and how individuals choose risky prospects for others (see Vieider et al., 2015; Andersson et al., 2016). We think studying the influence of organizational design in a setting characterized by risk may enhance the discussion. Another issue worth exploring is how organizational design and social hierarchy together influence group outcomes. Last, we implemented the choice tasks as a static game, without feedback. Employees within a firm instead play a repeated game, and factors such as reputation are likely to influence outcomes in a dynamic setting.

# CHAPTER 2

# INSTITUTIONAL AND BEHAVIORAL FACTORS INFLUENCING LIFETIME WEALTH ACCUMULATION OF U.S. SERVICEMEMBERS

The views expressed are those of the author and do not reflect the official policy or position of the US Air Force, Department of Defense, or the US Government.

## 2.1 Introduction

The mission of the Department of Defense (DOD) is to "provide the military forces necessary to deter war and protect the security of our country" (Department of Defense, 2017a). In order to accomplish this mission, the DOD must recruit, train, and retain quality individuals. Pay and benefits directly impact the DOD's ability to attract and retain quality recruits. For example, a 1 percent gain in military pay relative to civilian pay results in a 1 percent gain in recruitment (National Research Council, 2003, and the references therein). Unlike civilian organizations, which have total control over wage and benefit setting, the DOD must rely on Congress to set wages and determine benefits offered to U.S. servicemembers. Through this process of Congressional debate, the question of the right amount of pay and benefits becomes a matter of public concern.

Few would argue that veterans should be financially worse-off for their service relative to non-veterans with similar qualifications. However, recent research has shown that veterans have fallen behind in terms of lifetime wealth accumulation (Gustman, Steinmeier, & Tabatabai, 2016). Figure 2.1 presents results of the Gustman et al. (2016) analysis of Health and Retirement Study (hereafter, HRS) data comparing veteran and

non-veteran cohorts entering ages 51 to 56 in 1992, 1998, 2004, and 2010. We see a relatively close grouping of veterans and nonveterans prior to 2004 but a growing disparity from 2004 on. According to their research, as of 2010, veterans accumulated 25% less wealth than nonveteran households.[4] That is a difference of roughly $217,000 per household.

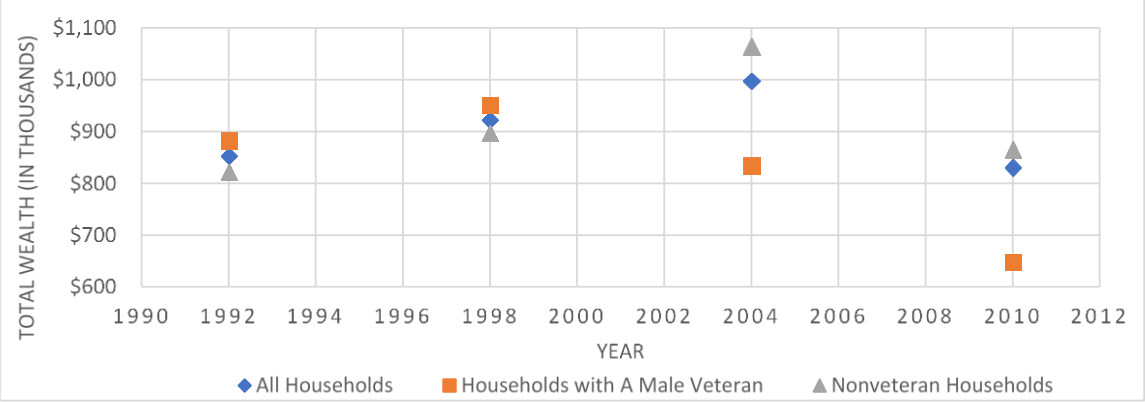



**Figure 2.1 – Total Wealth Accumulation by Cohort (in 2010 dollars)**

Figure 2.1 simply considers the difference in total wealth accumulation by veteran and nonveteran status. A richer discussion includes the influence that length of service has on wealth accumulation. In a separate analysis of the HRS data, Fitzgerald (2006) finds that additional years of military service negatively impacts lifetime wealth accumulation for each year of service, up to 20 years of service (the vesting period for the current military retirement system). Veterans from the all-volunteer military struggle

[4] Gustman, Steinmeier, & Tabatabai (2016) define total wealth as the sum of total household social security benefits, total value of all household pensions, net house value (home equity), real estate, business assets, net value of vehicles, financial assets, and IRA assets.

to keep pace with nonveterans in accumulating wealth over their lifetimes and this leads us to question why this is so, and what can be done to close the gap if necessary.

The life-cycle model of consumption and savings is a workhorse within the economics discipline used to describe savings behavior (Browning & Crossley, 2001). The model assumes that individuals plan consumption and savings choices over their life span, striving to even out consumption. The result of this planning is a pattern of consumption that includes borrowing before entering the workforce, accumulating wealth during working years (e.g. saving), and divesting accumulated wealth in retirement (e.g. dissaving). An unresolved issue is why similar households reach retirement with very different levels of wealth, if any at all. In this study, we consider factors which influence veterans' ability to accumulate wealth during their working years (institutional concerns) and potential departures from the standard life-cycle model which may also influence wealth accumulation (behavioral concerns).

This study first explores drivers for wealth accumulation by considering institutional factors related to veteran income, home ownership, and intergenerational transfers. We then explore the underlying behavioral components contributing to lifetime wealth accumulation such as financial literacy, self-control, and locus of control.

## 2.2 Income

Income has a significant impact on an individual's ability to save during their working years and accumulate wealth over their lifetime. In this section, we begin by considering the existence of a wage gap between military pay and civilian pay. Next, we consider the impact veteran status itself has on wages in the civilian sector relative to

nonveterans. Finally, we consider the influence military service has on attaining and maintaining a dual income household by examining the tied migrant problem.

### *2.2.1 Pay Gap Between Military and Civilian Pay*

Measuring a pay gap between military and civilian pay is extremely difficult due to a lack of consistent definitions and inconsistent reference points (Kapp & Torreon, 2017). In one report, using a starting point of 1982, the pay gap between military and civilians steadily increased, reaching a highpoint of nearly 14% in the early 2000s, then experienced a sharp decline falling to roughly 2% by 2012 (Military Officer's Association, 2013). Using a broader measure of income for military pay, the Congressional Budget Office (2010) reports military compensation "*exceeded* the cumulative increase in private-sector wages and salaries by 11 percent since 1982." These seemingly contradictory reports show how difficult it is to measure precisely the military and civilian pay gap, if there is one.

The DOD's position, as stated in the 2014 Quadrennial Defense Review, is that military pay is appropriate at this time and that, within a constrained fiscal environment, the DOD cannot afford the same rate of growth for military pay and benefits as in the previous decade. The aforementioned military pay and benefit increases have "more than closed compensation gaps." To maintain competitive compensation packages, the DOD proposed modest annual military pay raises, a leveling off in the growth rate of housing allowances, and updates to the military healthcare system (TRICARE).

Others echo this finding, suggesting military servicemembers are compensated appropriately relative to those not currently serving (Skimmyhorn, 2016; Financial Industry Regulatory Authority, 2013b; Hosek and Wadsworth, 2013). Of course,

constant monitoring is required to ensure military pay and benefits remain competitive with civilian wages, both for recruiting new talent and retention of those currently serving.

### *2.2.2 Veteran Status and Income*

The majority of those who join the military do not stay for a 20-year career, which is the minimum number of years required to earn the defined benefits portion of military retirement compensation. Under the current Uniformed Services retirement system, roughly 51 percent of officers and 83 percent of enlisted personnel will leave the military prior to 20 years of service (Department of Defense, 2012). This leads us to ask how veteran status influences earnings in civilian careers where individuals derive their income the remainder of their working years.

#### *2.2.2.1 Influence of Draft Era Veteran Status on Civilian Wages*

Draft era veteran status has shown a mixed influence on a servicemember's subsequent civilian earnings (Gabriel, 2016; and the references therein). World War I (WWI) veterans enjoyed a 3.6% wage premium relative to non-veterans. The wage premium for WWII veterans was nearly five times larger at 17%. The veteran premium for WWII is, at least partially, a natural extension of the newfound human capital gains in greater college education attainment, and completion attributed to the G.I. Bill signed into law in 1944 (Bound & Turner, 2002). However, these wage premiums essentially disappeared for Korean War veterans and turned negative for Vietnam War veterans (Schwartz, 1986).

In the early 1980s, at least a decade after their service in Vietnam for many, veterans were earning nearly 15% less per year than a comparable nonveteran

(Angrist, 1990).[5] While the Vietnam war was unpopular, the explanation for the loss of earnings is not necessarily bias against Vietnam veterans reintegrating into the civilian workforce. Instead, the loss of earnings can be attributed to the partial transferability of military experience to the civilian labor market. Using Social Security data, Angrist (1990) estimates that military service resulted in the equivalent loss of two years of civilian labor market experience and thus lower relative wages.

The wage gap between Vietnam veterans and nonveterans mostly subsided by 1999 (Angrist, Chen, & Song, 2011). These findings are still consistent with the loss-of-experience interpretation for the earnings loss for Vietnam veterans. Specific to this study, if we consider lifetime wealth accumulation impacts, it is clear the initial negative shocks to income were never recovered, leading to lower wealth accumulation for Vietnam era veterans.

#### *2.2.2.2 The All-Volunteer Force (AVF)*

While registering for the Selective Service System is still required for all males between the ages of 18 and 25, the last authority to induct draftees to military service expired on 30 Jun 1973. This begins an era of military service commonly referred to as the “All-Volunteer Force” or AVF. Bryant et. al (1993) provide an initial insight to the impact of veteran status on post-Vietnam veterans by considering full time workers in 1985 both with and without military experience. The reduced transferability of military

[5] This is specific to white Vietnam veterans. The difference between nonwhite veteran and nonveterans was not statistically different.

skills to the civilian work force and loss of experience still weigh on post-Vietnam veteran wages. While not as pronounced as the wage gap associated with Vietnam veterans, post-Vietnam veterans still received an estimated 1.7% less than non-veteran peers did.

More recent analysis has pointed to a persistent veteran to nonveteran wage gap that is also influenced by the nations attitudes towards veterans (Davila & Mora, 2012). In the years leading up to September 11, 2001 (hereafter, 9/11), male veterans earned roughly 5% less on average than their nonveteran peers. Shortly after 9/11 and between 2001 and 2005, a surge of patriotism helped to reduce the wage gap between veterans and nonveterans to roughly 3.5% less on average. Over time this improvement in the veteran and nonveteran wage gap dissipated and by 2006 the wage gap returned to pre-9/11 levels.

The AVF introduces new concerns for research in the lifetime wealth accumulation gap. In terms of economic research, this makes a comparison of veterans and non-veterans more challenging. The AVF is influenced by selection bias. This makes clearly identifying or attributing the influence military service on lifetime wealth accumulation more challenging. If there is a growing gap, is it because something about the military attracts individuals that are systematically different from those who do not choose military service? While selection bias complicates casual identification for researchers, we can still examine structural issues that directly influencing military veterans and their opportunities for wealth accumulation.

### *2.2.3 Dual Income Families and the Tied Migrant Problem*

It has been said that the military recruits the soldier but retains the family. That is to say that the DOD makes significant investments to attract and train talented individuals into service but must convince the families to stay in the military. In 2015, roughly 51% of enlisted members and roughly 70% of officers were married (Department of Defense, 2015a).[6] In Figure 2.2, we present a comparison of marriage rates for active component (AC) military enlisted personnel to civilians by gender and age. In Figure 2.3 we present the same comparison but for military officer personnel.

From Figure 2.2 and Figure 2.3, we see military males married at higher rates across all age groups regardless of officer or enlisted status. A similar pattern exists for enlisted women but the results are mixed for women who are commissioned officers.

It is generally accepted that marital status influences wealth accumulation. For example, utilizing data from the HRS and Panel Study of Income Dynamics (hereafter, PSID), Lupton and Smith (1999) show married households achieve a median net worth nearly 4 times never married households achieve. However, marital status as a static measure does not tell a complete story. Duration of marriage also influences household net worth as seen below in Figure 2.4.

[6] Here we focus on the Active Component as it relates to the tied migrant problem. For the same period of time, nearly 40% of Selected Reserve enlisted personnel and 69% of Selected Reserve officers reported married.

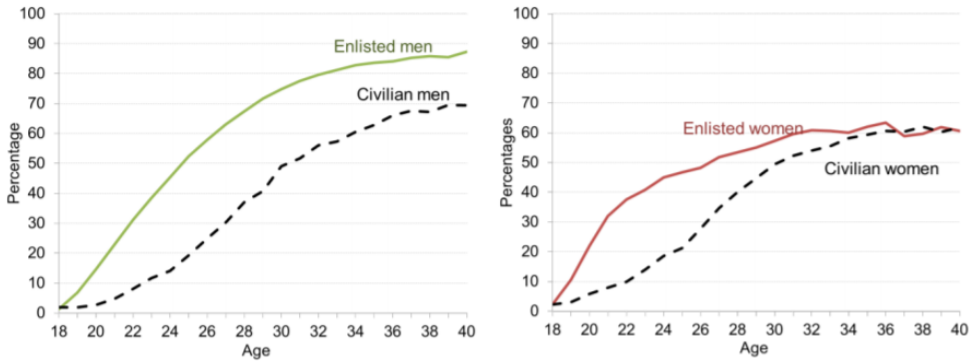



**Figure 2.2 – FY15 Married Rates of AC Enlisted Personnel and Civilian Comparison Groups, by Gender and Age (Department of Defense, 2015b)**

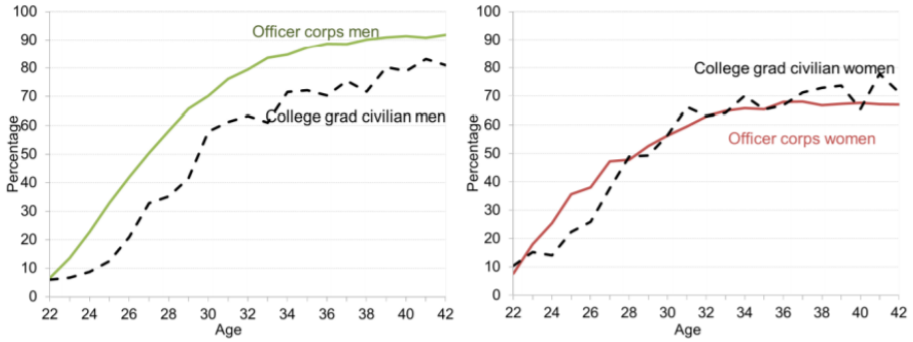
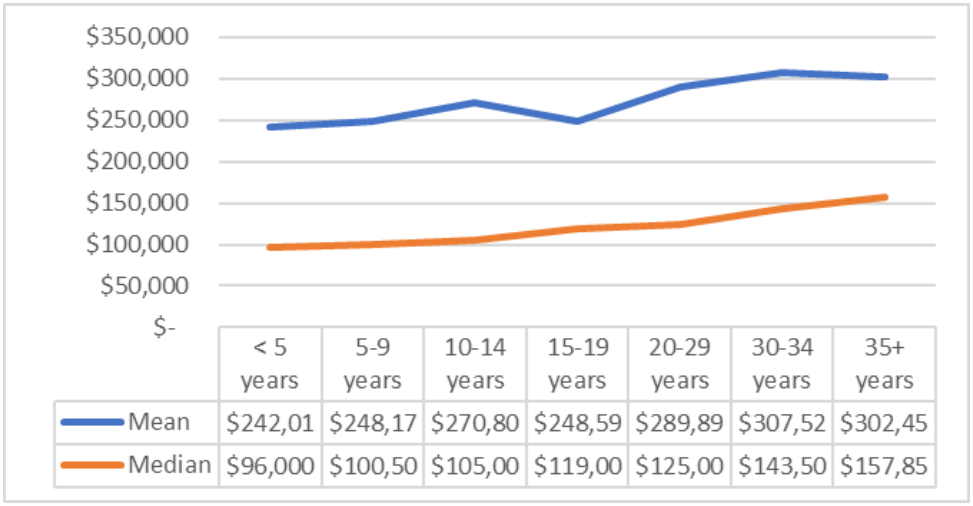



**Figure 2.3 – FY15 Married Rates of AC Commissioned Officers and Civilian Comparison Groups, by Gender and Age (Department of Defense, 2015)**




| | < 5 years | 5-9 years | 10-14 years | 15-19 years | 20-29 years | 30-34 years | 35+ years |
|---|---|---|---|---|---|---|---|
| Mean | $242,01 | $248,17 | $270,80 | $248,59 | $289,89 | $307,52 | $302,45 |
| Median | $96,000 | $100,50 | $105,00 | $119,00 | $125,00 | $143,50 | $157,85 |

**Figure 2.4 – HRS Household Net Worth by Duration of Marriage (Lupton & Smith, 1999)**

From Figure 2.4, we see household net worth increases at an increasing rate as marriage duration increases. When this is combined with PSID data showing median married households wages more than double never married household median wages, we should expect at least some advantage to accrue to military families given they marry so early. This advantage should help to close the wealth accumulation gap unless military families are encumbered in some way and unable to keep pace with nonveteran peers.

Military service requires a permanent change of stations roughly every 3-4 years, with some as few as 2 years. This has the potential to create a tied migrant problem for military families. The tied migrant problem describes a scenario when a spouse “moves even when their private calculus dictates they stay” (Mincer, 1978). In a military family context, if a servicemember receives orders to move to a new location, a spouse might give up a well-paid job with little to no prospects in the new location.

Cooke and Speirs (2005) published a paper that studied the impacts of being a tied migrant on civilian husbands and wives of military personnel. Cooke and Speirs used the Public Use Microdata Sample from the 1990 U.S. Census, which allowed them to identify military families in 1985 and 1990. Without access to military permanent change of station orders, Cooke and Speirs had to infer who in the sample was directed to move. A family was considered to have moved if they reported a residence in 1990 that was more than 50 miles away from the residence they reported in 1985. Over this five-year period, 77% of civilian wives and 62% of civilian husbands were considered migrants with over one-third of the sample moving more than 1000 miles.

Cooke and Speirs (2005) find that military migration has negative impacts on the economic status of both civilian husbands and the civilian wives of military personnel. Specifically, for civilian wives, military migration is associated with a 10% drop in employment and a four-hour decrease in hours worked per week for those who remain employed. For civilian husbands, military moves are associated with a five-hour decrease in hours worked and a similar 10% drop in employment.

More recent analysis of the 2000 U.S. Census, Sample Edited Detail File show consistently lower age-earning profiles for all military spouses, both for civilian husbands and wives (Hisnanick & Little, 2015). Figure 2.5 shows tied migrant military spouses, both husbands and wives, earn less across all age groups by as much as 30%. Additionally, analysis of military records on personnel and their dependents, and social security earnings records between 2001 and 2012, show the immediate negative impact of relocation on spousal earnings (Burke & Miller, 2017). Military moves reduce spousal wages by 14% of average spousal earnings in the year of the move and increases the likelihood the spouse has no earnings in the year of the move. These negative impacts of relocation on spouses persist for at least 2 years.

Finally, in Chapter 3 of this dissertation, we present results from our analysis of the gender specific wage impact of changing DOD presence through the 2005 Base Realignment and Closure. We find that increasing the presence of military personnel decreases median wages for both men and women in affected counties. However, we find suggestive evidence that decreasing military personnel increases median wages for women while wages for men remain relatively unchanged. This highlights another

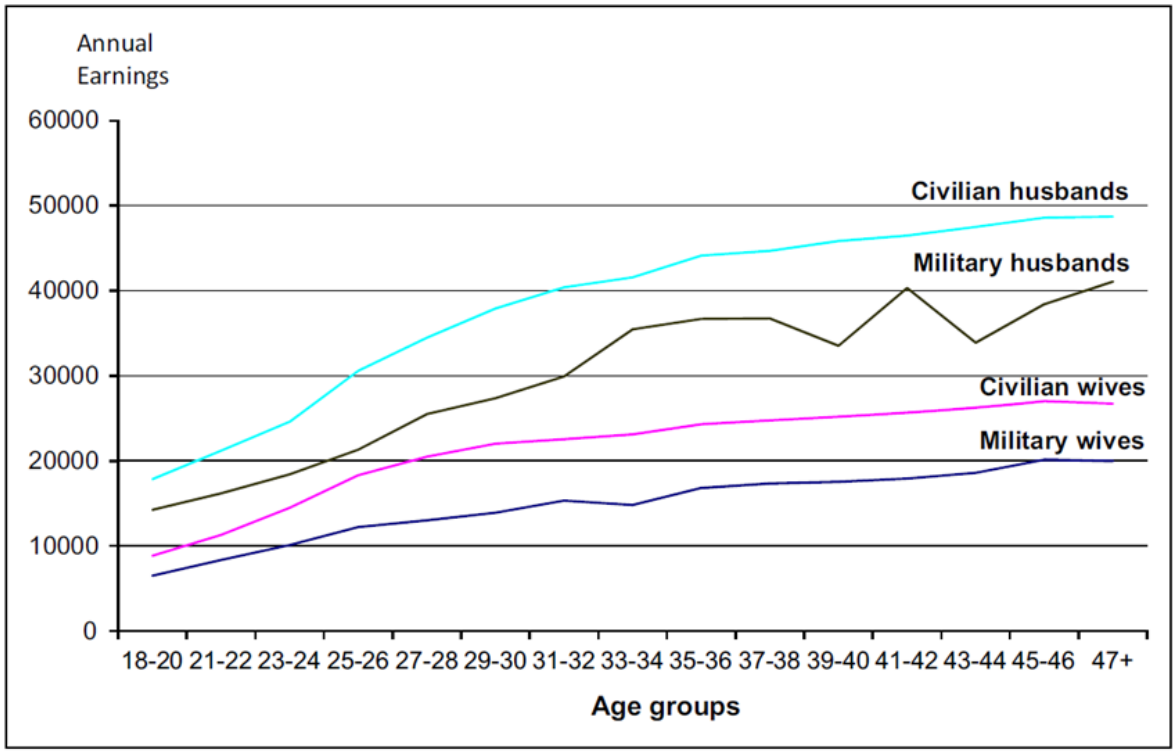



**Figure 2.5 – Average Annual Earnings by Age Group of Military Husbands & Wives Compared to Civilian Counterparts (Hisnanick & Little, 2015)**

challenge for military families as they work towards maintaining dual-income households. That is, the effect of military presence on the local labor markets may further negatively impact wages for tied migrants. At this time, the literature is silent on the cumulative net effect servicemembers' relatively early marriages may have on lifetime wealth accumulation when placed in the context of the tied migrant problem inherent with military families.

The tied migrant problem is one that is well known to the DOD, which estimates 77% of military spouses are unable to find or maintain work due to frequent moves (Military Spouse Employment Partnership, 2014). Furthermore, the DOD estimates a 26% unemployment rate among military spouses, and a 25% wage gap between civilian spouses and military spouses who do find work. A separate DOD estimate suggests that of the more than 1,000,000 military spouses, roughly 250,000 military spouses are unemployed and at least an additional 250,000 military spouses are underemployed (Lyle, 2014). In June 2011, the DOD launched the Military Spouse Employment Partnership (MSEP) redoubling its efforts to provide more opportunities for military spouses to find private sector careers. The MSEP partners with Fortune 500 Plus companies and seeks to prepare military spouses to secure and maintain private sector careers.

Related to military pay and wealth accumulation, future researchers must carefully disentangle the effects of repeated and prolonged deployments to combat zones for servicemembers in the post-9/11 era from compensation provided to servicemembers in peacetime. Servicemembers deployed to combat zones receive

additional pay such as hardship duty pay, hostile fire or imminent danger pay, family separation allowance, and combat zone tax exclusions. These benefits can easily surpass $1,000 in additional compensation per month. Since 2002, and as recently as 2010, the DOD has identified between 200,000 and 250,000 personnel that qualify for combat zone tax exclusion each year (Gould & Horowitz, 2011). Each military service manages their own deployment strategy. The Army for example has traditionally deployed servicemembers for 12-month rotations, whereas the Air Force has more recently deployed servicemembers for 6 month or longer rotations. If researchers fail to properly account for the “war-time” compensation in the AVF, they may provide policy recommendations that negatively impact compensation for servicemembers in peace time.

## 2.3 Home Ownership

While Income certainly correlates with greater wealth accumulation, it is the existence and duration of homeownership that results in greater future household net wealth accumulation (Di, Belsky, & Liu, 2007). Utilizing data from PSID between 1989 and 2001, Di et. al find that after controlling for location, income, education, and other characteristics, families who owned homes and owned them for longer periods had significantly greater wealth accumulation by 2001. Differences in net wealth between renters and homeowners can be quite large as presented in Figure 2.6.

