An Analysis of the Effect of Reserve Activation on Small Business

by

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for

Under contract no. SBAHQ-07-F-0306

Release Date: October 2009

This report was developed under a contract with the Small Business Administration, Office of Advocacy, and contains information and analysis that was reviewed and edited by officials of the Office of Advocacy. However, the final conclusions of the report do not necessarily reflect the views of the Office of Advocacy.

Abstract

The authors use Department of Defense (DOD) data on the employment and activation of military Reserve personnel and Dun and Bradstreet data on sales and firm size to examine the impact of Reserve activation on employers. The study includes an analysis of the size and industry characteristics of firms employing activated reservists as well as the impact of the length of activation on the firm. The authors find that small businesses are disproportionately affected at the margin. Adding one more employee increases the percent activated in small firms from 0.36% to 2.6% but increases the percent activated in large firms by only 0.05% to 0.06%. There is a corresponding negative effect of 0.30% on the change in sales for small firms, about 15 times greater than the 0.02 percentage for large firms.

The authors also find that the length of activation has a small but significant negative effect on the firm's revenues. The econometric model found a 1.9 percentage point decrease in sales for small firms relative to larger firms for those with reservist employees activated 30 days or more and a 3.0 percentage point decrease in sales for those with employees activated 180 days or more.

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1. Introduction

Since 2003, thousands of military reservists have been called to active duty; whether that duty station is overseas or near home, these reservists are not available to work at their civilian jobs during the period of activation. Businesses that experience employee absences due to Reserve component activation must adjust staffing and are likely to experience productivity losses and decreased performance. To the extent that these lost employees possess unique job-specific or firm-specific skills or work in a team environment, the loss of productivity may substantially exceed the employee's foregone wages and lower the firm's profitability. Moreover, the firm may face increased costs due to mandatory requirements of the Uniformed Services Employment and Reemployment Rights Act of 1994, also known as USERRA.[1] These costs can include the continuation of certain benefits for the absent employee and higher management costs necessary to reallocate work and ensure that a comparable position is available upon the employee's return.

The costs of job absence also fall on the activated employee; absences may adversely affect career progression, for example. However, Reserve participation is a voluntary decision on the part of the employee. Other things being equal, those who volunteer for Reserve duty are in jobs where such absences are less likely to affect career progression and earnings. Firms have little latitude or choice regarding Reserve participation by their employees. Indeed, employers are prohibited by Federal law from discriminating against employees who participate in the Reserves.

Reservist activation may disproportionately affect small businesses in at least two ways. First, a higher number of activated reservists may be drawn from small firms than would be expected given their relative share of the total civilian workforce. Second, the average activation may have a greater relative impact on smaller firms in terms of productive hours lost.

Previous work has shown that productivity losses from absenteeism are larger for small firms than larger firms. Employees who have no perfect substitutes within the local production unit cause productivity losses to their firms in excess of their wages.[2] In firms with a small number of employees, those employees may be more likely to perform a large number of tasks and be more difficult to replace.

The main challenge in examining this issue is obtaining data. The Department of Defense (DOD) maintains a database with employee-provided information on their employers. Reporting for this database is now mandatory and includes a unique identifier called a DUNS number assigned by the Dun and Bradstreet Corporation (D&B) for most of the firms. DOD estimates that its database currently covers about 90 percent of members of the Selected Reserve, that portion of each service's Reserve components that trains regularly and is expected to be ready for quick mobilization at any time. This database can be linked to other DOD data that identify which reservists have been activated and for how long.

The Dun and Bradstreet Corporation has provided credit information on private businesses and corporations since 1841. D&B is best known for its Data Universal Numbering System (DUNS) and

[1] 38 U.S.C. § 4301 et seq.
[2] See Nicholson, et al. (2006).

its database with over 140 million business records with approximately 1,500 data elements. The DOD employer database includes DUNS numbers that can be matched to D&B's database.

Using these two data sources, we can construct a database of firms to identify differences in the characteristics of employers of reservists. Compared with the employers of non-activated reservists and otherwise similar civilians, are the employers of activated reservists more or less likely to be small businesses? Are activated reservists concentrated in particular occupations? Are there any differential impacts on firms in particular industries or regions of the country?

Small businesses are expected to face greater difficulties adjusting to extended absences of activated reservists because they have fewer employees. They must either work shorthanded or hire replacements, and there is an additional problem redistributing work when reservists return. The model of firm performance will determine if there are measurable differences between the productivity effects of small and large firms in terms of income and thus profitability when reservist employees are called to active duty.