From Figure 2.6, we see as home ownership duration increases, wealth differences between homeowners and renters increase as well, peaking at roughly 8 years. The decline beyond 8 years is not suggesting that homeowners should sell their

house after eight years of ownership but is instead an artifact of the dataset used in the analysis. Homeowners with more than eight years in duration purchased their homes in the early 1990s, which coincided with a peak in the housing market, followed by a drop in housing prices and a few years of relatively slow price appreciation. In Figure 2.7, we present the Case-Shiller U.S. National Home Price Index showing the annual percentage change over the period in question.

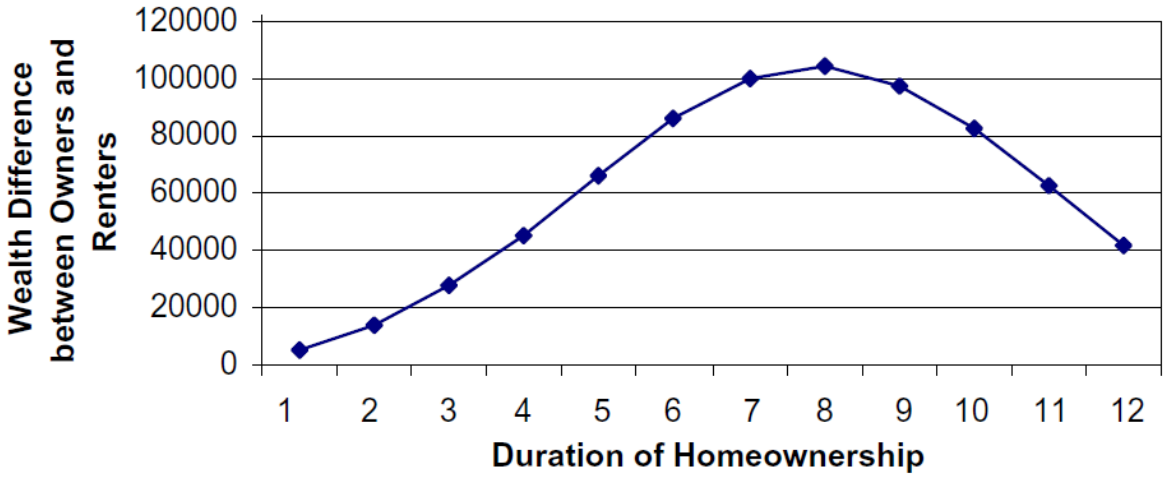



**Figure 2.6 – Estimated net wealth difference between owners and renters (in 2001 dollars) (Di, Belsky, & Liu, 2007)**

We urge caution in interpreting Figure 2.6. It appears that even short durations of home ownership can lead to large wealth differences between homeowners and renters. However, two factors must be considered. First, the timing of the decision to purchase a home will have significant impacts on wealth accumulation. We point to the relatively small downturn in the early 1990s and the significant downturn in housing prices during the financial crisis of 2007 (see Figure 2.7). This type of price volatility suggests short duration homeownership does not guarantee increases in wealth.


**Figure 2.7 – Case-Shiller U.S. National Home Price Index 1990 – 2016 (S&P Dow Jones Indices LLC, 2017)**

The second point of caution in interpreting Figure 2.6 is that in order to access the accumulated wealth, without borrowing against equity, homeowners would need to sell their homes. In 2002, Donald Haurin (a professor at Ohio State University) uses data from the 1992 Survey of the Married Military Officers and Enlisted Personnel report to estimate the impact of transaction costs and expected length of stay on homeownership. In his analysis, he finds the length of stay and transaction cost of selling a home have a significant impact on homeownership. Specifically, he estimates the transaction costs of selling a home (not the total cost of owning) are the sum of 3% of the house value and 4% of household earnings.

For illustrative purposes, a breakeven analysis might assume a median home value of $170,000, and a married couple with a median income of $60,000 in 2001. Using Haurin's (2002) estimates for transaction costs, a homeowner would need $7,500 in home equity to break even. This type of analysis is especially pertinent to military families who often move due to military orders after 3 years in one location.

Shelton (1968) considered the cost of renting versus owning a home to estimate a minimum duration to break even. He first estimates a homeowner will accrue an annual net savings of 2% of the home value relative to renting. This is based on avoiding the cost associated with operating as a landlord, such as higher annual maintenance costs, vacancy allowances, and management costs. He then estimates a non-recurring cost of transferring the home (transaction costs associated with selling the home) of 7% of the home value. From this we can calculate the minimum required tenure for homeownership to have a lower cost than renting to be 3.5 years or longer $(7\% \div 2\%)$. For tenures less than 3.5 years, it is less expensive to rent.

Given the regular intervals at which servicemembers are required to make military directed moves, 3.5 years is a difficult threshold to meet. Haurin (2002) points to data on expected stays for military members from the 1992 Survey of the Married Military Officers and Enlisted Personnel. He finds only 35% of his sample had an expected duration for their current assignment of 3-4 years. Additionally, 26% of respondents expected to stay in their current assignment for 1-2 years and 39% expected to stay between 2-3 years.

### *2.3.1 Military Families and Housing*

> *"There are few human needs in life more basic or important than a decent place to live. Housing is certainly on our people's minds. Every time I visit an installation and sit down with enlisted folks to hear their concerns, they bring up housing. We have a special duty to ensure quality housing." – Secretary of Defense William J. Perry (Department of Defense, 1995)*

When a military family moves to a new location within the U.S. there are three broad categories of housing available. First, families can apply to live in a limited

number of government owned military housing units or, more recently, privatized military housing. Second, families can rent housing off base. Finally, families can choose to purchase a home.

In 1995, the Defense Science Board Task Force on Quality of Life found military family housing in a state of disrepair, obsolescence, and substandard relative to civilian living arrangements (Department of Defense, 1995). In addition to strongly recommending a liberalization of financial policy on the DOD to support privatization by Congress, the Task Force also strongly recommended home ownership by military families.[7] Specifically, the Task Force found that homeownership was consistent with DOD policy in utilizing private sector housing solutions as a primary solution to housing military families and in line with the goals of many Americans to own homes. The Task force went so far as to suggest that the DOD "actively seek to eliminate hurdles to home ownership" and "strongly encourage, evaluate and implement imaginative programs to encourage home ownership by Servicemembers" (Department of Defense, 1995).

When choosing a home, military families place a significant weight on economic considerations (Buddin et. al, 1999). Nearly 60% of military families choosing to live in military housing stated "good economic decision" as the first or second most important consideration. Roughly 40% of military families choosing to rent a home on the

[7] In response, Congress established the 1996 Military Housing Privatization Initiative which allowed for the privatization of the first 2,663 military family housing units in 2000 (U.S. Department of Housing and Urban Development, 2015). The project culminated in the privatization of 219,000 military family housing units or roughly 98% of military family housing units by 2012.

economy states “military housing unavailable” as the first or second most important factor leading to their home decision presumably preferring military housing for similar reasons. Finally, military families who choose to buy a home state “Investment” and “good economic decision” as first or second most important drivers roughly 40% and 30% respectively. Nearly 70% of military families prefer military housing to civilian alternatives due to cost-effectiveness and about 27% of military families owned homes.

Increases in servicemembers’ basic allowance for housing in the early 2000s, and decreases in mortgage interest rates, led to increases in military family homeownership rates from roughly 27% in 1997 to 38% in 2007 (Bissell, Crosslin, & Hathaway, 2010). While military families experienced greater gains in homeownership, overall American homeownership rates grew over the same period, increasing from 65.7% in the first quarter of 1997 to 68.9% in the fourth quarter of 2006 (U.S. Bureau of the Census, 2017).

As previously mentioned, military personnel are often required to make frequent relocations, and short-term home ownership does not guarantee wealth accumulation. Following the financial crisis of 2007-2008, Congress moved to protect servicemembers and their families from significant financial loss due to military directed relocations during the Financial Crisis through an expansion of the Homeowners Assistance Program (Office of the Inspector General - Department of Defense, 2011).[8] Specifically,

[8] The Homeowners Assistance Program was established as part of the Demonstration Cities and Metropolitan Development Act of 1966 and originally provided assistance to assist eligible

Congress appropriated $555 million under the American Recovery and Reinvestment Act of 2009 with an additional $300 million under the National Defense Authorization Act of 2010. As of 23 February 2011, the Housing Assistance program had paid $725.5 million to 4,825 applicants with an additional 4,897 pending cases. These payments are used to offset financial losses to homeowners who needed to sell their house because of military directed relocation during the financial crisis.

Considering the recent financial crisis, the 1995 Defense Science Board Task Force on Quality of Life's recommendations may have reflected the housing euphoria of the time. However, an important question remains: does the lower homeownership rate of military families disadvantage veterans in accumulating wealth over their lifetimes? If this is an undesirable side effect of military service, how do we close the gap without creating excessive burdens on taxpayers if another financial crisis were to occur?

Data from HRS points to significant gaps in home equity between veterans and nonveterans (Gustman, Steinmeier, & Tabatabai, 2016). In Figure 2.8, we present Gustman et. al HRS data comparing net house value (home equity) for veteran and non-veteran cohorts entering ages 51 to 56 in 1992, 1998, 2004, and 2010. There are striking similarities between Figure 2.1 and Figure 2.8. Perhaps unsurprisingly, the difference in net house values represents 32% and 35% of the wealth gap in the 2004 and 2010 cohorts, respectively.

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servicemembers and civilian Federal employee homeowners negatively impacted by Base Realignment and Closure.

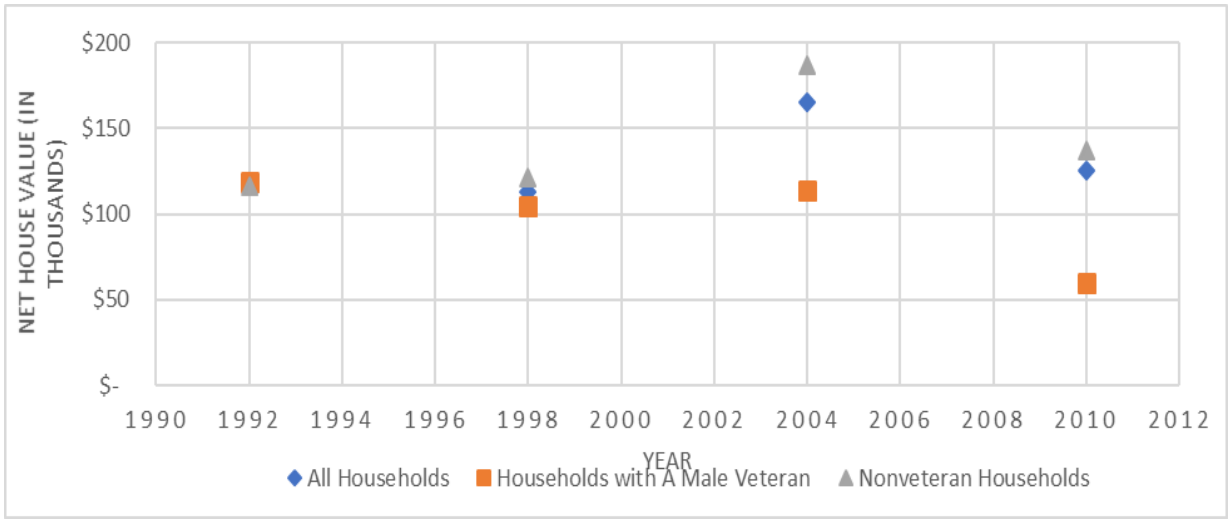


**Figure 2.8 – Net House Value by Cohort (in 2010 dollars)**

The increasing gap between veterans and nonveterans coincides with a sharp decrease in the proportion of respondents serving in the military. The proportion fell from roughly 50% in the 1992 and 1998 cohorts to 29% and 16% in the 2004 and 2010 cohorts, respectively. At the same time, we see increases in the duration of military service. In the 1998 cohort, 7% of male veterans served more than 10 years while 8% and 13% of the 2004 and 2010 cohorts served for more than 10 years. The trend of increasing duration of military service has continued since the 1970s increasing to roughly 11 years for officers and 7 years for enlisted servicemembers (see Figure 2.9). As a draft era reference point, the average duration of service for WWII was 2.75 years (The National WWII Museum, 2017). If military families postpone home purchases while on active duty, longer durations for military service result in longer delays in home purchases. This subsequently reduces the amount of time to build equity through home ownership before the ages of 51-56 (the ages the HRS observations are made).

We are unaware of any data showing historical homeownership rates for military families prior to the 1995 Defense Science Board Task Force on Quality of Life report. However, it seems reasonable to assume that growth of the basic housing allowance in the early 2000s and relatively low mortgage interest rates culminated in a historically high military family ownership rate of 38% in 2007, roughly half the homeownership rates of the American average for the same year (Bissell, Crosslin, & Hathaway, 2010). This suggests that as active duty servicemembers continue to serve for longer durations, a large proportion are postponing purchasing homes for longer periods of time.

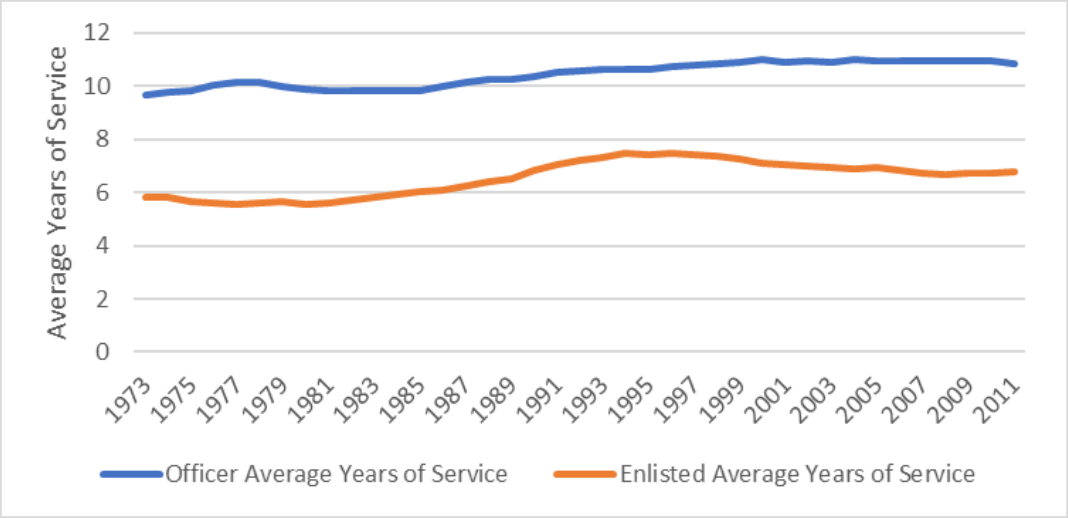


**Figure 2.9 – Average Years in the Military 1973-2011 (Department of Defense, 2011a)**

After leaving military service, veterans show a higher likelihood of purchasing homes than their nonveteran peers (Department of Veterans Affairs, 2004).[9] While active duty servicemembers lag behind the American average for homeownership rates, the veteran population achieves a roughly 12% higher home ownership rate. Even after controlling for demographic and socioeconomic characteristics, veterans achieve a 5% higher likelihood of homeownership relative to the comparable American. Much of the credit for this goes to the Veterans Administration (henceforth VA) Home Loan Guaranty program, which provides eligible servicemembers and veterans home loans that require neither a down payment nor private mortgage insurance. Traditionally, borrowers with

[9] This may not apply uniformly to subsets of the veteran population and is sensitive to how the estimating model is specified. Utilizing data from the 2000 Decennial Census Long Form and the 2005 American Community Survey, Conely and Heerwig (2011) estimate Vietnam veterans show no difference or lower probability of homeownership compared to nonservice peers.

less than 20% down require private mortgage insurance, generally at a cost of 0.5% of the loan amount per year. Roughly 60% of veterans who borrowed money to buy, improve, or refinance a home have obtained a VA home loan.

To provide a rough estimate of potential equity appreciation veterans may have enjoyed from buying a home sooner, we estimate a home price appreciation profile. Specifically, we utilize Case-Shiller monthly percent change in U.S. National Home Price index data from 1 Jan 1990 – 1 Aug 2017. We conduct a 500-iteration simulation to randomly sample, with replacement, 79 continuous month periods from the data.[10]

We use our 79-month Case-Shiller price index simulation to establish an 80-month monthly price appreciation profile (includes the first month of ownership) and corresponding 95% confidence interval. We also calculate a 30-year mortgage schedule, again assuming a $170,000 home price, a 10% down payment, and a 4% interest rate. We present the results of this simulation in Figure 2.10.

From Figure 2.10, we see that if veterans purchased a home 5 years earlier, they may have enjoyed a $68,542 increase in their equity position. Interestingly, the home equity gap identified by Gustman et al. (2016) is roughly $73,000 and $77,000 in the 2004 and 2010 cohorts, respectively.

The VA home loan is also popular among the active duty servicemembers who choose to purchase homes (FINRA Investor Education Foundation, 2013b). In 2012,

[10] 79 continuous months is an arbitrary cutoff. Including the first month of ownership this provides a price appreciation profile of 80 months.

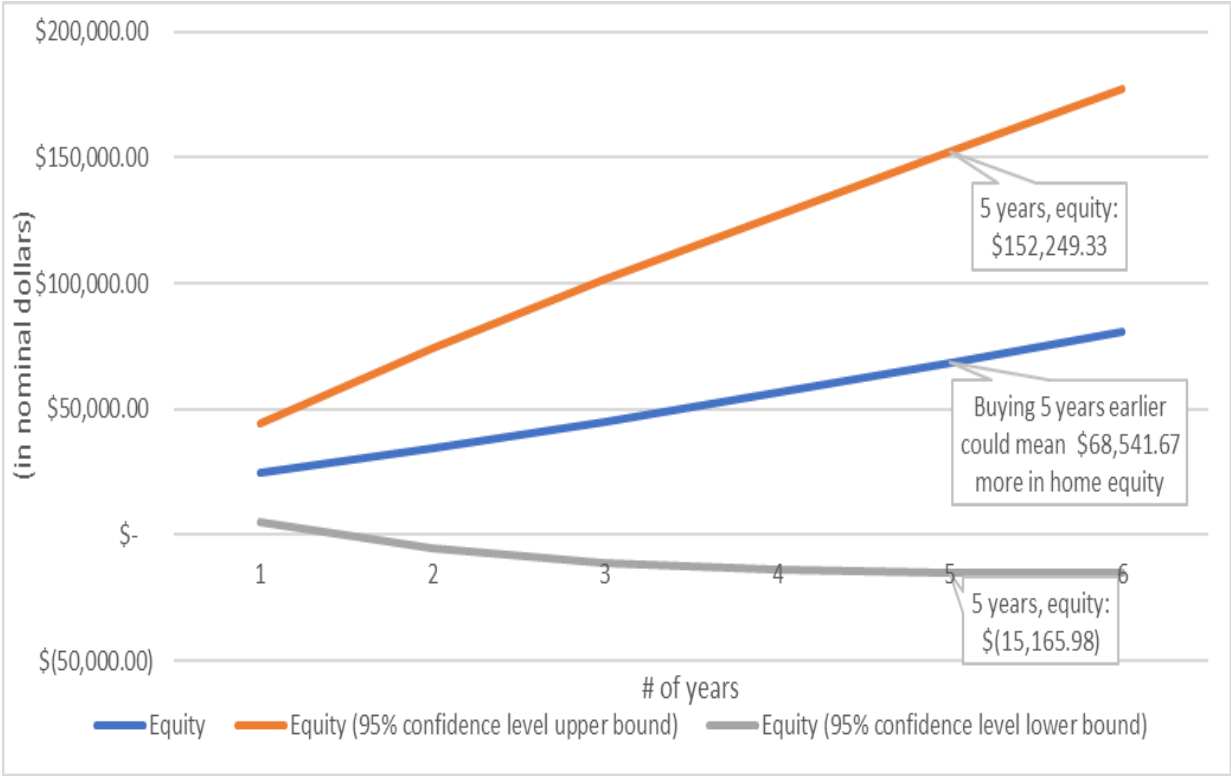


**Figure 2.10 – Estimated Equity Appreciation to Veterans of Purchasing a Home Sooner by Year**

roughly 30% of military families stated they had placed 0% towards down payments when purchasing homes since 2000. This presents significant risk towards losses in the event of even minor downturns in housing prices. Roughly 46% of active duty homeowners responded they are “underwater” or owe more than their home is worth, significantly higher than the 31.4% of Americans underwater in the first quarter of 2012 (Humphries, 2014). Additionally, 12% of active duty homeowners in the FINRA study stated they were involved in a foreclosure between 2010 and 2012.

When taken together, the postponement of homeownership by active duty servicemembers, the increasing duration of military service, and the significant utilization of 0% down financing provides a plausible explanation for the increasing gap in home equity observed by Gustman et. al. It also paints a picture of the vulnerability of active duty homeowners and the potential for future risks to American taxpayers if another housing downturn were to occur.

## 2.4 Intergenerational Transfers

Wealth is generated from two sources, income and transfers from others. Here, we define intergenerational transfers as simply transfers from oneself to one’s descendants. These transfers can be as simple as a parent providing money to their children to help pay rent after they move out or a grandparent providing funds to help with a down payment for a first home. There are two types of transfers. The first type of transfer, *inter vivos* transfers, are transfers made between living people. The second type of transfer, bequests, are transfers that are made after the death of the donor.

Gale (1994) utilized data from the 1983 and 1986 Survey of Consumer Finances to study the impact of both inter vivos transfers and bequests on U.S. wealth accumulation. The 1983 Survey of Consumer Finances contains extensive financial interviews from 3,824 randomly selected U.S. households. Of these households, 2,822 households were re-interviewed in the 1986 Survey of Consumer Finances. In addition to detailed data on wealth, income, and demographics, households were asked about transfers of more than $3,000 from one household to another between 1983 and 1986. Of these transfers, 75.4% consisted of transfers sent to support children and averaged $16,430. Another 11.8% or these transfers went to support grandchildren with an average transfer of $16,272. For individuals reporting that they had received a transfer of $3,000 or more, 84.2% reported receiving an average transfer of $14,966 from their parents.

These transfers make up a large portion of aggregate U.S. wealth. Specifically, Gale and Scholz find *inter vivos* transfers account for at least 20% of wealth. Bequests account for an additional 31% of wealth. These transfers together account for at least 51% of total wealth accumulation. These figures exclude transfers for college expenses, which one in eight families reported contributing towards in the mid-80s.[11]

Having wealth to transfer is especially important for postsecondary schooling. Conley (2001) highlighted the influence wealth may have on enrolling in and completing

[11] Gale & Scholz (1994) report that among families with positive contributions towards college expenses for their children, the average was $9,373 between 1983-85. That amount in 2017 dollars is $22,516. (https://data.bls.gov/cgi-bin/cpicalc.pl?cost1=9373&year1=198401&year2=201707)

college. By analyzing data from the annual Panel Study of Income Dynamics interviews, Conley was able to analyze multigenerational family level data on a large number of financial and demographic dimensions from 1984 to 1995. He finds that even after controlling for income and other socioeconomic factors parental net worth has a strong effect on postsecondary schooling of children. Specifically, higher levels of net worth allow parents to finance higher levels of educational and professional credientials for their children. Resulting in increases to the total number of years of schooling and the chances that a child will graduate. That is to say, “nonhuman capital (property) and human capital are linked across generations.” These linkages allow parents with greater wealth to secure higher socioeconomic status for their children.

### *2.4.1 The Warrior Caste*

If the wealth gap between veterans and nonveterans persists, intergenerational transfers will grow in importance for veterans and their families. In the context of the contributions intergenerational transfers make to wealth, lower levels of wealth accumulated by veterans will lead to lower total transfers to their children. Below, we discuss particular challenges faced by veterans regarding intergenerational transfers and recent policies aiding veterans and their families.

In the AVF era, military service has become a family business. In a six-month census of new recruits in 2012-13, the DOD found roughly 28% of new recruits joining the military had parents who served in the military (Department of Defense, 2013). Roughly 81% of new recruits reported having at least one family member (parent, sibling, grandparent, aunt/uncle, or cousin) who served in the military.

At the same time the general American public has reduced its familial association with those in the Military. The Pew Research Center (2011) finds 79% of respondents between 50-64 reported having an immediate family member (spouse, parent, sibling, or child) who served in the military. Only 33% of respondents between 18-29 reported having any immediate family members who served. Furthermore, the report confirms the intergenerational nature of military service. Veterans are roughly 22% more likely to have a parent who has also served, 59% more likely to have a sibling who has also served, and 133% more likely to have a child who has or is serving than the general American public.

If military families are less able to accumulate wealth throughout their lifetimes, the logical conclusion must be that there is less wealth to transfer between generations. This negative trend for intergenerational transfers has the potential to compound over time due to successive generations of military families. This compounding has the potential to lead to large deviations in total wealth accumulation for legacy servicemembers and their families.

### *2.4.2 Post-9/11 GI Bill*

Recent policy has provided new avenues for military families to provide intergenerational transfers. Dating back to the Servicemen's Readjustment Act of 1944, the GI Bill has provided a viable path to college for millions of veterans (U.S. Department of Veterans Affairs, 2013). In 2008, the GI Bill was updated again. The updated version of the GI Bill, commonly referred to as the Post-9/11 GI Bill, provides expanded benefits over the 1984 "Montgomery" GI Bill covering more education expenses, provides a living allowance, and money for books. One of the key new

benefits of the Post-9/11 GI Bill is that it allows transferability of the unused portion of the 36 months of educational benefits to spouses or children, a direct intergenerational transfer.[12] As a reference point, the estimated value of 36 months of benefits utilized by an eligible servicemember's child in 2017 at the University of Tennessee totals $73,900.

### *2.4.3 Blended Retirement System*

Under the current Uniformed Services retirement system, eligible servicemembers with at least 20 years of service receive an inflation-protected annuity. If the retiree dies, military retired pay stops unless the servicemember elected to participate in the Survivor Benefit Plan, which provides an annuity of up to 55% of the member's retired pay to a surviving spouse and/or eligible children (Department of Defense, 2017b). Under this retirement system, bequests must come from other sources outside of these retirement funds. In a gloomy example, if a servicemember retires after 20 years of service but passes away the next day and is only survived by a 22-year-old child, there are no bequests available from the value of the annuity the government would have paid the member.[13]

With the Fiscal Year 2016 National Defense Authorization Act, Congress created a new Blended Retirement System (henceforth BRS), effective 1 January 2018. Under the new BRS the DOD provides a 1% automatic contribution and up to an additional 4%

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[12] Eligible servicemembers must have at least six years of service and agree to serve four additional years. Children of eligible servicemembers can only begin using the transferred benefits after the servicemember has completed 10 years of service. (https://www.benefits.va.gov/GIBILL/docs/factsheets/Transferability_Factsheet.pdf)

[13] Under the Survivor Benefit Plan, children under the age of 18 are eligible to receive a portion of the military retired paid, if elected. If the child is a full-time student, the age of eligibility is increased to 22.

in matching contributions to a tax preferred Thrift Savings Plan account, the DOD's version of a 401(k). After completing two years of service, these funds are fully vested. The new BRS also provides an annuity for eligible servicemembers after 20 years of service. However, the defined benefit portion of the BRS is slightly reduced relative to the current system.

Related to intergenerational transfers, this new retirement system provides an integrated path for savings that can be transferred as a bequest. Compared to our prior gloomy example, if the same servicemember joined the military after 1 Jan 2018, served 20 years, and died the next day, military retired pay will still stop. However, the automatic 1% government contribution and any additional savings with government match in the TSP account are available to transfer as a bequest.

Several areas ripe for future research include the effect of transferring education benefits through the post-9/11 GI bill on recruiting, retention, and wealth accumulation of dependents of veterans. The new BRS will also provide new opportunities for future research, perhaps the most significant of these opportunities is how BRS impacts intergenerational transfers.

Underlying the previously discussed institutional dimensions, we find behavioral influences can move us closer or further away from desired savings. In what follows, we consider these behavioral factors for servicemembers. We begin by exploring the influence of financial education on financial behavior. Next, we consider issues at the intersection of financial education, self-control, and loss aversion by highlighting a

unique savings program called the Save More Tomorrow™ (Thaler & Benartzi, 2004). Finally, we dive into how locus of control shapes individual savings behaviors.

## 2.5 Financial Literacy

Underlying the act of retirement planning is a strong implicit assumption that individuals understand basic financial concepts such as compound returns, the differences between stocks and bonds, tax implications associated with investment decisions, and much more. These concepts are generally gathered under the heading of financial literacy. Here we consider the influence financial literacy has on financial behavior and lifetime wealth outcomes.

Over the last few decades, the financial landscape has become increasingly complex and difficult to navigate for consumers (Boshara, Gannon, Mandell, & Sass, 2010). Since the mid-1970s, financial firms have seen the deregulation of brokerage commissions and standardized bank interest rates, as well as the elimination of usury laws which drove increased profitability of credit cards and consumer debt. Additionally, financial innovation, combined with relaxation of interest rate ceilings on consumer debt, led to increased access for consumers to subprime consumer debt such as credit cards, car loans, and home mortgages. Simultaneously, employers have shifted away from defined benefit pensions in favor of defined contribution plans that place the burden of making costly and risky retirement decisions on individuals. While these innovations and deregulations have increased the availability of choices to consumers, it has also increased the need for more financially competent consumers.

Unfortunately, America has a financial literacy problem. Lusardi and Mitchell (2014) considered the state of economic research on financial literacy. In this paper, they present a simple three question survey used to gauge an individual's basic understanding of (i) numeracy (ability to understand and work with numbers) and interest rates; (ii) inflation; and (iii) risk diversification. These three questions are (answers provided in footnote):

1. Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 Years, how much do you think you would have in the account if you left the money to grow: [more than $102; exactly $102; less than $102; do not know; refuse to answer.]
2. Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy: [more than; exactly the same as; or less than today with the money in this account; do not know; refuse to answer.]
3. Do you think that the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund." [true; false; do not know; refuse to answer.][14]

If an individual can answer all three questions correctly, it seems reasonable to believe the individual understands fundamental financial concepts. These fundamental concepts form the foundations necessary for making quality savings, investment, and retirement planning decisions.

Since the first administration of the three questions above in the 2004 Health and Retirement Study, researchers have incorporated them into several other studies in the US and internationally. For example, the 2007-2008 National Longitudinal Survey of

[14] Answers: 1.) More than $102, 2.) Less than today, 3.) False

Youth surveyed individuals ages 23-28 (Lusardi, Mitchell, & Curto, 2010), and the RAND American Life Panel surveyed individuals of all ages (Lusardi & Mitchell, 2009). These questions have also been translated and used in more than a dozen international studies cited by Lusardi and Mitchell (2014) including the Netherlands, Japan, Australia and many more.

So how does the US compare with other countries? Not well. Regardless of age, gender, or education level, the US tends to lag behind comparable countries in financial literacy when measured by the above questions. Below we present Figures 11, 12, and 13. In each of these figures, we present the percentage of individuals providing correct responses for all three financial literacy questions. In Figure 2.11, we see fewer than 20% of Americans below the age of 36 answer the three financial literacy questions correctly. Compared to 55% of Germans the same age or roughly 45% of Dutch and Swiss the same age. In Figure 2.12, we see large differences between Americans by gender but also see Americans lag behind the Germans, Dutch, and Swiss across the board. Finally, in Figure 2.13 we see Americans again lagging behind the German, Dutch, and Swiss in financial literacy across all comparable education levels.

These statistics are concerning due to the substantial influence financial literacy has on decision making. Lusardi and Mitchell (2014) point to several studies that find those with greater financial literacy are also more likely to participate in financial markets, invest in stocks, and hold emergency funds. Furthermore, individuals with greater financial literacy are more likely to plan for retirement, and those who make financial plans accumulate more wealth.

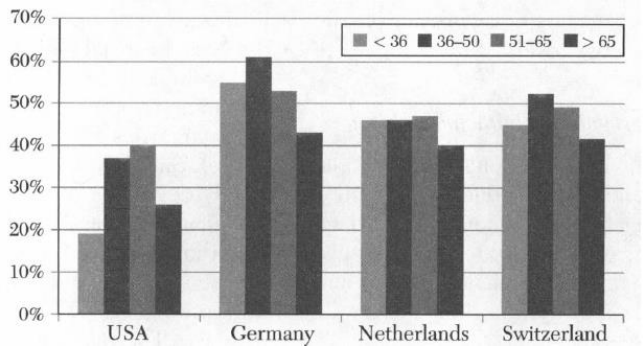


**Figure 2.11 – Percent Providing Correct Answers to All Three Financial Literacy Questions by Age Group (Lusardi & Mitchell, 2014)**

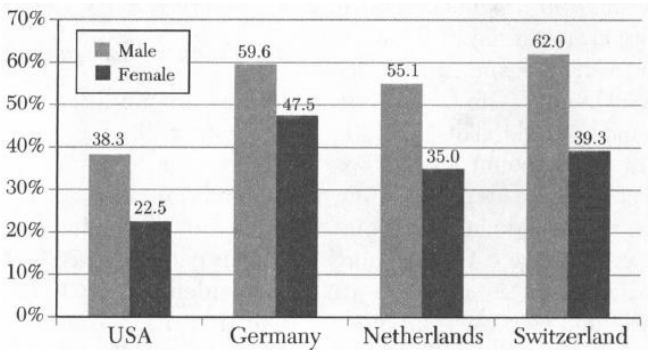


**Figure 2.12 - Percent Providing Correct Answers to All Three Financial Literacy Questions by Gender (Lusardi & Mitchell, 2014)**

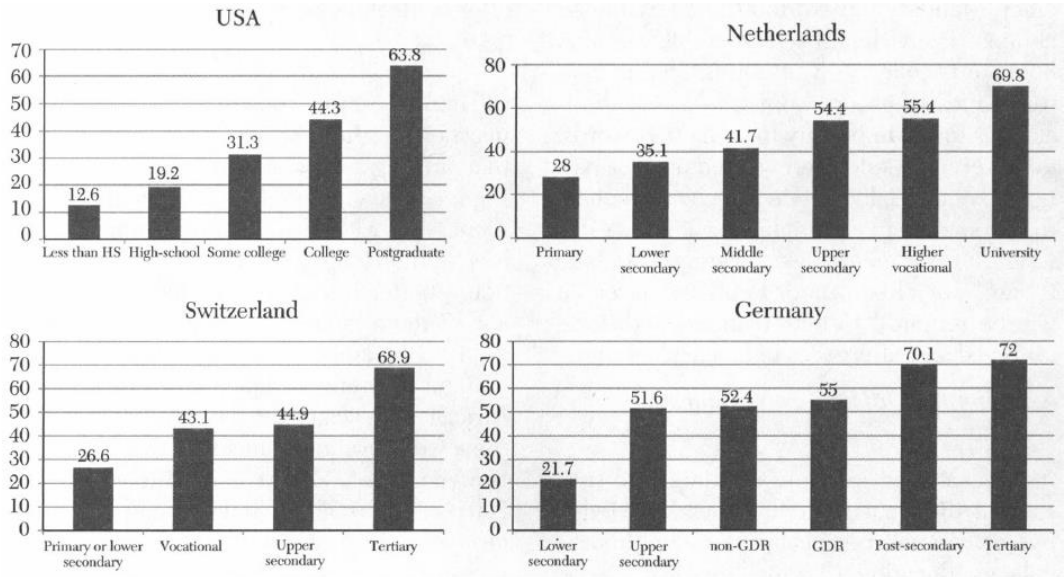


**Figure 2.13 – Percent Providing Correct Answer to All Three Financial Literacy Questions by Education (Lusardi & Mitchell, 2014)**

Conversely, Lusardi and Mitchell (2014) also point to studies that find individuals with lower financial literacy are more likely to engage in costly behavior. For example, lower financial literacy is associated with costly mortgages through higher transaction costs, paying higher fees, and high-cost borrowing. Additionally, lower financial literacy is associated with costly credit card behavior, excessive debt loads, and engaging in alternative financial services (such as payday loans, pawn shops, auto title loans, or rent-to-own services).

Taking a slightly different approach, Allgood and Walstad (2016) explore the linkage between financial literacy and financial behaviors associated with credit cards, investments, loans, insurance, and financial advice. More specifically, Allgood and Walstad consider the difference between perceived financial literacy (subjective and self-assessed) and "actual" financial literacy (test based on financial concepts). The authors accomplish this by conducting a national survey of over 28,000 U.S. adults and households. Not surprisingly, individuals with both high perceived and actual financial literacy are more likely to show positive financial behaviors with credit cards, investments, loans, insurance, and financial advice than those with low perceived and actual financial literacy.[15] However, a counterintuitive result is that increasing perceived financial literacy relative to actual financial literacy may have greater impacts on positive

[15] Positive financial behaviors are those that might be recommended by financial management experts such as: avoiding costly credit card usage and debt, participating in financial investments like stocks, bonds, and mutual funds, seeking financial advice, and so on.

financial behaviors. Allgood and Walstad relate perceived financial literacy to confidence in financial knowledge, which may be required to take actions associated with positive financial behaviors.[16]

The evidence pointing to positive economic outcomes associated with greater financial literacy raises the question of how to improve financial literacy. An obvious answer might be training and education programs. However, the next questions policy makers should ask are who should get the training, how much training is required (both intensity and duration), and how often?

Lusardi and Mitchell (2014) highlight the popularity of financial literacy programs by drawing on dozens of studies both in the US and internationally. These studies consider a wide spectrum of training programs such as those targeting young individuals (e.g. high school students), or professionals in large US firms. Still others look to provide training to those already in financial distress. However, few studies have carefully evaluated the effectiveness of these programs in the context of financial literacy as a human capital investment. Under this analytical lens, some individuals may find it optimal to invest in financial literacy while others will not (similar to an investment in higher education). Furthermore, many employers provide training programs to increase participation rates in retirement savings programs. Given people have

[16] Allgood and Walstad note their study may be limited due to the shortness of the test measure. Additionally, the authors note an inability to identify a causal relationship between financial literacy and behavior. Instead the authors point to the relationship between the combination of actual financial literacy and perceived financial literacy and financial outcomes.

heterogeneous preferences and economic conditions, it is unreasonable to expect every person to respond equally to these training opportunities. Finally, Lusardi and Mitchell (2014) point to best practices when considering the development of effective financial education programs such as avoiding short indiscriminate one-size-fits-all training regimes.

Fernandes, Lynch, and Netemeyer (2014) considers financial literacy, financial education, and associated economic behavior. This study was a meta-analysis that reviewed 168 papers covering 201 prior studies to understand the effectiveness of financial literacy programs on economic behavior. They find very small effects for financial literacy interventions (see our discussion from Lusardi and Mitchell (2014) above). However, Fernandes et al. (2014) point to the perishable nature of financial education showing even extensive interventions have negligible effects 20 months later. Similar to recommendations from Lusardi and Mitchell (2014), Fernandes et al. (2014) suggest eliminating one-size-fits-all training. More specifically, addressing the perishable nature of financial training by providing focused topical “just-in-time” financial training related to specific decisions being made.

### *2.5.1 The DOD and Financial Literacy*

Financial literacy concerns are nothing new to the DOD (Military Compensation and Retirement Modernization Commission, 2015). The Military Compensation and Retirement Modernization Commission report, and sources therein, point to the ways that financial illiteracy have degraded mission effectiveness and distracted servicemembers from their mission focus. For example, in Fiscal Year 2013, nearly 1,130 servicemembers lost their security clearance due to financial issues. Additionally,

it has been estimated that the DOD must involuntarily separate between 4,703 and 7,957 military personnel each year due to financial distress. With each separation costing as much as $57,333, these separations divert hundreds of millions of dollars away from other uses.

According to the 2013 Blue Star Families Annual Lifestyle Survey, 12% of military family households indicate servicemembers were provided financial education while 90% were interested in preventative financial education. Effective 19 Sept 2017, Title 10 U.S.C. § 992 requires the DOD to provide comprehensive financial literacy training, consistent with many recommendations outlined in the Military Compensation and Retirement Modernization Commission report. Specifically, the new law falls in line with just-in-time requirements suggested by Fernandes et al. (2014) for events such as promotion, vesting under the new Blended Retirement System, major life events (e.g. marriage, divorce, birth of first child), and many more circumstances.

While the new law is consistent with much of the current literature, the effectiveness of this new requirement remains unclear. As we previously mentioned, many families are interested in preventative financial education. Recent surveys conducted by the FINRA Investor Education Foundation (2013a and 2013b) show a strong interest among servicemembers for financial planning and financial advice services. In Table 2.1, we present the percent of respondents who have consulted a financial professional between 2007-2012 from a national survey and a survey specifically for servicemembers.

**Table 2.1 – Percent of respondents who have consulted a financial advisor between 2007-2012**

| Have consulted a financial professional about: | National Total | Service Member Total |
|---|---|---|
| Insurance of any type | 30% | 45% |
| Savings or investments | 29% | 42% |
| Taking out a mortgage or a loan | 20% | 40% |
| Tax planning | 18% | 26% |
| Debt counseling | 9% | 18% |
| Have consulted a financial professional about any of the above | 50% | 66% |

Table 2.1 suggests the military servicemembers who find it optimal to increase their financial literacy may search out opportunities to do so on their own. If this is true, the effects from the new training requirements may be negligible due to existing tendencies towards searching out opportunities to invest in their own financial literacy.

## 2.6 A "SMarT"-er Way to Save

Thaler and Benartzi (2004) outlines an innovative program designed to increase employee savings informed by principles from behavioral economics. They called this program the Save More Tomorrow™ (SMarT) program. In this section, we explore behavioral economic foundations underlying the SMarT program (financial literacy, self-control, procrastination, and loss aversion), discuss the mechanics of the SMarT program, and highlight the implications of implementing such a program within the DOD.

### *2.6.1 Financial Literacy*

As we have discussed in prior sections, there are many hurdles individuals (both veterans and nonveterans) face to saving adequately for the future. One such hurdle may be that individuals lack the information they require to adequately estimate their post retirement needs. For example, adequate retirement savings requires information

on expected lifetime income, estimated working years, anticipated risk adjusted investment returns, life expectancy, and consumption levels.

Goda, Manchester, and Sojourner (2014) presents a field experiment designed to study the effects that providing retirement income projections have on employer-sponsored retirement savings behavior. Their experiment was conducted at the University of Minnesota, involved nearly 17,000 employees, and provided three different randomized information treatments: general information on savings for retirement; individualized information on impacts of hypothetical additional contributions on balance at retirement; and individualized information on impacts of hypothetical additional contributions on income in retirement. In addition to the information brochure, individuals outside the control group were provided with a contribution change form that would allow individuals to make changes to their retirement contributions after reviewing the provided material.

All three information treatments made it more likely that individuals changed their retirement savings contributions when compared to the control group. However, the general information on savings treatment was not statistically different from the control group. The treatment including both retirement balance and income in retirement increased the average contribution to retirement savings. This experiment resulted in an average annual increase in retirement contributions by $2,504. Roughly 24% of the changes in retirement contributions are associated with those who went from contributing nothing to contributing something, the extensive margin. Among those who chose to contribute, the average annual increase in contributions was $7,612.

This experiment provided the first direct evidence that people will adjust their retirement contributions based on lifetime savings projections. Furthermore, this study confirms that targeted financial education, followed by an opportunity to take action and to commit oneself, is an effective strategy for increasing savings (see Lusardi and Mitchell, 2014; Fernandes, Lynch, and Netemeyer, 2014). These are important implications for an effective savings program, and we will revisit this as we discuss the mechanics of the SMarT program.

### *2.6.2 Self-Control*

The idea of self-control in an economic context was formally introduced by Strotz (1956). Consider a young person who has an idea of how they would like to retire. Perhaps they want to travel the world during their retirement years, or own a lakefront home and spend their retirement fishing. In any case, each day that passes presents an opportunity to stay on the path to achieving that goal or move further away from it. Splurging on the most current smartphone, newest model car, or a cutting edge ultra-high-definition TV are all possible examples of temptations that might move this person away from their intended goal. If this person fails to recognize the inconsistency, he will engage in undesirable, wasteful spending. Alternatively, if he is aware he may be tempted in the future, he may “precommit” his future behaviors by automatically setting aside money each month into the Thrift Savings Plan (hereafter TSP), 401(k) style

retirement account, or some other investment account.[17] By investing in a retirement account, this person increases the cost of deviating from his intended goal through the specter of heavy early withdrawal penalties or increased debt. Finally, he could account for his future temptations and decide to lower his retirement goals. For example, instead of traveling the world, he may resign himself to traveling the US or not traveling at all.

Strotz presents a theoretical model that suggests the way people discount their future consumption relative to the present drives this inconsistency. He conjectures that self-control problems arise because people "over-value" or "under-discount" consumption closer to the present relative to consumption that occurs much later. This can lead, for example, to individuals putting off saving for things like retirement or education and instead purchasing things that can be consumed right away, like clothes or electronics. Thaler and Benartzi (2004) point to a situation where an individual is offered a choice between two rewards, a small one at time *t* and a big one at time $t + 1$. When *t* is far off in the future, people would prefer the big prize because the value of the reward is larger than the perceived cost of waiting. However, as *t* approaches zero (or right now), the small prize looks more attractive now than waiting for a bigger prize later, and people switch their preference.

Coller and Williams (1999) conducted an experiment to better understand how people make choices between two prizes over time. In one of the sessions, individuals

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[17] Strotz points to Odysseus tying himself to the mast to avoid the sirens in The Odyssey as a famous precommitment example.

were asked to choose between receiving $500 one month from now or some larger amount 3 months from now (a two month wait).[18] The median respondent in their experiment stated they would require more than $516.94 to wait 2 months. However, in a separate session, individuals were asked to choose between receiving $500 today or some larger amount 2 months later (still waiting two months). The median respondent now stated they would require less than $516.94 to wait the same 2 months and would instead take $500 today. This present-bias preference has direct implications for lifetime wealth accumulation.

### *2.6.3 Procrastination*

Mark Twain once quipped, “Never put off till tomorrow what may be done the day after tomorrow just as well.” Unfortunately, these words ring true in practice for many tasks that we view as unpleasant, including retirement savings decisions.

Choi, Laibson, Madrian, and Metrick (2002) considered the effect different 401(k) plan features have on savings behavior. Part of their study included a randomized savings adequacy survey of employees at a large US food corporation. Individuals were asked how much they should *ideally* save towards retirement. The average response is 13.9% of income. These individuals were then asked to evaluate their *actual* savings rate. Roughly two-thirds of respondents said their actual 401(k) saving rate was too low when compared to their ideal saving rate. Next, individuals were asked about their

[18] One subject was selected at random at the end of the experiment and received a notarized payment certificate that was redeemable for a university check on or after the appropriate date based on the selections made by the subject during the experiment.

future plans for their saving rate. Of the individuals that reported their saving rate was too low, 35% of the respondents expressed an intent to increase their contribution rate over the next few months. Nearly 75% of these respondents who intended to increase their saving rate said they planned to do so within two months. Roughly half intended to make increases within the next month. However, when crosschecked against individual 401(k) records, 86% of individuals that reported they would increase their savings over the next few months had taken no action four months after the survey. Samuelson and Zeckhauser (1988) would consider this procrastination a status quo bias. That is, the individual has made no change to the status quo (their current savings rate) out of convenience, habit, or inertia. In this example, the status quo bias results in a presumably undesirable outcome (an individual realizes they save less than they would ideally like to but intends to make changes…tomorrow).

Procrastination and status quo bias is not necessarily bad and the effective assignment of default options may help those who are prone to these behaviors. In fact, if it is desirable to increase participation in employer sponsored 401(k) plans, a status quo (or default option) bias can lead to significantly greater participation rates.[19] In 2001, Madrian and Dennis Shea (from UnitedHealth Group) published a paper that analyzed the impact of automatic enrollment on 401(k) savings behavior.

[19] The new Blended Retirement System servicemembers are automatically enrolled in a default "lifecycle" fund at a rate of 3% of basic pay. If a servicemember opts out, the member will be automatically re-enrolled each calendar year (Department of Defense, 2017d).

In their paper, Madrian and Shea analyzed the 401(k) savings patterns of employees at a large US corporation before and after a policy change. The old policy required employees to opt-in to the 401(k) savings plan. The new policy automatically enrolled employees unless they opt-out of the 401(k) saving plan. These policies have become popular for reasons we will discuss here but require an employer to choose a default savings rate (usually modest, 3% or less) and a default savings plan (usually a conservative mix of stocks or bonds, or a money market fund). While classical economic predictions would say this policy change should have no effect, the policy significantly impacted participation rates.