Since the first Gulf War began in 1990, the DOD has increased the operational tempo of the Reserve components of the armed forces. In 2004 alone, over one-third of the service members deployed in Iraq and Afghanistan were from the Reserves. Generally speaking, the department includes National Guard components with the individual services' Reserve components.

The Uniformed Services Employment and Reemployment Rights Act of 1994:

- Guarantees the right of reservists to be reemployed by their civilian employers after serving on active duty;
- Prohibits employers from discriminating against individuals in any aspect of employment because of their service in the Reserves; and
- Mandates some continuation of benefits to reservists who have been activated.

There is little information about the type and magnitude of the disruption that firms experience when their reservist employees or reservist owners are activated.

The Congressional Budget Office (CBO) conducted a study in 2005 using survey information collected by the Departments of Defense and Labor and by other organizations. CBO found that most employers were unaffected by the activation of reservists; in fact, only about 6 percent of business establishments employed reservists, and fewer than one-half of one percent of self-employed people served in the Reserves. While this number may seem small when viewed from the perspective of the economy as a whole, for those firms that are affected by Reserve activation, it is important to know the degree of inconvenience to both the reservist and the firm.

Several studies have postulated that Reserve call-ups will be more severe for:

- Small businesses that lose essential (key) employees;
- Businesses that require workers with highly specialized skills; and
- Self-employed reservists.

Among reservists who held civilian jobs, including government jobs, CBO found that small businesses with fewer than 100 employees employed about 18 percent, and 35 percent were employed by businesses with fewer than 500 employees or were self-employed. The CBO also estimated that, of the 860,000 members of the Selected Reserves (who constitute the majority of active Reserve personnel), 8,000 to 30,000 held key positions in small businesses and an additional 55,000 were self-employed.

The existence of laws such as USERRA could in fact cause additional difficulties for employers with activated reservist employees. Not only could they experience a loss of productivity, but they may also incur ongoing costs to maintain benefits for the absent employees. Policymakers are required to balance conflicting goals in order to help DOD recruit and retain military personnel while minimizing the effect on the civilian economy and avoiding harm to small business.

This analysis will proceed with a brief literature review chapter followed by descriptive analysis of the data used. Next, we state the hypothesis to be tested, present an economic model of firm performance, and report the results of our econometric analysis. Finally, the report provides a set of conclusions and recommendations for further analysis.

2. Literature Review

The economic effects of National Guard and Reserve activation and deployment on small business employers (or any size business for that matter) have not been extensively studied. Few, if any, studies exist that directly or indirectly examine this relationship. This dearth of previous analysis is partially attributable to the fact that large-scale activations of reservists did not occur prior to the early 1990s. Before Desert Shield/Desert Storm (sometimes referred to as the first Gulf War), the last major mobilization of reservists occurred nearly 40 years previously during the Korean conflict. The Selected Reserve components before 1990 had practically no experience with any large-scale force mobilization, and the likelihood of activation or deployment probably played almost no role in enlistment and retention decisions.

Since that time, there have been few studies of the economic effects of Reserve deployment. These studies tend to fall into one of three categories: retention effects; personal and economic effects on the reservist, their family and community; and only recently, the economic effects on employers of activated reservists. In addition to these military-specific studies, there are also some studies on the general economic effects of long-term employee absenteeism for reasons other than military activation – usually sick leave or sabbaticals – that would, in theory, have similar economic effects on employers.

Retention Effects

The Department of Defense (DOD) commissioned the first survey of reservists' attitudes toward their military service in 1986: the Status of Forces Survey (Reserve) SOFS(R). In 1992, DOD included in the SOFS(R) questions relating to how mobilizations affect reservists. DOD cited three reasons for this focus:

1. Increased reliance on the Guard and Reserves had increased the likelihood of mobilization.
2. Little empirical research existed concerning the effects that mobilizations have on reservists' attitudes and those of their employers and families.
3. Reservists' stay/leave decisions are dependent on their own attitudes and perceptions and those of employers and families.

Kirby, et al. (1992) studied the 1986 and 1992 SOFS(R) and found a shift in the motivation for staying in the Guard and Reserve from purely pecuniary reasons to more of an emphasis on the educational benefits available. This was accompanied by an encouraging favorable shift when asked to describe their immediate civilian supervisors' overall attitude toward their participation in the Guard/Reserve.

The study used a sample from the 1991 Guard/Reserve Survey of Officers and Enlisted Personnel of 3,269 part-time enlisted reservists with 4-12 years of service, of whom 1,752 were mobilized. These survey responses were matched to individual-level administrative data from the Quarterly Master Personnel Files of the Reserve Common Component Personnel Data System (RCCPDS) maintained by the Defense Manpower Data Center (DMDC). Kirby et al. examined differences in retention among various subgroups and estimated the net effect of different variables on the probability of retention. They found no statistically significant difference in retention between mobilized and non-mobilized reservists.

Reservist Family and Community Effects

Angrist and Johnson (2000) analyzed the effects of deployment on military families in the first Gulf War. Using DOD's 1992 Survey of Officers and Enlisted Personnel, they found that deployments increased the divorce rate for both male and female soldiers. Deployments also decreased spousal employment. Children were not found to have an increase in disability due to parental deployment.

In a later study by the Rand Corporation, Loughran, et al. (2006) examined the impact of activations and deployments on the lives of reservists, their families, and their communities. The authors hypothesized that activation of reservists affects the supply of labor to the community. In addition, the demand for goods and services decreases when reservists are removed from the community. In order to test this, the authors generated counts of activated and deployed Reserve and active-duty personnel from the DMDC Global War on Terrorism (GWOT) Contingency File. The research showed that, although employment declines initially during the first month of activation, it recovers over the subsequent three months. There was no conclusive evidence that Reserve activation disproportionately drew from small communities. An additional interesting result was that police employment decreased after activation, but the magnitude was difficult to gauge.

In a separate Rand study, Loughran, et al. (2006) examined the effect of activation on reservist earnings using administrative data from DMDC and the Social Security Administration. Contrary to earlier findings based on survey data, the authors found that most reservists did not suffer earnings losses attributable to activation, but actually had earnings increases, particularly when the value of certain tax advantages was considered. Still, about 17 percent of reservists did experience a loss in earnings, and 11 percent experienced a loss of more than 10 percent of their base-year earnings.

Employer Effects

Doyle, et al. (2004) attempted to measure the costs incurred by businesses as a result of Reserve activation. Using estimates of costs based on analysis of provisions in the Uniformed Services Employment and Reemployment Rights Act (USERRA), and supported by interviews of a non-random sample of 8 companies applying for the Small Business Administration's Military Reservist Economic Injury Disaster Loans, or MREIDLs, (selected precisely because they had suffered serious economic consequences), they identified several sources of these costs. These included not only direct financial costs associated with activated reservists' retirement and health benefits and transition costs for their return to the job they left, but also the cost of replacement employees, such as hiring and training costs, and costs from lost productivity due to delays. Among the costs that they were able to objectively measure were health and retirement benefits which they extrapolated using the 2000 Survey of Reserve Component Personnel and data from the Employee Benefit Research Institute (EBRI) using a weighted average by sector and firm size. They concluded that the employer cost for a reservist's retirement plan averaged $372 per month and that for an employer-provided health insurance plan averaged $215 for singles and $550 for families. Other long-term costs that may also result from the loss of key personnel include losing clientele and effects on other employees in a team environment. They found that small businesses were particularly affected by Reserve activations. The authors concluded that further research was necessary to more specifically define the costs associated with Reserve mobilization and the businesses incurring those costs.

Golding, et al. (2007) examined the combined effects of reservists' activation and federal job protections on civilian employers using interviews with 19 employers of 28 reservists; 12 of these employers were MREIDL recipients. Using evidence from Nieva (1999), which found that about 6 percent of businesses employed reservists, along with anecdotal evidence, the authors concluded that small businesses that lose essential employees, businesses that employ highly skilled workers and self-employed reservists were most strongly impacted. Of the 860,000 reservists in the Selected Reserves, about 85,000 were in positions where activation could severely affect their employers or themselves as self-employed individuals. The study presented four options to mitigate the effects of Reserve activation: compensation of affected businesses through tax credits or direct payments, subsidized loans to employers, provision or subsidization of call-up insurance, and exemption of certain reservists from call-up.

Gotz (2003) examined available information on general employer support of the Guard and Reserve based upon the assumption that employer opinion of Reserve activities affects the decision of current and potential Reserve participants. He also found a lack of hard statistical evidence but plenty of anecdotal evidence. In order to improve access to relevant data, Gotz recommended that DOD institute five initiatives to increase employer support for Reserve participation:

1. Establish a mandatory-reporting employer database linked to Reserve Personnel file. (This policy was approved in August 2004 when the voluntary DOD Reserve Employer Survey became mandatory.)
2. Obtain timely information for early warning of problems.
3. Provide more timely information to employers.
4. Decrease uncertainty about call-up frequency and duration.
5. Offset employer costs.

As a direct result of these recommendations, the Civilian Employer Information (CEI) database was created, and it is this repository that we hope will provide crucial data in our study of Reserve activation effects.