There are two significant findings from the Madrian and Shea study. First, automatic enrollment plans significantly increase participation in employer sponsored 401(k) programs. Before the policy change, 49% of eligible employees participated in the 401(k) program. After the company moved to an automatic enrolment policy, participation increased to 86%. Other studies have found even higher participation rates after a similar policy change. For example, Choi et al. (2002) find participation rates in the 95-98% range for some companies 36 months after the policy change.

The second significant finding from Madrian and Shea is that a large portion of the 401(k) participants hired under the automatic enrollment plan kept both the default contribution rate and default fund allocation. Conversely, few employees hired before the automatic enrollment plan (those that had to opt-in and subsequently make their own contribution rate and fund allocation decisions) chose the specific combination of savings rate and fund allocation associated with the new program. Madrian and Shea

suggest this status quo bias is a result of both participant inertia and an employee perception that the default recommended by the employer represents sound investment advice.

On one hand, increased participation in retirement savings programs is arguably a positive outcome. On the other hand, the high number of individuals passively accepting the default savings rate and default fund allocation may lead to lower lifetime wealth accumulation compared to individuals who participate in a 401(k) plan at a firm without automatic enrollment (Choi, Laibson, & Madrian, 2004). Over time, few individuals change their contribution rate and fund selections. Even after 2 years, 40-54% keep the default choices. The increased participation rates in the 401(k) savings program raises average wealth accumulation, but the low default savings rate and conservative default funds may reduce total accumulation. Below, we will discuss how the SMarT program attempts to capture the advantages associated with the automatic enrollment plans while attempting to sidestep some disadvantages.

### *2.6.4 Loss Aversion*

Kahneman and Tversky (1979) published a revolutionary paper that changed the way many economists think about decision making.[20] The theory proposed by Kahneman and Tversky is called prospect theory, and they introduced the idea that individuals significantly weigh losses more heavily than gains (loss aversion). Empirical

[20] The 2002 Nobel Prize in Economics was awarded to Kahneman for joint work with Tversky. Unfortunately, Tversky passed away in 1996 and the award is not awarded posthumously. (https://news.stanford.edu/news/2002/october16/tversky-1016.html)

work has estimated loss aversion typically close to 2.0 both for risky choices and for riskless choices (Tversky and Kahneman, 1992; Kahneman, Knetsch, and Thaler, 1990). That is, losses hurt twice as much as a comparable gain gives us enjoyment. Another way to think of this is that a loss and foregone gains are both "bads," however people regard losses as twice as bad as an equal-size foregone gain.

Kahneman, Jack Knetsch (a professor at Simon Fraser University, Canada), and Thaler published a paper in 1986 that looked at fairness considerations in customer and labor markets. One of the interesting findings from this paper centers on individuals' perception of wage gains and losses in nominal terms. When asked if a wage cut of 7% during a recession with high unemployment and no inflation is acceptable or unfair, 62% respondents see this as unfair. However, when asked if a wage increase of 5% during a recession with high unemployment and inflation of 12% is acceptable or unfair, 22% of respondents state this is unfair. In both scenarios, an individual is losing 5% in real purchasing power but because people look at gains and losses in nominal terms we see a very different response. When people think of money only in nominal terms, economist call this money illusion. The combination of loss aversion and money illusion has powerful implications for savings behavior, as we will discuss below.

### *2.6.5 Save More Tomorrow™*

Providing employees with a voluntary and regimented savings program substantially increases savings rates (Thaler & Benartzi, 2004). Thaler and Benartzi (a professor at the University of California, Los Angeles) present a prescriptive savings program called Save More Tomorrow ™ (hereafter, the SMarT program). Under the SMarT program, employees voluntarily precommit a portion of their future salary

increases towards retirement savings. From 1998-2002 a midsize manufacturing company utilized the SMarT program and found 78% of those offered the program participated, 80% who joined the program remained enrolled, and the average savings rates increased from 3.5% to 13.6% over 40 months.

In designing the SMarT program, Thaler and Benartzi first attempt to diagnose the underlying causes for the lack of retirement savings. First, it is difficult to figure out what the “right” savings amount should be. In other words, people are limited by their cognitive ability. Second, many households lack the self-control necessary to increase savings towards retirement. Third, households tend to procrastinate when it comes to saving for retirement (related to self-control). Procrastination can also lead to inertia in retirement savings. As we previously discussed, companies that automatically enroll employees in retirement savings accounts with default savings rates find high participation rates with few deviations from the default settings. Finally, when households adjust their standard of living to their current level of disposable income, they view additional savings as a loss of income and are less likely to make changes due to loss aversion.

The SMarT program targets households who “…are not sure how much they should be saving, though they realize that it is probably more than they are doing now; but they procrastinate about saving more now, thinking they will get to it later.” The key components of the program are as follows:

1. Ask employees if they want to participate as early as possible before a scheduled raise
2. If employees join, the increase in savings contributions goes into effect with the first paycheck after a raise

3. The contribution rate increases with each scheduled raise until a preset maximum is met
4. Employees can opt-out at any time

Each component seeks to address one of the challenges to increasing retirement savings outlined above. The simplicity of the program minimizes the cognitive burden placed on households in making retirement savings decisions. Next, by maximizing the time between when employees opt-in and the first contribution, we take advantage of the way people discount future events. By tying savings contribution increases to pay raises, the program reduces perceived loss aversion associated with decreasing take home pay. Relatedly, by committing to predetermined increases in saving contributions, the SMarT program leverages inertia and status quo bias in favor of increased savings. Finally, knowing one can opt out at any time makes employees more comfortable in making the decision to join. If servicemembers are attracted to the military for structure and discipline as suggested by Gal and Mangelsdorff (1991), offering servicemembers a regimented savings program such as the SMarT program may be beneficial.

### *2.6.6 DOD Specific Considerations*

#### *2.6.6.1 Servicemembers' Discount Rates*

The military drawdowns in the early 1990s provided an opportunity to study directly the time preferences of servicemembers over meaningful decisions worth tens of thousands of dollars (Warner & Pleeter, 2001). During the 1992 U.S. military drawdown, mid-career servicemembers in selected occupations who elected to voluntarily separate from the military were offered a choice between a lump-sum separation benefit and an annuity. The DOD estimated that roughly half of enlisted personnel and a very small number of officers would select the lump sum over the

annuity. However, roughly half of officers and 90% of enlisted personnel made the less financially lucrative decision (were too impatient, or lacked self-control) when selecting a separation pay type.

Why were the DOD's estimates so off? To better understand this, we need to introduce the idea of personal discount rates. The personal discount rate is the measure of how much interest the individual must earn to be indifferent between savings and spending. The market interest rate is the amount the individual can actually earn. If the personal discount rate is below the market interest rate, an individual is better off saving. Conversely, if the personal discount rate is above the market interest rate, it does not make financial sense to save.

When deciding between a lump sum and an annuity, we are concerned with the break-even discount rate (the rate of return that would equate the lump-sum payment and the present value of the annuity). In this case, if the personal discount rate is below the break-even discount rate an individual will choose the annuity because they are compensated enough to do so. Again, if the personal discount rate is above the break-even discount rate, an individual will choose the lump-sum payment because they are not compensated enough to take the annuity and prefer to have the money today.

In the early 90s, money market funds were paying 7% interest rates (market interest rate). Depending on length of service for a servicemember, and a few other factors, the break-even discount rate for the separation payment choices were between 17.5% and 19.8%. The findings from Warner and Pleeter (2001) suggest that a large portion of servicemembers have personal discount rates in excess of 17.5%. Higher

personal discount rates indicate greater impatience due to the individual viewing future consumption as less valuable than consumption today. For example, a 100% discount rate suggests that an individual views future consumption (even tomorrow) as worthless when compared with today.

By observing the separation payment choices of roughly 11,000 officers and 55,000 enlisted personnel, Warner and Pleeter were able to estimate the average discount rates for officers and enlisted personnel for several different years of service (YOS). We present these results in Table 2.2.

From Table 2.2, we see the average discount rate for officers is roughly one-third that of enlisted personnel. Observable demographic differences such as the number of dependents, sex, race, education and the difference in lump-sum payments explains more than half this difference. Additionally, we see individuals who choose not to separate (Stayers) are more patient then those who choose to separate (Leavers). This is supported by the relatively lower discount rate associated with Stayers compared to Leavers in both the officer and enlisted personnel. Finally, we see that those servicemembers further away from the minimum 20 years of service, which is required for vesting in the military retirement system, are on average more impatient. In their concluding remarks, Warner and Pleeter find the discount rates are relatively high among military personnel, especially enlisted personnel.

While servicemembers show high levels of impatience in deciding what type of separation pay to choose, is there evidence of this same type of impatience (or self-control issues) in day-to-day financial decisions? A recent study suggests this may be

the case. Skimmyhorn (2016) utilizes data from the 2009 and 2012 National Financial Capability Studies, sponsored by FINRA Investor Education Foundation, and finds statistical differences between servicemembers and non-servicemembers in their household finances. Specifically, servicemembers have more types of savings accounts but also have more problems with credit cards. These results suggest that servicemembers may have intentions to plan for the future by setting up savings accounts, but struggle to avoid current temptations.

**Table 2.2 – Average Nominal Discount Rate (Warner & Pleeter, 2001)**

| | Officers | Enlisted |
|---|---|---|
| All | 0.104 | 0.354 |
| Stayers | 0.099 | 0.350 |
| Leavers | 0.129 | 0.369 |
| All in YOS: | | |
| 7 | 0.205 | 0.410 |
| 9 | 0.159 | 0.381 |
| 11 | 0.111 | 0.353 |
| 13 | 0.046 | 0.327 |
| 15 | 0.000 | 0.294 |

#### *2.6.6.2 DOD Precommitment Devices*

The DOD provides two main precommitment devices that can be used by servicemembers to prepare for retirement and wealth accumulation. The first device is the TSP, which provides tax advantaged savings accounts similar to civilian 401k plan (Thrift Savings Plan, 2017). Servicemembers who contribute to the TSP may face a 10% early withdrawal penalty, in addition to taxes due on any taxable withdrawal before

the age of 59.5.[21] This early withdrawal penalty makes financial "misbehavior" more expensive and therefore should reduce the temptation of current consumption.

The discretionary allotment is the second precommitment device the DOD provides. The discretionary allotment allows servicemembers to partition their pay automatically each month (Department of Defense, 2017c). As it relates to this study, the servicemember can send these partitioned funds to purchase savings bonds through the Savings Deposit Program or financial institutions where the servicemember holds a savings account, mutual funds, or other investment accounts. Generally speaking, there are no early withdrawal penalties associated with these types of discretionary allotments, and so compared to the TSP represents a weaker precommitment device.

### *2.6.7 Applying the SMarT Program Within the DOD*

Here we will explore the impact the SMarT program would have on a hypothetical enlisted Air Force servicemember who enlists at age 18. We can call him Joe Smith. We will make a few simplifying assumptions as this example is for purely illustrative purposes and will serve to provide a conservative estimate. We begin with an estimated promotion timeline collected from the Air Force Personnel Center's promotion statistics and anecdotal estimates from discussions with enlisted Airmen. For simplicity, we

[21] There are exceptions to this rule, for example, employees leaving federal service after the age of 55 will still pay regular income tax but will not face the 10% early withdrawal penalty. Anecdotally, this exception applies to a small number of military retirees. The structure of the military retirement system and the up-or-out promotion system suggests only a small number of senior officer and enlisted personnel stay in the military long enough to reach the age of 55.

consider Joe entering the Air Force as an Airman Basic (E-1) and over a 20-year career rises to the rank of Master Sergeant (E-7). After 20 years of service, Master Sergeant Joe Smith retires and makes no further contributions to his thrift savings plan until age 60, when we can begin withdrawing funds without penalty. To simulate the amount of savings that might accrue over Joe Smith's career we utilized the 2017 military pay chart from the Defense Finance and Accounting Service and assume a conservative 2% annual pay raise, the average over the last 10 years.

In Figure 2.14, we present a comparison between Joe Smith choosing to maintain the default 3% contribution rate and a simple SMarT program implementation (in nominal dollars). In the default 3% contribution rate scenario, Joe will receive a 1% Service Automatic Contribution after 60 days of service and a matching contribution of 3% after 2 years of service. In our hypothetical implementation of the SMarT program, Joe has pre-committed to begin with the 3% default contributions and will add 1% to his total savings rate for each annual pay raise and 3% for any promotions he earns. Joe decided to opt into increasing his total savings rate until he reaches 14% (the average savings rate individuals self-reported as ideal in Choi et al., 2002). We also take a conservative approach to modeling investment returns and assume a 5% annual return.[22]

[22] The average annual returns for many of the TSP funds are in excess of 7% and one, the C fund (which replicates the S&P 500), has an average annual return of 10.16% since its inception date of 29 Jan 1988. https://www.tsp.gov/InvestmentFunds/FundPerformance/returnSummary.html.

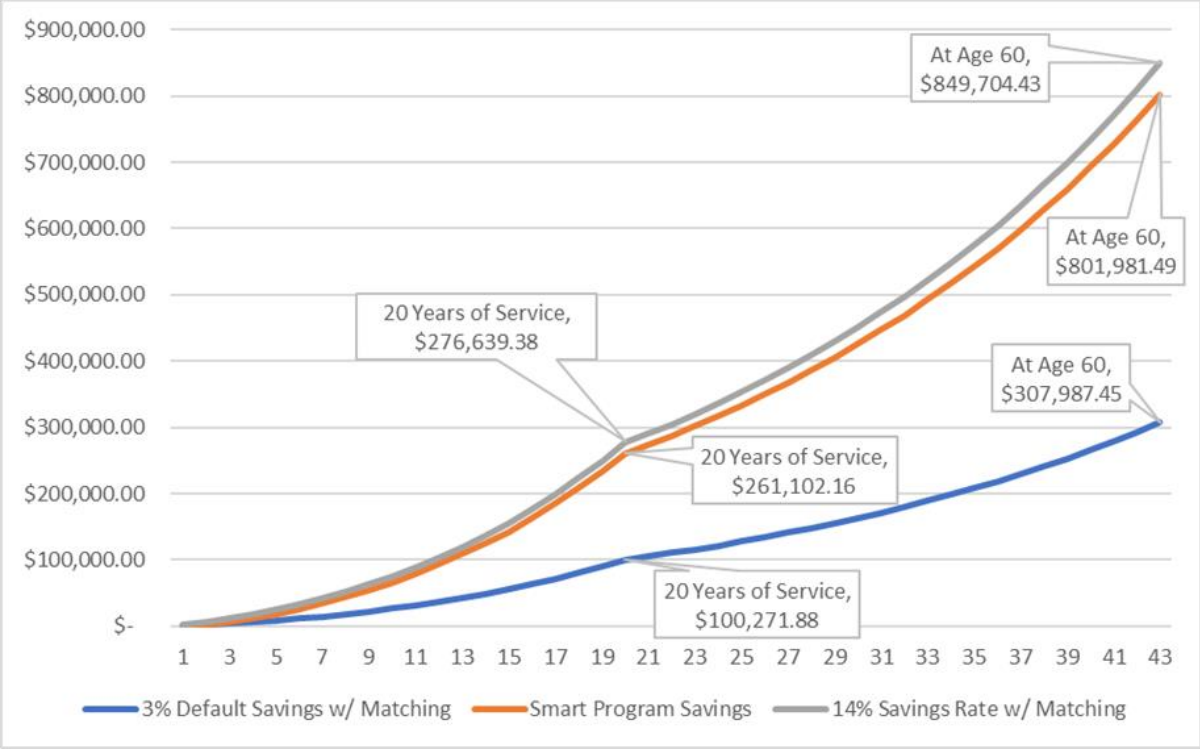


**Figure 2.14 – Comparison of Estimated Savings Outcomes by Savings Program (in nominal dollars)**

As we might expect, the savings differences in Figure 2.14 are substantial. This simple implementation of the SMarT program means the difference between having saved $261,102 after 20 years of service, and having saved only $100,272 without the program. At the age of 59.5, Joe can begin to withdraw funds from his TSP without early withdrawal penalties. In this case, the nominal value of his savings from participating in the SMarT program totals $801,981. This is compared to $307,987, which is what he would have saved had he maintained the 3% default savings rate (with matching and automatic contributions made by the DOD). Of course, if Joe had been able to set aside 14% of his income from the very start of his career, he would have saved a little more. However, for reasons we have already outlined, this is incredibly difficult for almost everyone. The SMarT program provides a powerful savings tool that can help move servicemembers towards retirement savings adequacy.

This program will especially benefit the roughly 83 percent of enlisted personnel who will leave the military prior to 20 years of service (Department of Defense, 2012). These individuals will not receive the defined benefit portion of the BRS. After 4 years of service (a common contract length for enlistment), savings are roughly 2 times larger for those under the SMarT program than those who stay under the 3% default setting. After 10 years of service, the savings are about 2.5 times larger for those under the SMarT program compared to the default setting.

Servicemembers gain promotions quickly early in their careers, and then the rate of promotion levels off. Additionally, fairly consistent annual pay raises and the recent roll-out of the new BRS contribute to an environment which appears ideal for applying

the SMarT program. Benartzi et al. (2017) provide a recent example of the effectiveness of these behavioral interventions within the DOD. In the 2015 experiment, simply sending an email designed to increase participation in the TSP lead to a conservative increase in savings of roughly $8 million in 1 year. This experiment generated $1,600 in additional savings per dollar spent by the government, which is an effect over 100 times larger than the available tax incentives produce. More research is required to understand the full impact of these interventions on the financial wellbeing of servicemembers. These interventions may substantially increase savings. However, it is less clear if these changes will lead to further financial problems in the short term, an undesirable outcome.

## 2.7 Locus of Control

Intelligence alone, or cognitive ability, does not drive wages (Cawley, Heckman, & Vytlacil, 2001). For two people with the same level of education, cognitive ability has little impact on wages. Relatedly, recent economics research has highlighted the impact of noncognitive skills on wages and education. Heckman, Stixrud, and Urzua (2006) find noncognitive skills have significant impacts on the level of education achieved and wages, given the level of education achieved. Some of these noncognitive factors include personality traits, persistence, motivation and charm. Specific to this study, we explore the noncognitive trait of locus (sense) of control and examine the influence it has on savings patterns and health.

Rotter (1966) presents findings that have had a wide-reaching impact, not only in psychology but also in the fields economics and management. Rotter (1966) finds the

effectiveness of rewards (or reinforcement) on behavior at least partially depended on if a person sees the reward as a direct result of their efforts (skill) or independent of it (chance). He describes these perceptions as internal or external control of reinforcement, respectively, but this terminology was eventually replaced with internal or external locus of control. Individuals fall somewhere between the two ends of the spectrum. Someone with an external locus of control believes that an outcome is unrelated to their efforts but instead a result of luck, fate, or due to someone else. Conversely, someone with an internal locus of control believes their efforts directly lead to specific outcomes. Interestingly, this work was supported with a 4-year grant from the Air Force.

Rotter theorizes our locus of control is developed from an early age. Through our specific life experiences, we form expectations about how our efforts relate to outcomes. These specific experiences become generalized to related situations we have not yet experienced. Our future attitudes are shaped by our current experiences, and can lead to stronger tendencies towards an internal locus of control. This occurs when our belief that specific effort leads to specific outcomes is confirmed. Conversely, failure of the effort-outcome relationship leads to reduced internal locus of control or even an external locus of control over time. This is especially true for the young (<20 years old) and elderly (80+); however, locus of control is especially stable for those between 25-60 years old (Cobb-Clark & Schurer, Two Economists' Musings on the Stability of Locus of Control, 2013).

Locus of control is relatively easy to measure. Rotter presented a survey that included 23 questions to measure internal versus external locus of control and 6 filler questions to attempt to conceal the true intent of the questionnaire. In each question, an individual is asked to choose the statement they most agree with. We present a few of these questions here (scoring information is provided in the footnote below): [23]

1. a. Children get into trouble because their parents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.
2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.
3. a. People are lonely because they don't try to be friendly.
   b. There's not much use in trying too hard to please people, if they like you, they like you.

Events occurring during formative years for young adults are especially important. For example, Giuliano and Spilimbergo (2014) find that people who experience a recession when young believe that their success in life is driven more by luck than effort. In other words, the uncertainty shocks driven by the macroeconomy moves individuals towards an external locus of control. As these individuals enter the workforce, their locus of control will influence not only their education outcomes but also their choice in jobs (Heywood, Jirjahn, & Struewing, 2017). We will return to this last point later as we relate locus of control back to the DOD.

[23] 1). A filler question and has no bearing on an internal-external locus of control score. 2). Statement "a" aligns more closely with an external locus of control and we add 1 to an individuals I-E score. Statement "b" aligns more closely with an internal locus of control and we add nothing. 3). Statement "a" aligns more closely with an internal locus of control so we add nothing to an individuals I-E score. Statement "b" aligns more closely with an external locus of control and we would add 1 to an individuals I-E score. The I-E score ranges from 0-23. Lower scores suggest a more internal locus of control while higher scores suggest an external locus of control.

As it relates to the main topic of our study, locus of control greatly influences wealth accumulation (Cobb-Clark, Kassenboehmer, & Sinning, 2016). Households with an internal locus of control tend to save more both in total amount and as a percentage of income. Cobb-Clark et al. conclude that locus of control "…may be as important as human capital and cognitive skills in explaining heterogeneity in wealth accumulation and portfolio allocations." Cobb-Clark et al. (2016) found the median wealth gap between households with an internal locus of control versus an external locus of control stood at $125,000 in the 2010. Consistent with earlier definitions of wealth, Cobb-Clark et al. (2016) define wealth (total net worth) based on financial wealth, business equity, real estate equity, vehicles, and pensions.

The influence of locus of control goes beyond education attainment, occupation selection, or savings behavior. An internal locus of control is also associated with individuals who are more likely to have healthier habits such as eating healthy, exercising regularly, and avoiding tobacco products (Cobb-Clark, Kassenboehmer, & Schurer, 2014). Presumably, these factors lead to greater life expectancy, which is also associated with more savings (Bloom, Canning, & Graham, 2003).

### *2.7.1 The DOD and Locus of Control*

As we have outlined, the non-cognitive skill of locus of control has the potential to have significant and long-lasting impacts. However, the question remains how this relates to the DOD. Are individuals with external or internal locus of control more likely to join the military? Given the young age of most recruits, does basic training influence servicemembers' locus of control? We explore these questions here.

The military attracts many different types of people; however, a pattern of personalities emerges that includes a high need for achievement, job and financial security, a need for conformity, and finally a need for authoritarianism (Gal & Mangelsdorff, 1991). We view the last personality trait, the need for authoritarianisms, as someone who expresses an external locus of control. In other words, the military attracts individuals who seek to allow others to control their fate. Those with an internal locus of control prefer participative supervision and dislike authoritarianism (Spector, 1982). In the context of our prior discussion on the benefits of an internal locus of control, this seems to suggest that the military attracts those who are predisposed to lower wealth accumulation.

In his concluding remarks, Spector (1982) argues, “battlefield operations where precise carrying out of orders is essential, would be most appropriate for externals who are more suited for directive supervision.” This is supported by behaviors most closely associated with individuals with an external locus of control such as conforming and compliance. However, the battlefields of the 21st century have fundamentally shifted, and require entirely new skillsets to face the irregular conflicts we face now and for the near future (Shultz, Godson, Hanlon, & Ravich, 2011). This new skill set will require servicemembers to take on more qualities associated with an internal locus of control. That is to say, the current conflicts require individuals who, provided the necessary training, will look to themselves for direction to seize the initiative in a highly decentralized irregular conflict. Spector (1982) states, “when tasks or organizational

demands require initiative and independence of action, the internal would be more suitable…"

Military service can influence an individual's locus of control through the recruit training process. Cook et al. (1982) found early evidence of the transformative nature of basic military training (commonly referred to as boot camp) on young men. Training units with higher attrition became more internally focused while training units with medium and low attrition became more externally focused. Duhigg (2016) relays a story of a 2010 initiative driven by U.S. Marine Corps General Charles C. Krulak to revamp the Marine Corps recruit training. The redesign specifically sought to encourage an internal locus of control. The end goal is to produce Marines that "take control of their own choices" and possess a "bias towards action."

We began this section by noting individuals with external locus of control have lower wealth accumulation, less healthful behaviors, and lower education attainment. If the military does attract individuals with an external locus of control, one would expect that veterans accumulate less wealth, have more health problems, and attain lower levels of education. As we have previously pointed out, Gustman et al. (2016) finds a growing wealth gap between veterans and nonveterans. In Table 2.3, we provide data collected by Gustman et al. from the Health and Retirement Study (hereafter, HRS) providing a comparison of wealth, health, and education outcomes for veteran and non-veteran cohorts entering ages 51 to 56 in 1992, 1998, 2004, and 2010. Importantly, the 2010 cohort is the only AVF cohort in the data set. The 1992, 1998, and 2004 cohorts included individuals impacted to some degree by the draft. However, Gustman et al.

(2016) recognize that the likelihood of draft exemptions increased overtime impacting those in the 1998 and 2004 cohorts the most. From Table 2.3, we see veterans in the 2010 cohort (AVF) had significantly lower wealth accumulation, more reports of health problems, and lost the education advantage they had enjoyed in prior cohorts, consistent with outcomes associated with individuals with an external locus of control.

The study of locus of control and its connection to economic outcomes has become a burgeoning area of study for economist. There are several promising avenues in which researchers can contribute to our understanding of locus of control, the military, and economic outcomes of interest. One such avenue should consider the interaction between locus of control and the effectiveness of behavioral interventions. If we find differences in response to behavioral nudges based on locus of control, we may have opportunities to tailor the implementation of programs like the SMarT program and other behavioral interventions more effectively.

## 2.8 Conclusions

We conclude this study with a call to action. The DOD has made significant strides in helping veteran families close the wealth gap identified by Gustman et al. (2016). Increases in military pay have brought military pay to near parity with civilian counterparts. Though it is too early to see the long-term impacts, the Military Spouse Employment Partnership program has provided increased opportunities for spouses to close the employment and pay gaps relative to their civilian counterparts. Expanded benefits such as the Post-9/11 GI bill and matching contributions to the Thrift Savings Plan have provided increased opportunities for intergenerational transfers, an important

**Table 2.3 – Wealth, Health, and Education Data for Veterans & Nonveterans entering ages 51-56 in 1992, 1998, 2004, and 2010**

| | HRS Cohort | | | |
|---|---|---|---|---|
| | 1992 | 1998 | 2004 | 2010 |
| Wealth | | | | |
| Total Nonveteran Household Wealth (in Thousands of 2010 dollars) | 822 | 897 | 1066 | 865 |
| Total Veteran Household Wealth (in Thousands of 2010 dollars) | 883 | 951 | 835 | 648 |
| Health | | | | |
| Percent Veterans in Fair or Poor Health | 13 | 17 | 25 | 27 |
| Percent Nonveterans in Fair or Poor Health | 19 | 21 | 20 | 21 |
| Percent Veterans with Health Problem Limiting Work | 17 | 16 | 20 | 33 |
| Percent Non-veterans with Health Problem Limiting Work | 17 | 18 | 17 | 17 |
| Education | | | | |
| Mean Years of Education Veterans | 13.2 | 13.7 | 13.6 | 13.4 |
| Mean Years of Education Nonveterans | 12.2 | 12.9 | 13.8 | 13.5 |
| Percent Some College Veterans | 51 | 58 | 67 | 57 |
| Percent Some College Nonveterans | 38 | 49 | 65 | 58 |

component of American wealth. However, there are still areas that require further study and action if the goal is to close the lifetime wealth accumulation gap between veterans and nonveterans.

Frequent Permanent Change of Stations required by the military place home ownership just beyond reach for the majority of military families. Home ownership is the primary driver of wealth accumulation for Americans and the differences in home equity levels are substantially smaller for veterans relative to nonveterans. Further study is required for new and innovative ideas to address this issue. Due to military necessity, it seems unlikely that duration of military assignments can increase to accommodate the time required to make home ownership economical for most servicemembers. Perhaps the study of an alternative tax preferred investment vehicle, such as a separate account within the Thrift Savings Plan dedicated to home purchasing, might allow for the accrual of pseudo equity while servicemembers continue their service. By doing so, we may mitigate some of the loss of home equity that veterans experience.

Finally, the new BRS provides an opportunity to utilize findings from behavioral economics to make substantial gains in savings for servicemembers. The first step requires targeted and actionable financial literacy training which Title 10 U.S.C. § 992 now requires. Another key component for implementing such a program requires the creation of a conditional discretionary allotment within the DOD financial system. A feasibility study of such an instrument should be undertaken sooner rather than later to maintain the momentum associated with the rollout of the new retirement system.

Strong gains have been made by Congress and the DOD along the institutional and behavioral dimensions we highlight in this study. However, if the goal is to close the lifetime wealth accumulation gap between veterans and nonveterans, more study and action is required. Our hope is that this study has provided additional depth to the ongoing discussion of how to support veterans and a potential roadmap to address some of the more pressing issues facing servicemembers and their families.

# CHAPTER 3

# MEASURING THE GENDER SPECIFIC ECONOMIC EFFECTS OF MILITARY BASE CLOSURE: AN ANALYSIS OF THE 2005 BASE REALIGNMENT AND CLOSURE

The views expressed are those of the author and do not reflect the official policy or position of the US Air Force, Department of Defense, or the US Government.

## 3.1 Introduction

As of September 30, 2014, the DOD managed a real property portfolio that consisted of more than 562,000 facilities worldwide with an estimated value of $879 billion (Department of Defense, 2014). As recently as April 2016, the DOD presented analysis showing a roughly 22% excess facility capacity distributed across the military services (Department of Defense, 2016). Unlike civilian firms, which can act quickly to shed unneeded infrastructure and reduce costs, the DOD must request congressional authorization to make such decisions. Reducing excess infrastructure is a key component of the DOD strategy to deal with continuing budget pressures and realize savings. The Base Realignment and Closure (BRAC) process provides affected communities with the added advantage of providing a “structured redevelopment process” (Department of Defense, 2016). Specifically, the DOD’s Office of Economic Adjustment provides financial assistance and technical guidance to affected communities. As future BRACs remain likely, it is important to understand better the implications of these closures and realignments on the local labor markets to support the previously mentioned structured redevelopment processes.

In this paper, we evaluate the impact of increasing or decreasing the level of DOD presence on the labor market. Specifically, we use the 2005 BRAC process, which resulted in the closure of military bases and realignment of DOD personnel, as a natural experiment from which to identify the impact on wages for men and women. We also consider the impact of the 2005 BRAC on occupational crowding. BRAC actions do not occur instantaneously and usually take several years to complete. We provide a novel dataset which captures the approximate 2005 BRAC rollout between 2006 and 2011. We use this dataset as an identification strategy for the effect of changes in DOD presence on local wages and occupational crowding.

Our analysis makes two important contributions to the literature that relates the impact DOD presences to local labor markets. First, we extend the literature by providing the evidence of heterogeneous impacts of BRAC on the wages of men and women. The existing evidence on the impact of BRAC on wages suggests that there are little to no effects on average, but analyses have not considered gender-specific effects. Secondly, because BRAC actions induce a large-scale migration of tied migrants (mostly spouses [predominately female] of military personnel [predominantly male]), our results suggests changes in DOD presence have no impact on local occupational crowding stemming from tied-migration.

We build on a growing body of literature related to the interaction of DOD presence and local labor markets. One string of this literature focuses on the impact of BRAC on employment and wages. Hooker & Knetter (2001; henceforth H&K) provided the first nationwide analysis of BRAC affected communities between 1971 and 1995.

Specific to our study, H&K find closures have no statistically significant impact on per-capita income. More recent analysis by Lee (2016) provides an analysis of the 2005 BRAC and find increases in DOD presence related to BRAC positively impacted local employment and income while decreases generated negligible impacts. As previously mentioned, this string of literature is silent on the possible heterogeneous impacts of BRAC on the wages of men and women.

The small or even negligible effect of BRAC activities on earnings in H&K and Lee (2016) are somewhat surprising given that in areas with significant military presence, on average, women have lower annual earnings and higher rates of unemployment when compared to women in nonmilitary areas (Booth, Falk, Segal, & Segal, 2000; Booth, 2003). Booth et al. (2000) further argue “the military emerges as a source of inequality in labor market outcomes for women working on or around military installations.” As a result, it seems that significant changes in military presence should impact earnings of women unless these changes are mostly offset when aggregated.

Booth (2013) argues that military presence affects the wages of women through two main channels. First, the underrepresentation of women in the military means that a large military presence brings with it a large number of unemployed military wives. This influx of military wives creates an oversupply of workers in jobs most often sought by women, and subsequently lowers wages. Booth et al. (2000) argued that a military base acts as a monopsonist in a local labor market, driving down wages. However, it may also be the case that military presence leads to occupational crowding.

The occupational crowding hypothesis is that the crowding of women into a small number of industries reduces wages for women and leads to a gender wage gap (Borjas, 2013). This crowding may stem from intentional discrimination or a result of rational choices made by women. For example, some jobs (such as cashier or retail sales associate) do not require significant investments in human capital. Other occupations, such as primary school teachers, may require skills that do not depreciate quickly during interruptions in labor force participation. However, other occupations (such as surgeon) require significant investments in human capital and the skills depreciate very quickly during interruptions in labor force participation. Women, who may expect to leave the work force to spend time in the household sector, choose occupations where skills do not depreciate quickly and that maximize the present value of lifetime earnings (Polacheck, 1981).

Duncan and Duncan (1955) provide a simple measure of occupational crowding, or occupational segregation (for example, see Macpherson and Hirsch [1995]). The Duncan index of segregation, measured as $\frac{1}{2}\sum|m_j - f_j|$, where $m_j$ is the proportion of male employment in occupation $j$ and $f_j$ corresponds to the proportion of female employment in occupation $j$. Under conditions of perfect segregation, the Duncan index equals one. The measure equals zero when the occupational distribution is equal between males and females.

Studying occupational crowding in labor markets surrounding military bases is particularly interesting due to the habitually tied migrant status of military spouses. Mincer (1978) first proposed the idea of tied migrants, or a spouse who chooses to

move to maintain family cohesion even when their “private calculus dictates they stay.” Military necessity requires regular relocations leading to what we term a habitually tied migrant status for military spouses. Under these conditions, it seems reasonable to assume that these habitually tied migrants optimize their career choices to maximize their present value of lifetime earnings as suggested above, but under the additional constraint that military necessity may require additional (and possibly frequent) interruptions and/or breaks in labor force participation.

Lim and Schulker (2010) provide evidence consistent with this view, showing that between 40 and 45 percent of military wives are not in the labor force, between 5 and 10 percent are unemployed, roughly 5 percent work part-time because full-time work is unavailable, and roughly 30 percent are underemployed. If we only consider the military wives in the labor force, roughly 60 percent are either unemployed, part-time employed involuntarily, underemployed by low income, or underemployed by educational mismatch. While dated, we provide Table 3.1, which compares military and civilian wives by occupational group from a special issue of *Monthly Labor Review* published by the US Bureau of Labor Statistics (Grossman, 1981). We are unaware of any more recent comparisons. There are noticeably fewer military wives serving in managerial and machine operative positions but more military wives serving in sales, clerical, and other services.[24]

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[24] A Chi-square Test for Homogeneity of the two distributions of occupational groups of employed wives by military or civilian status of their husbands results in a Chi-square test statistic of 25.17 with 9 degrees

**Table 3.1 – Occupational Group of Employed Wives by Military or Civilian Status of Their Husbands, March 1979 (Grossman, 1981)**

| Occupational Group | Military Wives | Civilian Wives |
|---|---|---|
| Total: Number (in thousands) | 292 | 19,570 |
| percent | 100 | 100 |
| Professional-technical | 18.2 | 18.4 |
| Managerial | 3.8 | 6.9 |
| Sales | 8.9 | 6.5 |
| Clerical | 41.8 | 36.7 |
| Crafts | 1.4 | 1.8 |
| Operatives including transport | 5.8 | 11.2 |
| Laborers | 2.4 | 1.1 |
| Private household service | 2.1 | 1.8 |
| Other service | 16.1 | 14.4 |
| Farm | 0 | 1.3 |

Women have seen a substantial decrease in occupational segregation by gender from 1970 to 2009 (Blau, Brummund, & Liu, 2013). However, institutional constraints on military wives, as evidenced by Lim and Schulker (2010), still exist. These institutional constraints may lead to continued crowding of military wives into occupations consistent with military life as shown in Grossman (1981).

Booth (2013) suggests the second channel negatively impacting wages of women is the types of jobs military presence creates in a labor market. The relatively young population of military servicemembers may result in increased demand for goods and services characteristic of this age group such as childcare, food services, and so

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of freedom which allows us to reject the null hypothesis that these two distributions are equal at the 0.01 significance level.

on. These jobs tend to employ a disproportionate number of women but also offer lower wages.

Turning to our analysis, we use county-level longitudinal wage data from the American Community Survey from 2005 to 2016 to identify the effect of BRAC shocks occurring between 2006 and 2011. The extent of changes in military presence varies considerably across counties, and further there is variation in the timing of shocks across counties. This provides a natural experiment from which to identify causal impacts on the labor market. We show decreasing DOD presence increases wages, specifically for women. Increasing DOD presence leads to decreases in median wages but we find no statistical support for either males or females bearing more of a decline in wages. More importantly, we find significant heterogeneity in median wage outcomes by gender in response to shocks associated with military personnel in particular. Increasing the number of military personnel leads to lower median wages for both men and women, for men in particular. Decreasing the number of military personnel leads to higher median wages, specifically for women. Similarly, we also find both increasing and decreasing military personnel significantly reduces the wage gap between men and women. However, the effect of decreasing military personnel on decreasing the wage gap is more than twice that of increasing military personnel and is driven by gains in wages by women. Finally, we find little evidence that suggests changes in DOD presence impacts occupational crowding.

The rest of the paper proceeds as follows. Section 3.2 describes our data and empirical framework. Section 3.3 presents estimates of the effect of BRAC on median

wages by gender, the wage gap between men and women, and occupational crowding. Section 3.4 concludes.

## 3.2 Data and Empirical Framework

### *3.2.1 Data*

We analyze the 2005 BRAC impact on local labor markets through analysis of county-level panel data. We begin by compiling data from the 2005 Defense Base Closure and Realignment Commission report (2005 Defense Base Closure and Realignment Commission, 2005). The DOD Closure and Realignment Recommendation serves as the starting point but we update these recommendations with the Commission's Final Recommendations to represent the final implementation of the 2005 BRAC.[25] We utilize the Report on 2005 Defense Base Closure and Realignment Implementation, or simply "Section 2907" reports, mandated by Congress as amended by Section 2931 of the National Defense Authorization Act for Fiscal Year 2006. Specifically, the 2006-2008, 2011, and 2013 reports informed our study with the estimated timing of BRAC actions throughout the implementation of the 2005 BRAC (see Appendix C for detailed procedures).

[25] The DOD Closure and Realignment Recommendation provided detailed personnel impacts and can be found in Appendix K of the 2005 Defense Base Closure and Realignment Commission report. The Commission's Final Recommendations provided a narrative description of amendments, sections that were deleted, and so on and can be found in Appendix O and Appendix Q of the 2005 Base Closure and Realignment Commission report. Where appropriate, these narratives were used to update the DOD recommendations in our data set.

With more than 190 recommendations and initial cost estimates of $24.6 billion, the 2005 BRAC was a complex effort affecting nearly every state, several installations overseas, and tens of thousands of military, civilian, and contractor personnel. The 2005 BRAC Commission recommendations became official on November 9, 2005 and Congress required the DOD to complete the BRAC activities by September 15, 2011. Below, we present Figure 3.1, which illustrates the change in net direct employment in each state because of the 2005 BRAC. Virginia and the District of Columbia top the list of largest declines in positions, each losing in excess of 7,000 positions that were mostly driven by a reduction in leased office space. Maryland received a large portion of those displaced by reductions in leased office space receiving nearly 9,000 positions. Texas and Georgia were also strong beneficiaries, gaining 8,151 and 4,331 positions respectively. Roughly 23 states received a net gain of 46,000 positions while 27 states received a net loss of nearly 52,000 positions.[26] In total, the 2005 BRAC reduced the number of positions in the US by roughly 6,000 positions.

Table 3.2 provides summary statistics at the installation level reported in the Final Commission Recommendations. The typical installation lost on average 13.66 total direct jobs but a median of 24 direct jobs. Fort Belvoir, VA gained the most in total direct jobs with 12,595, followed by Fort Bliss, TX with 11,501. Reductions in leased

[26] The BRAC Commission originally recommended the closure of Doble U.S. Army Reserve Center in Portmouth, New Hampshire however, the 2010 National Defense Authorization Act Section 2712 exempted this activity making New Hampshire the only state unaffected by the 2005 BRAC. For counting purposes, the District of Columbia is included as both a state and county.

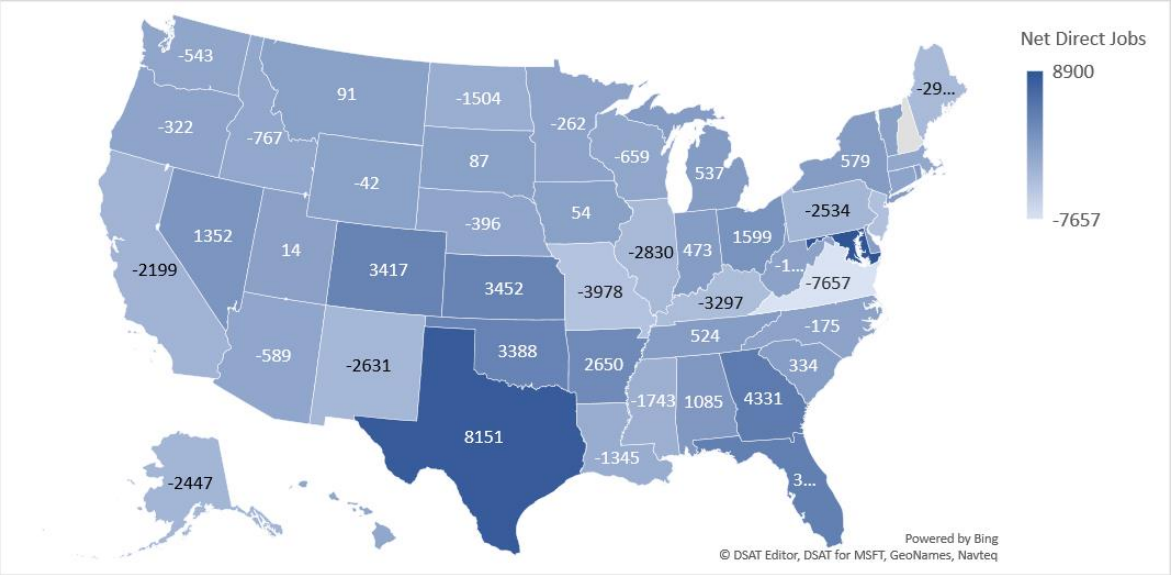


**Figure 3.1 – 2005 BRAC Net Direct Employment Change by State**

**Table 3.2 – BRAC Actions by Installation**

| | Mean | Minimum | Median | Maximum |
|---|---|---|---|---|
| Total Direct Jobs | -13.66 | -18,965 | -24 | 12,595 |
| Military | 22.38 | -4,833 | -9 | 11,354 |
| Civilian | -34.14 | -10,948 | 0 | 6,375 |
| Contractor | -1.89 | -3,985 | 0 | 2,058 |

office space in Virginia represented the largest declines in total direct jobs totaling nearly 19,000 positions. Contractor positions represented the smallest change across the three employee types.

With insights gained from the Section 2907 reports, we provide Figure 3.2, which presents the number of positive and negative BRAC actions taken through time. We see no activity in 2005 consistent with the BRAC authorization becoming law in November 2005. Due to the complexities of the 2005 BRAC many of the actions were deferred until late in the timeframe Congress authorized for BRAC activity. We see the first significant activity in 2007, relatively little change from 2008 to 2009, and a large surge of activity from 2010 to the end of BRAC in 2011. On average, non-zero positive BRAC actions represent roughly 0.60% of the 2005 county total workforce while non-zero negative BRAC actions represent 0.41% of the 2005 county total workforce.

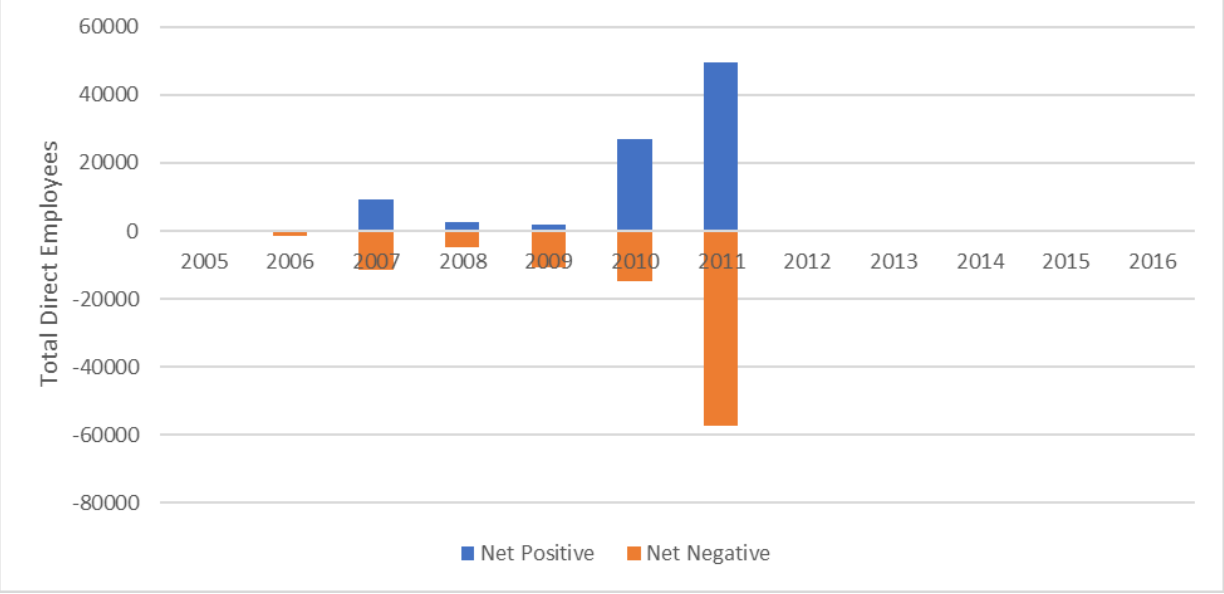


**Figure 3.2 – BRAC Actions Over Time**

We place the 2005 BRAC actions in the context of the 2005-2016 American Community Survey (ACS) data from the Census Bureau. We focus on the ACS 1-year estimates report ID S2401 (full/part-time) which provides the median earnings in the past 12 months, employment, and occupation type for all employed civilians 16 years of age or older by gender. Our initial count of US counties directly impacted by the 2005 BRAC totals 450. The ACS data is limited to counties with populations greater than 65,000 people. As a result, the number of counties directly impacted by the 2005 BRAC in our dataset is reduced by 47 counties to 403 counties. To provide counterfactuals and to control for aggregate trends, we include all counties reported in the ACS database resulting in a universe of counties totaling 775 in 2005 but due to continued population growth the universe of counties totals 820 counties by 2016. In total, we have 9,633 county-year observations. For more detailed information on data sources and variable definitions, we refer the readers to the Appendix C.

### *3.2.2 Method of Analysis*

In this paper, we look to understand the impact of BRAC on earnings by gender. Therefore, our outcome variable of interest is income by gender. As the shock, i.e. the change in military personnel within a county, is heterogeneous, we define the shock in terms of a percentage of the total year 2005 county workforce. Several counties experienced multiple shocks over time, and our specification accounts for both short-run and accumulated impacts. To control for unobserved county-specific factors (such as education and experience and of the workforce), and aggregate time-varying changes in the U.S. labor market, we include both county and year fixed effects. Formally, our model is:

$$\ln(y_{it}) = \beta_0 + \beta_1 Shock_{it}^{+} + \beta_2 Shock_{it}^{-} + \beta_3 Shock\_History_{it-1}^{+}$$
$$+\beta_4 Shock\_History_{it-1}^{-} + c_i + \theta_t + u_{it}$$

where $y_{it}$ typically represents median wages in county $i$ in year $t$; $Shock_{it}$ represents the level of the BRAC shock as a percentage of the total workforce in 2005 in county $i$, in year $t$; $Shock\_History_{it-1}$ represents the sum of shocks across prior years; and $c_i$ and $\theta_t$ are county and year fixed effects. A positive superscript on the $Shock_{it}$ and $Shock\_History_{it-1}$ variables indicates a positive shock (an increase in DOD presence) while a negative superscript indicates a negative shock (a decrease in DOD presence). However, in our analysis, we take the absolute value of the negative shocks making the interpretation of the $\beta$ coefficients more straightforward. Specifically, a positive coefficient associated with negative shocks tells us that larger negative shocks increase wages. Similarly, a negative coefficient tells us that negative shocks decrease wages. This specification allows us to estimate the effect of the contemporaneous BRAC shock while also accounting for a one period lag of the cumulative shocks from prior years ($Shock\_History_{it-1}$), or the BRAC shock "history." Other models reported later in this paper break the variable $Shock_{it}$ and $Shock\_History_{it-1}$ into its component parts of Military, Civilian, and Contractor employee types to estimate the effect of employee type on median wages. We also calculate the wage gap between men and women by subtracting the log median wages for women from the log median wages of men in each county in each year. We cluster our standard errors at the county level for all models.

Prior analysis related to BRAC actions on local labor markets (e.g. H&K; Lee, 2016) focuses on estimating employment and per capita income multipliers. Our

research question differs in that we focus on the possibility of heterogenous wage impacts for men and women. Additionally, our dataset includes the approximate roll-out schedule of the 2005 BRAC which provides more depth to the dataset than previously available. Given the rich dataset we have produced, we use a series of fixed effects regression models to isolate the effect of BRAC shocks on median wages. This approach allows us to consider dynamic relationships within the dataset, control for unobserved cross section heterogeneity, and maximize the utilization of available information within the dataset.

### *3.2.3 Descriptive Statistics*

Table 3.3 defines our dependent and independent variables used throughout our analysis and provides descriptive statistics. There is a sizeable difference between the average median wages of men and women of roughly $12,000. However, we see some instances where the median wages for women exceeds that of men represented by a negative wage gap. On average, and across all counties, positive BRAC shocks represent roughly 0.008% of the 2005 total workforce while negative BRAC shocks represent 0.009% of the 2005 total workforce. As might be expected, Military Shocks make up the majority of the positive and negative shocks by employee type.

**Table 3.3 – Descriptive Statistics Dependent and Independent variables**

| Variable Name | Description | Obs | Mean | S.D. | Min | Max |
|---|---|---|---|---|---|---|
| Dependent Variables | | | | | | |
| Overall Median Earnings | Overall (both men and women) median earnings in the past 12 months for civilian employed population 16 years and over (both full-/part-time) by county by year | 9,633 | $32,035 | $6,313 | $15,589 | $71,838 |
| Median Earnings for Men | Median earnings in the past 12 months for male civilian employed population 16 years and over (both full-/part-time) by county by year | 9,633 | $38,546 | $7,994 | $18,191 | $86,285 |
| Median Earnings for Women | Median earnings in the past 12 months for female civilian employed population 16 years and over (both full-/part-time) by county by year | 9,633 | $26,371 | $5,480 | $11,729 | $65,730 |
| Wage Gap | The difference between male and female median earnings by county by year | 9,633 | $12,175 | $4,845 | -$3,862 | $40,506 |
| Duncan Index | Measures the degree of occupational segregation by gender by county by year. A value of 0 represent complete gender integration while a value of 100 is complete gender segregation. | 9,504 | 30.65 | 7.59 | 6.87 | 61.27 |

| | | Non-Zero Sample | | | | | Full Sample | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variables | | Obs | Mean | S.D | Min | Max | Obs | Mean | S.D. | Min | Max |
| $Shock^{+}$ | Pos values (additions) of military, civilian, & DOD contractors | 121 | 0.6016 | 1.7011 | 0.0012 | 14.7427 | 9,280 | 0.0078 | 0.2051 | 0 | 14.7427 |
| $Shock^{-}$ | Neg values (loss) of military, civilian, & DOD contractors | 213 | 0.4068 | 1.1787 | 0.0001 | 8.6521 | 9,279 | 0.0093 | 0.1883 | 0 | 8.6521 |
| $Military^{+}$ | Pos values (additions) of military personnel | 96 | 0.5144 | 1.7366 | 0.0003 | 13.8241 | 9,280 | 0.0053 | 0.1833 | 0 | 13.8241 |
| $Military^{-}$ | Neg values (loss) of military personnel | 201 | 0.3003 | 1.1334 | 0.0004 | 11.9534 | 9,279 | 0.0065 | 0.1721 | 0 | 11.9534 |
| $Civilian^{+}$ | Pos values (additions) of civilian personnel | 115 | 0.2668 | 0.7445 | 0.0002 | 5.0647 | 9,280 | 0.0033 | 0.0876 | 0 | 5.0647 |
| $Civilian^{-}$ | Neg values (loss) of civilian personnel | 161 | 0.2141 | 0.5815 | 0.0001 | 4.8935 | 9,279 | 0.0037 | 0.0813 | 0 | 4.8935 |
| $Contractor^{+}$ | Pos values (additions) of DOD contractor personnel | 24 | 0.3508 | 0.7240 | 0.0001 | 3.3690 | 9,280 | 0.0009 | 0.0402 | 0 | 3.3690 |
| $Contractor^{-}$ | Neg values (loss) of DOD contractor personnel | 60 | 0.1251 | 0.2683 | 0.0001 | 1.3377 | 9,280 | 0.0008 | 0.0236 | 0 | 1.3377 |
| $Shock\_History^{+}$ | Pos cumulative value of military, civilian &DOD contractors | 488 | 0.7866 | 1.8854 | 0.0014 | 14.5634 | 8,506 | 0.0451 | 0.4868 | 0 | 14.5634 |
| $Shock\_History^{-}$ | Neg cumulative value of military, civilian &DOD contractors | 986 | 0.5086 | 1.7102 | 0.0001 | 17.5227 | 8,498 | 0.0590 | 0.6047 | 0 | 17.5227 |
| $Military\_History^{+}$ | Pos cumulative value of military personnel | 358 | 0.7424 | 2.0097 | 0.0003 | 13.6478 | 8,506 | 0.0312 | 0.4379 | 0 | 13.6478 |
| $Military\_History^{-}$ | Neg cumulative value of military personnel | 989 | 0.3377 | 1.1932 | 0.0005 | 11.9534 | 8,498 | 0.0393 | 0.4210 | 0 | 11.9534 |
| $Civilian\_History^{+}$ | Pos cumulative value of civilian history | 462 | 0.3500 | 0.8145 | 0.0005 | 5.0647 | 8,506 | 0.0190 | 0.2056 | 0 | 5.0647 |
| $Civilian\_History^{-}$ | Neg cumulative value of civilian history | 752 | 0.2747 | 0.9681 | 0.0001 | 9.9360 | 8,498 | 0.0243 | 0.2982 | 0 | 9.9360 |
| $Contractor\_History^{+}$ | Pos cumulative value of contractor history | 120 | 0.3548 | 0.7096 | 0.0003 | 3.3690 | 8,506 | 0.0050 | 0.0938 | 0 | 3.3690 |
| $Contractor\_History^{-}$ | Neg cumulative value of contractor history | 308 | 0.1532 | 0.4949 | 0.0001 | 3.4915 | 8,506 | 0.0055 | 0.0983 | 0 | 3.4915 |

## 3.3 Results

### *3.3.1 2005 BRAC Impact on Median Wages*

Table 3.4 reports results from our simplest specification, which includes the instantaneous asymmetric shocks, lagged cumulative asymmetric shocks, as well as county and year fixed effects. The dependent variables in these three specifications are the log of median wages overall, median wages for men, and median wages for women. For the "overall" model, increasing the level of DOD presence by one percentage point relative to the county's 2005 total employment (instantaneous positive shock, $Shock^{+}$) decreases the overall median wage by 0.50%. This effect is statistically significant at the 1% significance level. A decrease in DOD presence by one percentage point relative to the county's 2005 total employment (instantaneous negative shock, $Shock^{-}$) increases the overall median wage by a statistically insignificant 0.49%. Similarly, increasing the lagged cumulative shock of DOD presence increase by one percentage point relative to the county's 2005 total employment (lagged cumulative positive shock, $Shock\_History_{t-1}^{+}$) decreases wages by a statistically insignificant 0.36%. Finally, increasing in magnitude the lagged cumulative shock of DOD presence decrease by one percentage point relative to the county's 2005 total employment (lagged cumulative negative shock, $Shock\_History_{t-1}^{-}$) increases wages by 0.80% which is statistically significant at the 0.10 significance level. Columns two and three are interpreted in a similar manner except these columns represent the effect of BRAC shocks on gender-specific median wages.

**Table 3.4 – BRAC Shocks in Levels with Lagged Shock History on Median Wages**

| Dependent Variable: Log of Median Wages | | | | |
|---|---|---|---|---|
| | Overall | Male | Female | $H_0$: Male = Female |
| Regressor | (1) | (2) | (3) | (4) |
| $Shock^+$ | -0.00498*** | -0.00705*** | -0.00498** | 0.76 |
| | (0.00192) | (0.0023) | (0.00206) | |
| $Shock^-$ | 0.00486 | 0.0005 | 0.00957 | 4.53** |
| | (0.007) | (0.00598) | (0.00741) | |
| $Shock.H_{t-1}^+$ | -0.00364 | -0.00591** | -0.00342 | 0.86 |
| | (0.00278) | (0.00268) | (0.00334) | |
| $Shock.H_{t-1}^-$ | 0.00804* | 0.00447 | 0.00835** | 2.94* |
| | (0.00432) | (0.00406) | (0.00367) | |
| N | 8,496 | 8,496 | 8,496 | 8,496 |
| County Fixed Effects | Yes | | | |
| Time Fixed Effects | Yes | | | |

Notes: The dependent variable is measured by the log of the county's median wage (overall, male, and female). The regressor variables are expressed as percentages of total county employment in 2005. Standard errors are listed in parentheses and are clustered at the county level. Hypothesis testing in column 4 is a test for equality of coefficients across models estimaing the effects of BRAC shocks on male wages and female wages respectively. *,**, and *** represent statistical significance at the 10, 5, and 1% levels respectively.

To test for differences in coefficients across gender-specific models, we need an estimator for the covariance between the two models, which of course rely on the same covariates. To facilitate this, we use the seemingly unrelated estimation framework (Weesie, 1999). The BRAC shocks occur at the county level and we naturally expect correlation between wage observations within a county. That is, male and female labor markets are dependent. We therefore maintain clustering of standard errors at the county level when computing the covariance matrix. Robust F-statistics are provided in the last column of Table 3.4.

We fail to reject the null hypothesis that positive instantaneous or positive lagged cumulative shocks impact men and women differently. However, we can reject the null hypothesis that negative instantaneous shocks impact men and women equally at the 5% significance level. Similarly, we can reject the null hypothesis that lagged negative shock history impact median wages for men and women equally at the 0.10 significance level.

**Result 1.** Decreases in overall DOD presence, both in terms of contemporaneous and lagged cumulative decreases, increases median wages for women more than men.

There are a few possible explanations for heterogeneous effects by gender on wages. Increasing DOD presence may increase the proportion of lower-paying service sector occupations such as food service, childcare, and cashiers, lowering earnings for men and women. Similarly, decreasing DOD presence may decrease the proportion of lower-paying service sector occupations but also potentially decreases the number of habitually tied migrants (predominantly women due to the proportion of men in military service) associated with military presence, thus increasing median wages for women who remain relative to men. To understand better this possibility, we now turn to our results of the effect of BRAC shocks by employee type.

Table 3.5 reports the effects of the 2005 BRAC shocks by employee type and lagged cumulative shocks by employee type on median wages. We find fairly consistent patterns with Table 3.4 in that positive shocks tend to decrease wages while negative shocks tend to increase wages. Interpreting the magnitudes of these shocks require some additional care. The reported coefficients have the usual interpretation in that they represent a one-percentage point increase in the respective shocks relative to the 2005 total workforce. However, from Table 3.3 we see that this level of shock may be rare. For example, a one percentage point increase in magnitude for the level of shock related to decreases in DOD contractor presence ($Contractor^{-}$) represents nearly four standard deviations when we consider only non-zero BRAC action sample. Additionally,

**Table 3.5 – BRAC Shocks in Levels by Employee Type with Lagged Shock History on Median Wage**

| Dependent Variable: Log of Median Wages | | | | |
|---|---|---|---|---|
| Regressor | Overall (1) | Male (2) | Female (3) | $H_0$: Male = Female (4) |
| $Military^+$ | -0.00464* | -0.00744** | -0.00338* | 4.14** |
| | (0.0027) | (0.00301) | (0.00204) | |
| $Military^-$ | 0.00573 | -0.00196 | 0.01577 | 13.91*** |
| | (0.00978) | (0.00797) | (0.00978) | |
| $Civilian^+$ | -0.01384 | -0.00518 | -0.01838 | 1.49 |
| | (0.02215) | (0.01703) | (0.01981) | |
| $Civilian^-$ | 0.00374 | 0.00960 | 0.01105 | 0.00 |
| | (0.01071) | (0.01712) | (0.01864) | |
| $Contractor^+$ | -0.00704 | -0.00877 | -0.02738 | 1.28 |
| | (0.02584) | (0.02557) | (0.02150) | |
| $Contractor^-$ | -0.00885 | -0.01431 | -0.08030 | 0.46 |
| | (0.04323) | (0.07117) | (0.05571) | |
| $Military.H_{t-1}^+$ | -0.00349 | -0.00640** | -0.00234 | 1.20 |
| | (0.00294) | (0.00311) | (0.00378) | |
| $Military.H_{t-1}^-$ | 0.01293** | 0.00877 | 0.01325** | 1.14 |
| | (0.00651) | (0.00603) | (0.00581) | |
| $Civilian.H_{t-1}^+$ | -0.02755** | -0.02940* | -0.02374* | 0.14 |
| | (0.01359) | (0.01530) | (0.01218) | |
| $Civilian.H_{t-1}^-$ | 0.00018 | -0.00026 | -0.00518 | 0.08 |
| | (0.01422) | (0.01810) | (0.00732) | |
| $Contractor.H_{t-1}^+$ | 0.03458** | 0.04556** | 0.01333 | 3.04* |
| | (0.01719) | (0.021360) | (0.01857) | |
| $Contractor.H_{t-1}^-$ | 0.00745 | 0.00244 | 0.02096 | 0.14 |
| | (0.03686) | (0.04826) | (0.02415) | |
| N | 8,496 | 8,496 | 8,496 | 8,496 |
| County Fixed Effects | | Yes | | |
| Time Fixed Effects | | Yes | | |

Notes: The dependent variable is measured by the log of the county's median wage (overall, male, and female). The regressor variables are expressed as percentages of total county employment in 2005.Standard errors are listed in parentheses and they are clustered at the county level. Hypothesis testing in column 4 is a test for equality of coefficients across models estimaing the effects of BRAC shocks on male wages and female wages respectively. *,**, and *** represent statistical significance at the 10, 5, and 1% levels respectively.

shocks related to increases in DOD contractor presence may suffer from data paucity with only 24 observations. With these limitations in mind, we focus primarily on the estimates related to Military and Civilian shocks.

Turning first to the results of instantaneous shocks, we find that increases in military presence lead to statistically significant decreases in the overall median wage of 0.46%. While the median wages for men and women fall, an increase in military personnel decreases wages doubly for men relative to women. This is confirmed by our hypothesis test in which we reject the null hypothesis that the effect of military increases equally impact men and women median wages at the 5% significance level. While the effect of decreasing military personnel is not statistically significant, we see the point estimates for the effect of decreases in military personnel have the opposite signs. Specifically, the point estimate for decreasing military personnel, though not statistically significant, points to slight decreases in median wages for men while increasing median wages for women. We find strong support for heterogeneous effects of decreasing military personnel on the wages of men and women at the 1% significance level.

**Result 2.** (1) Increases of military personnel reduce the median earnings for both men and women but more so for men. (2) The point estimate for decreases of military personnel, while not statistically significant, provides suggestive evidence of median wages for women increasing while decreasing for men.

When we consider the results associated with cumulative shocks, we find the point estimate for decreasing military personnel points to persistent gains in median wages for women. However, statistical tests no longer support heterogeneous effects between men and women for decreases in military presence. This suggests there is a more immediate impact of removing tied migrants associated with military personnel,

while the cumulative effect of removing military personnel may represent a reduction in lower paid service related jobs and replacing the lower paid tied migrants lost by reducing military personnel at higher wages.

Finally, we see sizable differences in the effect of increasing DOD civilian personnel when compared with increasing military personnel. One possible explanation for this centers on benefits extended to military personnel which are not currently available to civilian personnel. On nearly every military installation, military personnel and their dependents can shop tax free for common goods and services at stores provided by the Army and Air Force Exchange Service or Navy Exchange. Groceries are also provided tax free through the Defense Commissary Agency. Military personnel can choose to shop on the military installation while DOD civilians cannot. From this, increasing DOD civilian personnel may increase the proportion of lower-paying service related occupations in the local economy at a higher rate than increasing military personnel, explaining the larger relative effect.

To gain further insight into the heterogeneity of the 2005 BRAC shocks on wages for men and women, we turn our attention to the effect of these shocks on the wage gap. In Table 3.6, present regressions that use the variable Wage Gap, defined as the difference between log median wages for men and for women. We find negative instantaneous shocks decrease the wage gap by roughly 0.91%, an effect that is statistically different from zero at the 5% significance level. Neither a positive instantaneous shock nor lagged cumulative shocks (in either direction) have significant impacts on the wage gap between men and women. However, as has been shown in

Table 3.5, the employee type may have large heterogeneous impacts on wages by gender, particularly shocks associated with military personnel.

**Table 3.6 – BRAC Shocks in Levels with Lagged Shock History on Wage Gap**

| Dependent Variable: Wage Gap | |
|---|---|
| Regressor | |
| $Shock^{+}$ | -0.0021 (0.0025) |
| $Shock^{-}$ | -0.0091 (0.0045)** |
| $Shock.H_{t-1}^{+}$ | -0.0025 (0.0028) |
| $Shock.H_{t-1}^{-}$ | -0.0039 (0.0024) |
| N | 8,496 |
| County Fixed Effects | Yes |
| Time Fixed Effects | Yes |

Notes: The dependent variable is measured by subtracting the log of median wages for women from the log of median wages from men in each county in each year. The regressor variables are expressed as percentages of total county employment in 2005. Standard errors are listed in parentheses and they are clustered at the county level. *, **, and *** represent statistical significance at the 10, 5, and 1% levels respectively.

In Table 3.7, we present our regression results for the effect of instantaneous shocks by employee type and lagged cumulative shocks by employee type on the wage gap. We see that the coefficient associated with instantaneous military personnel shocks (in either direction) both decrease the wage gap in a statistically significant way. Increasing military personnel by 1 percent relative to the 2005 total workforce leads to a decrease in the wage gap of roughly 0.41%. This estimate is weakly significant. Similarly, decreasing the level of military personnel by 1 percentage point decreases the wage gap by a more precise 1.77% which is significant beyond the 1% level. It may seem unusual that both increasing and decreasing military personnel decreases the wage gap. However, these decreases may result from different mechanisms. From Table 3.5, we found increases in military personnel leads to decreases in wages for both men and women but more so for men. Potentially as a result of increased demand for lower wage service and retail jobs which may lead to a closing of the wage gap as

seen in Table 3.6. However, increasing in magnitude the size of decreases in military personnel leads to increases in wages for women both when we consider the instantaneous shock and lagged cumulative shock. Men's wages are statistically unchanged. This may point to a decreased supply of tied migrants associated with the military workforce as well as less demand for lower paying service and retail occupations. An increase in women's wages while holding men's wages relatively constant again leads to a closing of the wage gap. We view these results as further evidence for heterogeneous impacts on wages for men and women from the 2005 BRAC.

**Result 3.** Both increases and decreases in military personnel decrease the wage gap, which we speculate occurs through different mechanisms.

**Table 3.7 – BRAC Shocks in Levels by Employee Type with Lagged Shock History on Wage Gap**

| Dependent Variable: Wage Gap | |
|---|---|
| Regressor | |
| $Military^{+}$ | -0.0041 (0.0021)* |
| $Military^{-}$ | -0.0177 (0.0050)*** |
| $Civilian^{+}$ | 0.0132 (0.0114) |
| $Civilian^{-}$ | -0.0015 (0.0286) |
| $Contractor^{+}$ | 0.0186 (0.0173) |
| $Contractor^{-}$ | 0.0660 (0.1018) |
| $Military.H_{t-1}^{+}$ | -0.0041 (0.0039) |
| $Military.H_{t-1}^{-}$ | -0.0045 (0.0044) |
| $Civilian.H_{t-1}^{+}$ | -0.0057 (0.0158) |
| $Civilian.H_{t-1}^{-}$ | 0.0049 (0.0182) |
| $Contractor.H_{t-1}^{+}$ | 0.0322 (0.0194)* |
| $Contractor.H_{t-1}^{-}$ | -0.0185 (0.0513) |
| N | 8,496 |
| County Fixed Effects | Yes |
| Time Fixed Effects | Yes |

Notes: The dependent variable is measured by subtracting the log of median wages for women from the log of median wages from men in each county in each year. The regressor variables are expressed as percentages of total county employment in 2005. Standard errors are listed in parentheses and they are clustered at the county level. *,**, and *** represent statistical significance at the 10, 5, and 1% levels respectively.

In nearly every specification provided above, we find at a minimum suggestive evidence of heterogeneous impacts of BRAC shocks on wages by gender. In particular, decreasing military personnel leads to increases in median wages but these increases are almost completely driven by gains in wages by women. Similarly, in our preferred specification estimating the impact of BRAC actions by employee type on the wage gap (reported in Table 3.7), we find strong statistical evidence that decreasing military presence leads to a large decrease in the wage gap. This decrease is more than twice the decrease in the wage gap associated with increasing the presence of military personnel.

### *3.3.2 2005 BRAC Impact on Occupational Crowding*

The next issue we address is whether shocks related to the 2005 BRAC had any impact on occupational crowding, which can also place downward pressure on wages for women. As previously discussed, we use the Duncan Index of Occupational Dissimilarity, which measures the proportion of women (or men) that would have to change occupations to find a state of equality. We have scaled these such that a value of 100 indicates a completely gender segregated county while a value of 0 indicates complete gender balance. Table 3.4, summarized data concerning occupational crowding. Due to missing employment information, we have 129 fewer county-year observations than our wage analysis data. In our dataset, a typical county has a Duncan Index of 30.65.

Table 3.8 reports results from our regression on the effects of BRAC shocks by employee type on occupational crowding.[27] We see the 2005 BRAC had little to no effect on occupational crowding. Only increases in DOD Contractor presence has any statistical significance. However, as previously discussed, we observe only a handful of positive DOD Contractor shocks. Additionally, this change represents roughly one-fourth of one standard deviation a relatively small change. A lack of statistical significance for shocks by employee type may point to further support for the role of reducing tied migrants associated with military personnel. Given BRAC shocks have minimal impact on occupational crowding, large changes in wages for women may result more directly from substituting lower paid tied migrants with higher waged women.

**Result 4.** The 2005 BRAC generated no economic or statistically meaningful impacts on occupational crowding.

## 3.4 Conclusion

In this paper, we present evidence which suggest DOD presence does not induce inequality between men and women in the workforce per se. Instead, we find a more nuanced structural issue inherent to military presence, the tied migrant problem. These tied migrants suffer from earnings penalties and human capital accumulation limitations (Burke & Miller, 2017). Reducing military presence then reduces these tied

[27] We estimated but do not report the effect of changes in general DOD presence. We find neither instantaneous shocks (in either direction) nor lagged cumulative shocks (in either direction) have significant impacts on occupational crowding.

**Table 3.8 – BRAC Shocks in Levels by Employee Type with Lagged Shock History on Duncan Index**

| Dependent Variable: Duncan Index | |
|---|---|
| Regressor | |
| $Military^{+}$ | -0.12256 |
| | (0.21395) |
| $Military^{-}$ | -0.18939 |
| | (0.24502) |
| $Civilian^{+}$ | 0.13935 |
| | (0.53281) |
| $Civilian^{-}$ | -0.85105 |
| | (0.74528) |
| $Contractor^{+}$ | 1.89601*** |
| | (0.62349) |
| $Contractor^{-}$ | 2.48151 |
| | (1.86613) |
| $Military.H_{t-1}^{+}$ | 0.03599 |
| | (0.07582) |
| $Military.H_{t-1}^{-}$ | 0.20228 |
| | (0.20297) |
| $Civilian.H_{t-1}^{+}$ | -0.37201 |
| | (0.46624) |
| $Civilian.H_{t-1}^{-}$ | -0.46600 |
| | (0.44657) |
| $Contractor.H_{t-1}^{+}$ | 0.94470 |
| | (0.67750) |
| $Contractor.H_{t-1}^{-}$ | 1.00913 |
| | (1.30313) |
| N | 8,428 |
| County Fixed Effects | Yes |
| Time Fixed Effects | Yes |

Notes: The dependent variable is measured by calculating the Duncan Index for Occupational Dissimilarity in each county in each year. The regressor variables are expressed as percentages of total county employment in 2005. We include controls for county and year fixed effects. Standard errors are listed in parentheses and they are clustered at the county level. *,**, and *** represent statistical significance at the 10, 5, and 1% levels respectively.

migrants throughout the local workforce and results in a statistically significant closing of the wage gap between men and women.

We also find statistically significant heterogeneous impacts on wages when both increasing and decreasing military presence. For example, the point estimate for the effect of decreasing military personnel on wages for women is eight times in magnitude that of the effect on men. We find little support for the claim that changes in DOD presence effect occupational crowding.

Recent programs established by the DOD to increase the participation of military spouses in highly mobile private sector careers may have positive externalities (Military Spouse Employment Partnership, 2014). For example, if these programs lead to spouses filling a wider variety of occupations or taking remote working opportunities in large numbers, this may potentially mitigate the wage penalty and human capital limitations highlighted by Burk & Miller (2017). Widespread participation in the Military Spouse Employment Partnership may attenuate effects of future changes in military personnel presence.

Under continued budgetary pressure and force restructuring the DOD has and will continue to request BRAC authorizations from Congress to right-size their infrastructure and minimize costs. The DOD has worked closely with affected communities to minimize adverse effects of closing military installations by providing both financial and technical support as communities look to repurpose these assets. While this paper focused on the heterogeneous impacts of changes in DOD presence on wages and occupational crowding, there are still opportunities to extend this

research. For example, recent attention has been placed on the role the military has on closing racial homeownership gaps in local communities (see DePillis, 2018). Advancing our knowledge about the role of DOD presence in local economies is critical as the DOD continues to face future budget pressure and force restructuring.

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# APPENDIX

## Appendix (A). Decision tasks and Observed Group Outcomes

*E&S Series 1* –This setting is characterized by a "middle income" individual choosing payoffs for a "high income" individual and a "low income" individual. The "middle income" individual is provided with the same payoff across the three allocations to remove selfish motives.

We have arranged the allocations so that Player 3, in our design, is the "middle income" individual. In decision task F and Fx, efficiency coincides with maximin preferences. While in treatments in E and Ex, efficiency and maximin are separated into two different choices. We present the predicted decisions using self-interest, efficiency, and maximin. Additionally, we present the allocations for decision tasks F, E, Fx, and Ex below (all payoffs are denominated in US dollars). We also present the totals, averages of Player 1 and Player 2's payoffs, Player 3's payoff relative to the total for each of the respective choices, and the group decisions made using the procedures outlined in our experimental design section.

| Taxation Games (E&S Series 1) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F (E&S1.1) | | | E (E&S1.2) | | | Fx (E&S1.3) | | | Ex (E&S1.4) | | |
| | A | B | C | A | B | C | A | B | C | A | B | C |
| Player 3 | 2.8 | 2.8 | 2.8 | 3.2 | 3.2 | 3.2 | 5 | 5 | 5 | 6 | 6 | 6 |
| Player 2 | 4.1 | 4.4 | 4.7 | 4.7 | 4.2 | 3.7 | 8.5 | 9 | 9.5 | 10.5 | 8.5 | 6.5 |
| Player 1 | 2.3 | 1.8 | 1.3 | 1.3 | 1.6 | 1.9 | 4.5 | 2.5 | 0.5 | 1.5 | 2 | 2.5 |
| Total | 9.2 | 9 | 8.8 | 9.2 | 9 | 8.8 | 18 | 16.5 | 15 | 18 | 16.5 | 15 |
| Average 1, 2 | 3.2 | 3.1 | 3 | 3 | 2.9 | 2.8 | 6.5 | 5.75 | 5 | 6 | 5.25 | 4.5 |
| Relative 3 to total | 0.304 | 0.311 | 0.318 | 0.348 | 0.356 | 0.364 | 0.278 | 0.303 | 0.333 | 0.333 | 0.364 | 0.400 |
| Predictions | | | | | | | | | | | | |
| Selfish | A | B | C | A | B | C | A | B | C | A | B | C |
| Efficiency | A | | | A | | | A | | | A | | |
| Maximin | A | | | | | C | A | | | | | C |
| Choices (Count) | | | | | | | | | | | | |
| T1 - Engineering Model | 10 | 1 | 2 | 2 | 3 | 8 | 11 | 2 | 0 | 4 | 2 | 7 |
| T2 - Flat Bureaucracy | 12 | 1 | 0 | 1 | 4 | 8 | 13 | 0 | 0 | 2 | 2 | 9 |
| T3 - Tall Bureaucracy | 13 | 1 | 0 | 1 | 6 | 7 | 14 | 0 | 0 | 2 | 5 | 7 |
| T4 - Autocracy | 13 | 1 | 0 | 3 | 3 | 8 | 14 | 0 | 0 | 4 | 3 | 7 |
| Total | 48 | 4 | 2 | 7 | 16 | 31 | 52 | 2 | 0 | 12 | 12 | 30 |
| E&S (Count) | 57 | 7 | 4 | 27 | 16 | 25 | 26 | 2 | 2 | 12 | 5 | 13 |
| Choices (Percentage) | | | | | | | | | | | | |
| T1 | 76.9 | 7.7 | 15.4 | 15.4 | 23.1 | 61.5 | 84.6 | 15.4 | 0.0 | 30.8 | 15.4 | 53.8 |
| T2 | 92.3 | 7.7 | 0.0 | 7.7 | 30.8 | 61.5 | 100.0 | 0.0 | 0.0 | 15.4 | 15.4 | 69.2 |
| T3 | 92.9 | 7.1 | 0.0 | 7.1 | 42.9 | 50.0 | 100.0 | 0.0 | 0.0 | 14.3 | 35.7 | 50.0 |
| T4 | 92.9 | 7.1 | 0.0 | 21.4 | 21.4 | 57.1 | 100.0 | 0.0 | 0.0 | 28.6 | 21.4 | 50.0 |
| Total | 88.9 | 7.4 | 3.7 | 13.0 | 29.6 | 57.4 | 96.3 | 3.7 | 0.0 | 22.2 | 22.2 | 55.6 |
| E&S (Percentage) | 83.8 | 10.3 | 5.9 | 39.7 | 23.5 | 36.8 | 86.7 | 6.7 | 6.7 | 40.0 | 16.7 | 43.3 |

*E&S Series 2* – The envy games are characterized by the ability of the "middle income" individual to reduce the payoff available to the "high income" individuals by simultaneously reducing the payoff available to "low income" individuals. In decision task N, the payoff to the "middle income" individual, Player 3, is kept constant across the three available options. However, in decision tasks Nx, Ny, and Nyi, E&S introduce a selfish motive by providing different payoffs to Player 3 across the three available options. This variation provides insight to the tradeoff individuals are willing to make between selfish concerns or efficiency concerns and maximin preferences.

| Envy Games (E&S Series 2) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N (E&S2.1) | | | Nx (E&S2.2) | | | Ny (E&S2.3) | | | Nyi (E&S2.4) | | |
| | A | B | C | A | B | C | A | B | C | A | B | C |
| Player 3 | 4 | 4 | 4 | 4.5 | 4 | 3.5 | 3.5 | 4 | 4.5 | 3.75 | 4 | 4.25 |
| Player 2 | 8 | 6.5 | 5 | 8 | 6.5 | 5 | 8 | 6.5 | 5 | 8 | 6.5 | 5 |
| Player 1 | 2.5 | 1.5 | 0.5 | 2.5 | 1.5 | 0.5 | 2.5 | 1.5 | 0.5 | 2.5 | 1.5 | 0.5 |
| Total | 14.5 | 12 | 9.5 | 15 | 12 | 9 | 14 | 12 | 10 | 14.25 | 12 | 9.75 |
| Average 1, 2 | 5.25 | 4 | 2.75 | 5.25 | 4 | 2.75 | 5.25 | 4 | 2.75 | 5.25 | 4 | 2.75 |
| Relative 3 to total | 0.276 | 0.333 | 0.421 | 0.300 | 0.333 | 0.389 | 0.250 | 0.333 | 0.450 | 0.263 | 0.333 | 0.436 |
| Predictions | | | | | | | | | | | | |
| Selfish | A | B | C | A | | | | | C | | | C |
| Efficiency | A | | | A | | | A | | | A | | |
| Maximin | A | | | A | | | A | | | A | | |
| Choices | | | | | | | | | | | | |
| T1 - Engineering Model | 10 | 1 | 2 | 11 | 2 | 0 | 9 | 2 | 2 | 10 | 3 | 0 |
| T2 - Flat Bureaucracy | 13 | 0 | 0 | 13 | 0 | 0 | 6 | 6 | 1 | 8 | 5 | 0 |
| T3 - Tall Bureaucracy | 13 | 1 | 0 | 14 | 0 | 0 | 3 | 5 | 6 | 1 | 8 | 5 |
| T4 - Autocracy | 12 | 0 | 2 | 14 | 0 | 0 | 4 | 3 | 7 | 6 | 2 | 6 |
| Total | 48 | 2 | 4 | 52 | 2 | 0 | 22 | 16 | 16 | 25 | 18 | 11 |
| E&S (Count) | 21 | 8 | 1 | 25 | 5 | 1 | 23 | 4 | 3 | 18 | 5 | 7 |
| Choices (Percentage) | | | | | | | | | | | | |
| T1 | 76.9 | 7.7 | 15.4 | 84.6 | 15.4 | 0.0 | 69.2 | 15.4 | 15.4 | 76.9 | 23.1 | 0.0 |
| T2 | 100.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 46.2 | 46.2 | 7.7 | 61.5 | 38.5 | 0.0 |
| T3 | 92.9 | 7.1 | 0.0 | 100.0 | 0.0 | 0.0 | 21.4 | 35.7 | 42.9 | 7.1 | 57.1 | 35.7 |
| T4 | 85.7 | 0.0 | 14.3 | 100.0 | 0.0 | 0.0 | 28.6 | 21.4 | 50.0 | 42.9 | 14.3 | 42.9 |
| Total | 88.9 | 3.7 | 7.4 | 96.3 | 3.7 | 0.0 | 40.7 | 29.6 | 29.6 | 46.3 | 33.3 | 20.4 |
| E&S (Percentage) | 70.0 | 26.7 | 3.3 | 80.6 | 16.1 | 3.2 | 76.7 | 13.3 | 10.0 | 60.0 | 16.7 | 23.3 |

*E&S Series 3*– In contrast to the prior decision tasks, the rich and poor games are characterized by Player 3 receiving the highest payoff or the lowest payoff respectively. Player 3's payoff is constant across the three choices for each of the decision tasks. The final decision task provided by E&S, decision task Ey, reintroduces the taxation game structure but separates efficiency from all other fairness motives

considered by E&S. These structures were chosen by E&S to analyze efficiency, maximin preferences, and inequality aversion. Again, we focus our analysis on efficiency and maximin preferences.

| Rich and Poor Games (E&S Series 3) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | R (E&S3.1) | | | | P (E&S3.2) | | | Ey (E&S3.3) | | |
| | A | B | C | | A | B | C | A | B | C |
| Player 3 | 6 | 6 | 6 | | 2 | 2 | 2 | 4.5 | 4.5 | 4.5 |
| Player 2 | 5.5 | 4 | 2.5 | | 7 | 5.5 | 4 | 10.5 | 8.5 | 6.5 |
| Player 1 | 1 | 1.5 | 2 | | 2.5 | 3 | 3.5 | 1.5 | 2 | 2.5 |
| Total | 12.5 | 11.5 | 10.5 | | 11.5 | 10.5 | 9.5 | 16.5 | 15 | 13.5 |
| Average 1, 2 | 3.25 | 2.75 | 2.25 | | 4.75 | 4.25 | 3.75 | 6 | 5.25 | 4.5 |
| Relative 3 to total | 0.480 | 0.522 | 0.571 | | 0.174 | 0.190 | 0.211 | 0.273 | 0.300 | 0.333 |
| Predictions | | | | | | | | | | |
| Selfish | A | B | C | | A | B | C | A | B | C |
| Efficiency | A | | | | A | | | A | | |
| Maximin | | | C | | A | B | C | | | C |
| Choices | | | | | | | | | | |
| T1 - Engineering Model | 4 | 3 | 6 | | 6 | 5 | 2 | 7 | 1 | 5 |
| T2 - Flat Bureaucracy | 4 | 3 | 6 | | 4 | 4 | 5 | 2 | 6 | 5 |
| T3 - Tall Bureaucracy | 5 | 4 | 5 | | 2 | 4 | 8 | 2 | 7 | 5 |
| T4 - Autocracy | 4 | 1 | 9 | | 5 | 0 | 9 | 4 | 2 | 8 |
| Total | 17 | 11 | 26 | | 17 | 13 | 24 | 15 | 16 | 23 |
| E&S (Count) | 21 | 8 | 1 | | 25 | 5 | 1 | 23 | 4 | 3 |
| Choices (Percentage) | | | | | | | | | | |
| T1 | 30.8 | 23.1 | 46.2 | | 46.2 | 38.5 | 15.4 | 53.8 | 7.7 | 38.5 |
| T2 | 30.8 | 23.1 | 46.2 | | 30.8 | 30.8 | 38.5 | 15.4 | 46.2 | 38.5 |
| T3 | 35.7 | 28.6 | 35.7 | | 14.3 | 28.6 | 57.1 | 14.3 | 50.0 | 35.7 |
| T4 | 28.6 | 7.1 | 64.3 | | 35.7 | 0.0 | 64.3 | 28.6 | 14.3 | 57.1 |
| Total | 31.5 | 20.4 | 48.1 | | 31.5 | 24.1 | 44.4 | 27.8 | 29.6 | 42.6 |
| E&S (Percentage) | 70.0 | 26.7 | 3.3 | | 80.6 | 16.1 | 3.2 | 76.7 | 13.3 | 10.0 |

*Hierarchy Consistent Payoff Task Series1* – The prior 11 decision tasks focused primarily on cases where Player 3 maintains a fixed payoff across the three allocations for each decision task. Only decision tasks Nx, Ny, and Nyi provide an opportunity for self-interest. In the following 12 decision tasks we expand on this and provide variation across player 3's payoff in the three allocations for each decision task introducing larger incentives for selfish behavior.

In the HCP1 series of decision tasks we disentangle self-interest from efficiency and maximin preferences. To choose the efficient allocation in T2, T3, and T4, Player 3 must give up some amount of their own payoff. To select the maximin allocation, Player

3 must give up double the amount relative to the amount required to choose the efficient allocation. The cost to achieve an efficient or maximin allocation increases from HCP1.1 to HCP1.2 and again from HCP1.2 to HCP1.3.

| Hierarchy Consistent Payoff Task Series 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HCP1.1 | | | | HCP1.2 | | | HCP1.3 | | |
| | A | B | C | | A | B | C | A | B | C |
| Player 3 | 9 | 9.25 | 8.75 | | 9.5 | 11 | 8 | 11 | 13.5 | 8.5 |
| Player 2 | 7.5 | 5 | 6.25 | | 8 | 5 | 6.5 | 8.5 | 6.5 | 7.5 |
| Player 1 | 4.5 | 4 | 5 | | 4.75 | 4.25 | 5.25 | 6 | 4.5 | 7.5 |
| Total | 21 | 18.25 | 20 | | 22.25 | 20.25 | 19.75 | 25.5 | 24.5 | 23.5 |
| Average 1, 2 | 6 | 4.5 | 5.625 | | 6.375 | 4.625 | 5.875 | 7.25 | 5.5 | 7.5 |
| Relative 3 (to total) | 0.429 | 0.507 | 0.438 | | 0.427 | 0.543 | 0.405 | 0.431 | 0.551 | 0.362 |
| Predictions | | | | | | | | | | |
| Selfish | | B | | | | B | | | B | |
| Efficiency | A | | | | A | | | A | | |
| Maximin | | | C | | | | C | | | C |
| P3 loses (if selected) | -0.25 | 0 | -0.5 | | -1.5 | 0 | -3 | -2.5 | 0 | -5 |
| Gains in efficiency | 2.75 | 0 | 1.75 | | 2 | 0 | -0.5 | 1 | 0 | -1 |
| Gain to min | 0.5 | 0 | 1 | | 0.5 | 0 | 1 | 1.5 | 0 | 3 |
| Choices | | | | | | | | | | |
| T1 - Engineering Model | 3 | 3 | 7 | | 7 | 2 | 4 | 4 | 2 | 7 |
| T2 - Flat Bureaucracy | 10 | 2 | 1 | | 5 | 7 | 1 | 5 | 7 | 1 |
| T3 - Tall Bureaucracy | 7 | 5 | 2 | | 2 | 11 | 1 | 4 | 9 | 1 |
| T4 - Autocracy | 3 | 8 | 3 | | 3 | 9 | 2 | 5 | 7 | 2 |
| Total | 23 | 18 | 13 | | 17 | 29 | 8 | 18 | 25 | 11 |
| Choices (Percentage) | | | | | | | | | | |
| T1 | 23.1 | 23.1 | 53.8 | | 53.8 | 15.4 | 30.8 | 30.8 | 15.4 | 53.8 |
| T2 | 76.9 | 15.4 | 7.7 | | 38.5 | 53.8 | 7.7 | 38.5 | 53.8 | 7.7 |
| T3 | 50.0 | 35.7 | 14.3 | | 14.3 | 78.6 | 7.1 | 28.6 | 64.3 | 7.1 |
| T4 | 21.4 | 57.1 | 21.4 | | 21.4 | 64.3 | 14.3 | 35.7 | 50.0 | 14.3 |
| Total | 42.6 | 33.3 | 24.1 | | 31.5 | 53.7 | 14.8 | 33.3 | 46.3 | 20.4 |

*HCP2 Series* – The HCP1 series decision tasks focused on isolating self-interest, efficiency concerns, and maximin preferences. Here we instead focus on self-interest while allowing the efficient and maximin allocation to coincide. This design provides a clear contrast for self-interest against efficiency and maximin preferences.

| HCP Task Series 2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | HCP2.1 | | | | HCP2.2 | | | | HCP2.3 | | |
| | A | B | C | | A | B | C | | A | B | C |
| Player 3 | 6.5 | 7 | 6 | | 8.5 | 10 | 7 | | 10 | 12.5 | 7.5 |
| Player 2 | 6 | 5 | 5.5 | | 7 | 6 | 6.5 | | 8 | 6 | 7 |
| Player 1 | 3 | 1 | 5 | | 3.5 | 0.5 | 6 | | 2.5 | 0.5 | 6.5 |
| Total | 15.5 | 13 | 16.5 | | 19 | 16.5 | 19.5 | | 20.5 | 19 | 21 |
| Average 1, 2 | 4.5 | 3 | 5.25 | | 5.25 | 3.25 | 6.25 | | 5.25 | 3.25 | 6.75 |
| Relative 3 (to total) | 0.419 | 0.538 | 0.364 | | 0.447 | 0.606 | 0.359 | | 0.488 | 0.658 | 0.357 |
| Predictions | | | | | | | | | | | |
| Selfish | | B | | | | B | | | | B | |
| Efficiency | | | C | | | | C | | | | C |
| Maximin | | | C | | | | C | | | | C |
| P3 loses (if selected) | -0.5 | 0 | -1 | | -1.5 | 0 | -3 | | -2.5 | 0 | -5 |
| Gains in efficiency | 2.5 | 0 | 3.5 | | 2.5 | 0 | 3 | | 1.5 | 0 | 2 |
| Gain to min | 2 | 0 | 4 | | 3 | 0 | 5.5 | | 2 | 0 | 6 |
| Choices | | | | | | | | | | | |
| T1 | 4 | 4 | 5 | | 3 | 2 | 8 | | 1 | 1 | 11 |
| T2 | 5 | 2 | 6 | | 3 | 3 | 7 | | 3 | 4 | 6 |
| T3 | 5 | 3 | 6 | | 4 | 7 | 3 | | 4 | 7 | 3 |
| T4 | 2 | 6 | 6 | | 2 | 6 | 6 | | 2 | 8 | 4 |
| Total | 16 | 15 | 23 | | 12 | 18 | 24 | | 10 | 20 | 24 |
| Choices (Percentage) | | | | | | | | | | | |
| T1 | 30.8 | 30.8 | 38.5 | | 23.1 | 15.4 | 61.5 | | 7.7 | 7.7 | 84.6 |
| T2 | 38.5 | 15.4 | 46.2 | | 23.1 | 23.1 | 53.8 | | 23.1 | 30.8 | 46.2 |
| T3 | 35.7 | 21.4 | 42.9 | | 28.6 | 50.0 | 21.4 | | 28.6 | 50.0 | 21.4 |
| T4 | 14.3 | 42.9 | 42.9 | | 14.3 | 42.9 | 42.9 | | 14.3 | 57.1 | 28.6 |
| Total | 29.6 | 27.8 | 42.6 | | 22.2 | 33.3 | 44.4 | | 18.5 | 37.0 | 44.4 |

*HCP3 Series* – We carry forward elements from the HCP2 series of decision tasks but now hold constant the payoff for Player 2. This adjustment makes Player 2 indifferent between the three allocations in each of the decision tasks with respect to their own payoff. Having Player 2 indifferent between allocations concerning their own payoff reduces the cognitive energy required to self-deceive oneself into choosing the selfish choice. In the HCP2 series of decision tasks, if Player 3 chooses selfishly it is at the expense of both Player 1 and Player 2. This dynamic is no longer present in the HCP3 series since the payoff to Player 2 is constant across allocations. We maintain the alignment of efficiency and maximin predictions to isolate self-interest motives.

| HCP Task Series 3 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HCP3.1 | | | | HCP3.2 | | | | HCP3.3 | |
| | A | B | C | | A | B | C | | A | B | C |
| Player 3 | 6.5 | 7 | 6 | | 8.5 | 10 | 7 | | 10 | 12.5 | 7.5 |
| Player 2 | 5.5 | 5.5 | 5.5 | | 6.5 | 6.5 | 6.5 | | 7 | 7 | 7 |
| Player 1 | 2 | 1 | 3 | | 4 | 2 | 6 | | 3.5 | 0.5 | 6.5 |
| Total | 14 | 13.5 | 14.5 | | 19 | 18.5 | 19.5 | | 20.5 | 20 | 21 |
| Average 1, 2 | 3.75 | 3.25 | 4.25 | | 5.25 | 4.25 | 6.25 | | 5.25 | 3.75 | 6.75 |
| Relative 3 (to total) | 0.464 | 0.519 | 0.414 | | 0.447 | 0.541 | 0.359 | | 0.488 | 0.625 | 0.357 |
| Predictions | | | | | | | | | | | |
| Selfish | | B | | | | B | | | | B | |
| Efficiency | | | C | | | | C | | | | C |
| Maximin | | | C | | | | C | | | | C |
| P3 loses (if selected) | -0.5 | 0 | -1 | | -1.5 | 0 | -3 | | -2.5 | 0 | -5 |
| Gains in efficiency | 0.5 | 0 | 1 | | 0.5 | 0 | 1 | | 0.5 | 0 | 1 |
| Gain to min | 1 | 0 | 2 | | 2 | 0 | 4 | | 3 | 0 | 6 |
| Choices | | | | | | | | | | | |
| T1 | 2 | 1 | 10 | | 3 | 3 | 7 | | 3 | 2 | 8 |
| T2 | 3 | 5 | 5 | | 0 | 8 | 5 | | 4 | 6 | 3 |
| T3 | 1 | 8 | 5 | | 2 | 10 | 2 | | 3 | 10 | 1 |
| T4 | 1 | 7 | 6 | | 2 | 8 | 4 | | 1 | 8 | 5 |
| Total | 7 | 21 | 26 | | 7 | 29 | 18 | | 11 | 26 | 17 |
| Choices (Percentage) | | | | | | | | | | | |
| T1 | 15.4 | 7.7 | 76.9 | | 23.1 | 23.1 | 53.8 | | 23.1 | 15.4 | 61.5 |
| T2 | 23.1 | 38.5 | 38.5 | | 0.0 | 61.5 | 38.5 | | 30.8 | 46.2 | 23.1 |
| T3 | 7.1 | 57.1 | 35.7 | | 14.3 | 71.4 | 14.3 | | 21.4 | 71.4 | 7.1 |
| T4 | 7.1 | 50.0 | 42.9 | | 14.3 | 57.1 | 28.6 | | 7.1 | 57.1 | 35.7 |
| Total | 13.0 | 38.9 | 48.1 | | 13.0 | 53.7 | 33.3 | | 20.4 | 48.1 | 31.5 |

*HCP4 Series* – Finally, we present the HCP4 series of decision task. In the HCP3 series of decision tasks, we focused on the alignment of the maximin preferences and efficiency concerns while isolating selfish motives. In the HCP4 series of decision tasks, we relax the constant payoff across allocations for Player 2 and now align selfish motives with maximin. By doing so, we isolate efficiency concerns and show the influence the efficiency motive when a decision maker is faced with clearly aligned selfish and maximin allocations.

| HCP Task Series 4 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HCP4.1 | | | | HCP4.2 | | | | HCP4.3 | |
| | A | B | C | | A | B | C | | A | B | C |
| Player 3 | 10 | 9.5 | 9 | | 11.5 | 10 | 8.5 | | 12.5 | 10 | 7.5 |
| Player 2 | 4 | 6.5 | 9 | | 5 | 8 | 12 | | 3 | 7.5 | 12 |
| Player 1 | 4 | 3 | 2 | | 5 | 4 | 4.5 | | 3 | 2 | 1 |
| Total | 18 | 19 | 20 | | 21.5 | 22 | 25 | | 18.5 | 19.5 | 20.5 |
| Average 1, 2 | 4 | 4.75 | 5.5 | | 5 | 6 | 8.25 | | 3 | 4.75 | 6.5 |
| Relative 3 (to total) | 0.556 | 0.500 | 0.450 | | 0.535 | 0.455 | 0.340 | | 0.676 | 0.513 | 0.366 |
| Predictions | | | | | | | | | | | |
| Selfish | A | | | | A | | | | A | | |
| Efficiency | | | C | | | | C | | | | C |
| Maximin | A | | | | A | | | | A | | |
| P3 delta (if selected) | 0 | -0.5 | -1 | | 0 | -1.5 | -3 | | 0 | -2.5 | -5 |
| Gains in efficiency | 0 | 1 | 2 | | 0 | 0.5 | 3.5 | | 0 | 1 | 2 |
| Gain to min | 2 | 1 | 0 | | 1 | 0 | 0.5 | | 2 | 1 | 0 |
| Choices | | | | | | | | | | | |
| T1 | 4 | 4 | 5 | | 9 | 2 | 2 | | 8 | 3 | 2 |
| T2 | 10 | 1 | 2 | | 10 | 2 | 1 | | 11 | 2 | 0 |
| T3 | 11 | 2 | 1 | | 13 | 1 | 0 | | 12 | 2 | 0 |
| T4 | 11 | 0 | 3 | | 9 | 2 | 3 | | 13 | 1 | 0 |
| Total | 36 | 7 | 11 | | 41 | 7 | 6 | | 44 | 8 | 2 |
| Choices (Percentage) | | | | | | | | | | | |
| T1 | 30.8 | 30.8 | 38.5 | | 69.2 | 15.4 | 15.4 | | 61.5 | 23.1 | 15.4 |
| T2 | 76.9 | 7.7 | 15.4 | | 76.9 | 15.4 | 7.7 | | 84.6 | 15.4 | 0.0 |
| T3 | 78.6 | 14.3 | 7.1 | | 92.9 | 7.1 | 0.0 | | 85.7 | 14.3 | 0.0 |
| T4 | 78.6 | 0.0 | 21.4 | | 64.3 | 14.3 | 21.4 | | 92.9 | 7.1 | 0.0 |
| Total | 66.7 | 13.0 | 20.4 | | 75.9 | 13.0 | 11.1 | | 81.5 | 14.8 | 3.7 |

## Appendix (B). Experimental Instructions

This appendix provides the instructions read aloud verbatim to subjects prior to beginning each session in z-tree.

*B.1 Engineering Model Setting (T1) Instructions*

**Experiment Instructions**

Introduction

This is an experiment in economic decision-making. Please follow the instructions carefully. Please do not communicate with other participants during the experiment unless instructed. Importantly, please refrain from verbally reacting to events that occur. You are welcome to ask questions as we read the instructions. If you ask a question, please refrain from suggesting what choices you or others should make as this may compromise the scientific value of the experiment.

You will never be asked to reveal your identity to anyone during the course of the experiment. Your name will never be associated with any of your decisions. In order to keep your decisions private, please do not reveal your choices to any other participant.

You will earn money based on decisions made in the experiment. We will also pay you $5.25 for completing the entire experiment, along with a post-experiment questionnaire. At the end of the session, you will be paid your earnings in private and in cash.

The Decision Setting

In this experiment, you will be randomly matched into a group with two other players that are sitting in the room. The identity of your group members will never be revealed to you. You will remain in the same group for the entire experiment.

The three players in your group will be assigned the role of Player 1, Player 2, and Player 3. You will be in the same role for the entire experiment.

In a decision round, all members in your group will consider three options. Each option defines a payment amount for each of the three players. An example is provided on the next page.

| Option A | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 1.0 |
| Player 1 | 2.0 |

| Option B | |
|---|---|
| Player 3 | 1.0 |
| Player 2 | 2.0 |
| Player 1 | 3.0 |

| Option C | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 2.0 |
| Player 1 | 1.0 |

In this example, if Option A is selected, Player 1 will receive 2.00, Player 2 will receive 1.00 and Player 3 will receive 3.00. If instead Option B is chosen, Player 1 will receive 3.00, Player 2 will receive 2.00 and Player 3 will receive 1.00. And so on.

How is the option selected? In each round, all players will cast a vote for which option the group should select. If a majority in your group (2 out of 3) vote for the same option, the option with the majority vote will be chosen. If there is no majority, the computer will randomly select one of the options. In either case, the selected option will be in effect for all group members.

Experiment Organization

The experiment consists of several decision rounds, and all involve the same decision setting described before. You will not know the number of decision rounds until the experiment is finished. Please know that after a decision round is completed, you will not be provided with any feedback before the next round begins, including the option selected for the group. The specific payment amounts for the three options will change from one round to the next, so please look at all the options carefully before making choices.

To determine your earnings, after the last decision round TWO of the decision rounds will be selected at random and played out for real. That is, the option selected in this round – using the procedure described before – will be in effect for your group. You will simply earn the payment amount indicated in this option for your Player role.

Each round is equally likely to be selected as the paid round. You should thus treat each round as if it will be the randomly selected, paid round.

We have now completed the instructions. Before we proceed to the decision rounds, are there any questions?

*B.2 Flat Bureaucracy Setting (T2) Instructions*

**Experiment Instructions**

Introduction

This is an experiment in economic decision-making. Please follow the instructions carefully. Please do not communicate with other participants during the experiment unless instructed. Importantly, please refrain from verbally reacting to events that occur. You are welcome to ask questions as we read the instructions. If you ask a question, please refrain from suggesting what choices you or others should make as this may compromise the scientific value of the experiment.

You will never be asked to reveal your identity to anyone during the course of the experiment. Your name will never be associated with any of your decisions. In order to keep your decisions private, please do not reveal your choices to any other participant.

You will earn money based on decisions made in the experiment. We will also pay you $5.25 for completing the entire experiment, along with a post-experiment questionnaire. At the end of the session, you will be paid your earnings in private and in cash.

The Decision Setting

In this experiment, you will be randomly matched into a group with two other players that are sitting in the room. The identity of your group members will never be revealed to you. You will remain in the same group for the entire experiment.

The three players in your group will be assigned the role of Player 1, Player 2, and Player 3. You will be in the same role for the entire experiment.

In a decision round, all members in your group will consider three options. Each option defines a payment amount for each of the three players. An example is provided on the next page.

| Option A | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 1.0 |
| Player 1 | 2.0 |

| Option B | |
|---|---|
| Player 3 | 1.0 |
| Player 2 | 2.0 |
| Player 1 | 3.0 |

| Option C | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 2.0 |
| Player 1 | 1.0 |

In this example, if Option A is selected, Player 1 will receive 2.00, Player 2 will receive 1.00 and Player 3 will receive 3.00. If instead Option B is chosen, Player 1 will receive 3.00, Player 2 will receive 2.00 and Player 3 will receive 1.00. And so on.

How is the option selected? In each round, Player 3 will choose an option on behalf of the group. This option will be in effect for all group members. Player 1 and Player 2 will be able to make recommendations. In particular, Player 1 and Player 2 will first make a recommendation to Player 3 of what option to choose. These recommendations will be made separately. Player 1 will not know of Player 2's recommendation, and vice versa.

Player 3 will receive the recommendations from Player 1 and Player 2 before entering his or her decision. Player 3 is free to select any option, whether it is one recommended by Player 1 and/or Player 2 or something different.

Experiment Organization

The experiment consists of several decision rounds, and all involve the same decision setting described before. You will not know the number of decision rounds until the experiment is finished. Please know that after a decision round is completed, you will not be provided with any feedback before the next round begins, including the option selected for the group. The specific payment amounts for the three options will change from one round to the next, so please look at all the options carefully before making choices.

To determine your earnings, after the last decision round, TWO of the decision rounds will be selected at random and played out for real. That is, the option selected in this round – using the procedure described before – will be in effect for your group. You will simply earn the payment amount indicated in this option for your Player role.

Each round is equally likely to be selected as the paid round. You should thus treat each round as if it will be the randomly selected, paid round.

We have now completed the instructions. Before we proceed to the decision rounds, are there any questions?

*B.3 Tall Bureaucracy Setting (T3) Instructions*

**Experiment Instructions**

Introduction

This is an experiment in economic decision-making. Please follow the instructions carefully. Please do not communicate with other participants during the experiment unless instructed. Importantly, please refrain from verbally reacting to events that occur. You are welcome to ask questions as we read the instructions. If you ask a question, please refrain from suggesting what choices you or others should make as this may compromise the scientific value of the experiment.

You will never be asked to reveal your identity to anyone during the course of the experiment. Your name will never be associated with any of your decisions. In order to keep your decisions private, please do not reveal your choices to any other participant.

You will earn money based on decisions made in the experiment. We will also pay you $5.25 for completing the entire experiment, along with a post-experiment questionnaire. At the end of the session, you will be paid your earnings in private and in cash.

The Decision Setting

In this experiment, you will be randomly matched into a group with two other players that are sitting in the room. The identity of your group members will never be revealed to you. You will remain in the same group for the entire experiment.

The three players in your group will be assigned the role of Player 1, Player 2, and Player 3. You will be in the same role for the entire experiment.

In a decision round, all members in your group will consider three options. Each option defines a payment amount for each of the three players. An example is provided on the next page.

| Option A | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 1.0 |
| Player 1 | 2.0 |

| Option B | |
|---|---|
| Player 3 | 1.0 |
| Player 2 | 2.0 |
| Player 1 | 3.0 |

| Option C | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 2.0 |
| Player 1 | 1.0 |

In this example, if Option A is selected, Player 1 will receive 2.00, Player 2 will receive 1.00 and Player 3 will receive 3.00. If instead Option B is chosen, Player 1 will receive 3.00, Player 2 will receive 2.00 and Player 3 will receive 1.00. And so on.

How is the option selected? In each round, Player 3 will choose an option on behalf of the group. This option will be in effect for all group members. Player 1 and Player 2 will be able to make recommendations. In particular, Player 1 will first make a recommendation to Player 2 of what option to choose. Player 2 will then make a recommendation to Player 3 of what option to choose. Player 2 is free to recommend any option to Player 3, whether it is the one also recommended by Player 1 or a different option.

Player 3 will receive the recommendation from Player 2 before entering his or her decision. Player 3 is free to select any option, whether it is the one recommended by Player 2 or a different option. Player 3 will not know the recommendation provided by Player 1.

Experiment Organization

The experiment consists of several decision rounds, and all involve the same decision setting described before. You will not know the number of decision rounds until the experiment is finished. Please know that after a decision round is completed, you will not be provided with any feedback before the next round begins, including the option selected for the group. The specific payment amounts for the three options will change from one round to the next, so please look at all the options carefully before making choices.

To determine your earnings, after the last decision round TWO of the decision rounds will be selected at random and played out for real. That is, the option selected in this round – using the procedure described before – will be in effect for your group. You will simply earn the payment amount indicated in this option for your Player role.

Each round is equally likely to be selected as the paid round. You should thus treat each round as if it will be the randomly selected, paid round.

We have now completed the instructions. Before we proceed to the decision rounds, are there any questions?

*B.4 Autocracy Setting (T4) Instructions*
**Experiment Instructions**

Introduction
This is an experiment in economic decision-making. Please follow the instructions carefully. Please do not communicate with other participants during the experiment unless instructed. Importantly, please refrain from verbally reacting to events that occur. You are welcome to ask questions as we read the instructions. If you ask a question, please refrain from suggesting what choices you or others should make as this may compromise the scientific value of the experiment.

You will never be asked to reveal your identity to anyone during the course of the experiment. Your name will never be associated with any of your decisions. In order to keep your decisions private, please do not reveal your choices to any other participant.

You will earn money based on decisions made in the experiment. We will also pay you $5.25 for completing the entire experiment, along with a post-experiment questionnaire. At the end of the session, you will be paid your earnings in private and in cash.

The Decision Setting
In this experiment, you will be randomly matched into a group with two other players that are sitting in the room. The identity of your group members will never be revealed to you. You will remain in the same group for the entire experiment.

The three players in your group will be assigned the role of Player 1, Player 2, and Player 3. You will be in the same role for the entire experiment.

In a decision round, all members in your group will consider three options. Each option defines a payment amount for each of the three players. An example is provided on the next page.

| Option A | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 1.0 |
| Player 1 | 2.0 |

| Option B | |
|---|---|
| Player 3 | 1.0 |
| Player 2 | 2.0 |
| Player 1 | 3.0 |

| Option C | |
|---|---|
| Player 3 | 3.0 |
| Player 2 | 2.0 |
| Player 1 | 1.0 |

In this example, if Option A is selected, Player 1 will receive 2.00, Player 2 will receive 1.00 and Player 3 will receive 3.00. If instead Option B is chosen, Player 1 will receive 3.00, Player 2 will receive 2.00 and Player 3 will receive 1.00. And so on.

How is the option selected? In this task, Player 3 will choose an option on behalf of the group. This option will be in effect for all group members. Player 1 and Player 2 are

asked to provide the option they would recommend to Player 3 if they could. Player 3 will not receive this information.

Experiment Organization

The experiment consists of several decision rounds, and all involve the same decision setting described above. You will not know the number of decision rounds until the experiment is finished. Please know that after a decision round is completed, you will not be provided with any feedback before the next round begins, including the option selected for the group. The specific payment amounts for the three options will change from one round to the next, so please look at all the options carefully before making choices.

To determine your earnings, after the last decision round TWO of the decision rounds will be selected at random and played out for real. That is, the option selected in this round – using the procedure described before – will be in effect for your group. You will simply earn the payment amount indicated in this option for your Player role.

Each round is equally likely to be selected as the paid round. You should thus treat each round as if it will be the randomly selected, paid round.

We have now completed the instructions. Before we proceed to the decision rounds, are there any questions?

## Appendix (C). Data Appendix

This appendix provides a more detailed description of the procedures used to develop the data sources and manipulations utilized in our paper.

*DOD BRAC Recommendations*. We first collected the DOD proposed 2005 realignment and closure list from Appendix K of the BRAC Commission report to the President (2005 Defense Base Closure and Realignment Commission, 2005). Appendix K provided the DOD's recommendation to the BRAC Commission for further consideration. The DOD's recommendation consisted of 190 recommendations broken down by military branch of service. For example, the Army made 56 recommendations consisting of roughly 200 individual actions with the largest single increase in personnel representing an increase of 12,466 personnel while the largest single decrease in personnel represented a decrease of 14,870 personnel. Similarly, the Navy and the Air Force made 20 and 41 recommendations respectively. In addition to branch specific recommendations, the DOD looked to find synergies among the independent branches by also recommending 70 recommendations which seek to develop "Joint" or blended capabilities across services. The 70 Joint recommendations spanned a diverse set of focus areas such as education and training, headquarters and support activities, industrial support (i.e depot maintenance and storage of ammunition), medical services, and technical support (i.e. consolidating ground vehicle development and acquisition).

Each of the recommendations from Appendix K provided a recommendation number, the name of the installations impacted by the recommendation, the state these installations belong to, the number of direct net military, civilian, and contractor personnel impacted by the recommendation, and the recommended action (i.e. closure,

realignment, or gainer). In many cases, a recommendation to close or realign one installation resulted in decreasing personnel in one location and reallocating those positions across several locations in the US. For military personnel, these actions resulted in moving impacted personnel from one location to another. For DOD civilian personnel, it is not always the case that the DOD moved impacted individuals from one location to another and we are unaware of data tracking the number of civilians moved by the DOD as a result of the 2005 BRAC. To our knowledge, the DOD did not relocate DOD contractor personnel.

The BRAC Commission provided Appendix K as a Portable Document Format (PDF). As a result, we manually key-punched the recommendation number, DOD recommendation, installation name, State, net military, net civilian, and net contractor personnel into an Excel document.

*Final and Approved BRAC Commission Recommendations*. The DOD recommendations provided in Appendix K of the BRAC Commission report to the President formed the starting point for the BRAC Commission's deliberations. The BRAC commission considered the DOD recommendations against two categories of criteria. The first of these categories focused on military value such as the current and future mission capabilities, cost of operations, or the potential operating environment of both the existing and potential receiving locations. The second, more general category, focused on other considerations such as time of potential costs and savings, economic impact on existing communities, available infrastructure to accommodate new

personnel, and environmental impact. As directed by law, military value was to hold primacy in the BRAC Commission deliberation process.

Appendix Q of the BRAC Commission report to the President provides a recommendation by recommendation history of decisions from the BRAC Commission concerning the DOD's recommendations. In many cases, the BRAC Commission simply found the recommendations of the DOD consistent with the final selection criteria. However, the BRAC Commission also made minor changes to verbiage for clarity or made more substantial structural changes to the DOD recommendations. In some cases, the BRAC Commission voted to delete recommendations. In total, the BRAC Commission voted to delete 30 of the DOD recommendations. Finally, the BRAC Commission also added 5 recommendations mostly impacting Navy installations.

We carefully reviewed Appendix Q and incorporated updates to the data we key-punched from the DOD recommendations (Appendix K). Appendix Q provides a text narrative for the BRAC Commission decisions and does not provide the same numerical level of detail provided in the DOD recommendations. This leads to some ambiguity in personnel impacts related to the BRAC Commissions final decision. In cases where the partial change recommended by the BRAC Commission led to ambiguity in the personnel impacts, we maintained the DOD's recommendation. Later, we updated the final personnel impacts utilizing data from Appendix O of the BRAC Commission report to the President.

Appendix O of the BRAC Commission report to the President provides the final net job changes by military, DOD civilian, and DOD contractor employee types.

However, Appendix O also summarizes the net job changes at the installation level which leads to a loss of mapping individual BRAC recommendations to the installation. For example, the DOD makes four recommendations (Recommendations# 5, 130, 140, and 141) in Appendix K which directly impact Fort Meade, MD; Appendix O simply lists Fort Meade, MD once. We map the DOD recommendations in Appendix K, updated by information in Appendix Q, to the final net job changes in Appendix O of the BRAC Commission report to the President. Before resolving any differences in the reported net job changes, we identify the county each BRAC affected installation resides in and identify the year in which the DOD completed each BRAC recommendation. We outline these procedures here, followed by our procedure to resolve any disagreements in final net job changes in our dataset with those in Appendix O of the BRAC Commission report to the President.

*Linking US County to BRAC Recommendations.* In order to perform our analysis at the county level, we documented the location data for each of the BRAC action recommendations. We began by utilizing DOD provided information relating to location data for DOD installations. In supporting documents provided to the BRAC Commission, we find an Excel document titled “Counties MSA and Stuff.xls” which contains information pertaining to the branch of service of installations, the name of the installation, city, state, and county (Department of Defense, 2017e). However, this data provided incomplete coverage of installations directly impacted by the 2005 BRAC. In the absence of DOD provided installation location data, we simply conducted web searches using Google.com to access publicly available installation location data.

Combining these two sources of information, we developed a complete linkage between installation location data at the county level and the DOD recommendations.

*Linking DOD Recommendation to Implementation Schedule.* Once we established the link between counties of interest and DOD recommendations from Appendix K (updated using Appendix Q), we turned our attention to the implementation schedule. To accomplish this, we utilize the 2006-2008, 2011, and 2013 Reports on 2005 Defense Base Closure and Realignment Implementation, or simply “Section 2907” reports, mandated by Congress as amended by Section 2931 of the National Defense Authorization Act for Fiscal Year 2006.

These reports provide a wide variety of information related to the 2005 BRAC. Specific to our study, the Section 2907 reports provide the BRAC Commission’s recommendation number, the installation name, the BRAC action undertaken, and the estimated completion date for BRAC actions. Due to the complex nature of the BRAC actions, we begin with a reasonable assumption that the DOD scheduled completion of BRAC actions towards the end of availability of BRAC authority in 2011 to maximize planning and orderly transitions in both the losing and gaining installations. This assumption seems reasonable due to the complexity of large personnel movements and the necessity of major construction in gaining locations to accommodate the influx of new personnel and mission requirements.

Utilizing the most current Section 2907 report in 2013 and working towards the oldest report in 2006, we reviewed each document to find information on the timing of completion of each of the BRAC recommendations. We only use the most current

information available for each BRAC recommendation and where applicable apply the date of completion to both the losing and gaining locations. If we lack specific year of completion associated with BRAC recommendations, we assume these actions were completed in 2011.

*Reconciling DOD and Final BRAC Commission Recommendations.* As previously discussed, we began with the DOD recommendations in Appendix K, and updated the DOD recommendations with information in Appendix Q of the BRAC Commission report to the President. We then utilized the Section 2907 reports to build the approximate realized implementation schedule of the 2005 BRAC. Finally, we reconciled our dataset with the final net job changes listed in Appendix O of the BRAC Commission report to the President. We compared the total net jobs by employee type (military, DOD civilian, and DOD contractor) in our dataset with those listed in Appendix O. If a recommendation in our dataset did not match those listed in Appendix O, we amended our dataset to match those provided in Appendix O. If a disagreement occurred which spanned several years in our dataset, we matched the final net job changes by employee type listed in Appendix O by proportionally time phasing the data in Appendix O.

For example, the DOD made recommendations 99, 101, 102, 103, 106, 117, and 118 in Appendix K which directly impacted Little Rock Air Force Base, Arkansas leading to an increase of 2,713 personnel. According to Section 2907 reports, the DOD accomplished these recommendations throughout 2006, 2008, 2010, and 2011. The final BRAC Commission recommendations documented in Appendix O of the BRAC

Commission report to the President states Little Rock Air Force Base will gain 2,752 positions, a difference of 49 positions. To reconcile this difference, we calculate the proportion of each employee type in 2006, 2008, 2010, and 2011 then allocate the final net job changes by employee type documented in Appendix O. By following this procedure, we maximize the utilization of available information while matching the final net job changes approved by the BRAC Commission.

## VITA

Charlton “Eli” Freeman was born an “Air Force military brat” in Warner Robins, Georgia. He grew up in various locations both within the US and abroad. He attended Kennesaw State University, where he received a Bachelor of Business Administration in Finance in December of 2008. He then commissioned as an officer in the Air Force. Following his initial assignment as a Deputy Budget Officer at Tyndall AFB, Florida he was competitively selected to attend the Air Force Institute of Technology at Wright-Patterson AFB where he received his Master of Science Degree in Government Cost Analysis. Next, he served as a Weapons System Cost Analyst with the Air Force Cost Analysis Agency, Andrews AFB, Maryland. In this position, he was responsible for developing life cycle cost estimate for Major Defense Acquisition Programs. While assigned to the Air Force Cost Analysis Agency, Eli deployed in support of Operations Enduring Freedom and Freedom’s Sentinel serving as the Afghan National Army Budget Officer, Combined Security Taskforce-Afghanistan, Kabul, Afghanistan.

Eli entered the University of Tennessee, Knoxville, through the Air Force sponsored Air Force Institute of Technology Civilian Institution Program. Upon graduation, he will join the Air University faculty at Maxwell Air Force Base in Montgomery, Alabama where he will serve as Chief, Department of Defense Strategic and Financial Management Environment. His duties as an instructor at the Defense Financial Management and Comptroller School will include teaching graduate-level economics to senior military and civilian comptrollers and resource managers from across all services within the Department of Defense.