Firm Demographics

The Dun and Bradstreet Corporation has provided credit information on private businesses and corporations since 1841. Often referred to as D&B, it is best known for its Data Universal Numbering System (DUNS) and its database with over 140 million business records with approximately 1,500 data elements.

Evans (1987) examines the relationship between firm growth, firm size, and firm age for a sample of manufacturing firms between 1976 and 1982. Data from the Small Business Data Base (SBDB), which was originally collected by D&B for credit reporting, provides data on firm age, number of employees, sales, and various corporate demographics. Evans found several problems with the data: under-representation of very small firms; data that did not apply to the file year for which the data were held; and a lack of information on firm acquisitions and mergers. As with most survey datasets, the SBDB data had various errors due to firms reporting bad data, firms' misunderstanding questions, or D&B making various clerical errors. Overall, Evans found that the quality of the data was reasonable compared with other datasets used by economists. The paper found that firm growth decreases with firm age and size.

Struyk (1972) examines the impact of industry location on the Boston, Cleveland, Minneapolis, and Phoenix metropolitan areas over a 32-month period. He found that industry locations significantly changed the existing spatial configuration of the metropolitan areas. This research was conducted by using D&B DUNS Market Identifier files to determine Standard Metropolitan Statistical Areas (SMSAs) and which firms either relocated within an SMSA, entered the SMSA, ceased operating within the SMSA or remained at their current location. He found that there were some biases toward firms that ceased to operate in certain SMSAs, though other SMSAs provided highly accurate accounts of entry and exit through crosschecks against secondary data.

Employee Absenteeism

There exists a small amount of research pertaining to the more general case of employees who are absent from work for other reasons (whether for a major illness, a sabbatical, or Family Medical Leave Act (FMLA) reasons). We can extrapolate that the firm effects will likely be similar to the temporary loss of a reservist employee due to activation or deployment.

De Kok (1997) constructed an explanatory model of involuntary absence from work based on a telephone inquiry of 900 small and medium-sized (fewer than 200 employees) Dutch firms in 6 different sectors (industry, construction, trade and catering, transport, financial and business services).[3] Due to a small survey sample that increases the possibility of biased parameter estimates, he modeled the impact of a firm's precautionary measures on involuntary employee absences using a two-stage estimation technique. The first endogenous measurement equation estimated a set of

[3] The data were originally collected in a previous study, Bosch and de Kok (1997).

latent variables that measure a firm's efforts to curb involuntary absences by using several indicator variables as proxies. These were in turn used in the second-stage maximum likelihood structural equations estimation that measured the impact of these efforts on the employee's involuntary absences. He found that small and medium-sized enterprises are less likely to consider absenteeism a significant problem and less likely to take precautionary actions against involuntary absenteeism.

Pauly et al. (2002) constructed a general theoretical model without using any empirical analysis. This model examined the production function effects of employee absenteeism for the firm in different situations. Starting with a baseline model where all labor is homogeneous, the study examined the effects of varying the production function, including team production, employee penalties for output shortfalls, full employment and less than full employment. They found that small businesses are more likely than large businesses to suffer losses due to absenteeism. This is due to the inability to hire additional employees to offset small probabilities of absence for their small worker pool. The team production scenario and the penalty for shortfalls scenario are viable possibilities for use in this study.

Navarro and Bass (2006) provided an overview of the problem of employee absence and its associated costs by summarizing several surveys, including the 2005 CCH Business Compliance Group survey and the 2003 survey by the Society of Human Resource Management. They suggested that absenteeism costs could amount to nearly 15% of payroll for some companies. They also noted that only 20% of large companies track the cost of absenteeism and only a third track leave utilization.

Nicholson et al. (2006) examined the effect of absenteeism on employee productivity as a percentage of employee wages. The authors hypothesized that the loss of productivity would exceed the absent workers' wages for two reasons. First, it may be difficult to find perfect substitutes for the absent employees, particularly on short notice. Second, the employees' jobs may involve teamwork and thus adversely affect the productivity of other employees. Using data collected through surveys of over 800 managers and covering 57 jobs in 12 industries, the authors found significant evidence to support their hypothesis. The average productivity loss was 1.28 times the absent employees' wages, although there was significant variation across occupations.

Findings

There is little existing evidence in the literature about the type and magnitude of disruption that firms experience when their reservist employees or reservist owners are activated and most of what there is uses less than rigorous econometric techniques to analyze the results. While some studies do hint at a differential impact of activation and/or other forms of employee absence by firm size, much of this is based on anecdotal evidence. In our analysis we provide an empirical starting point from which future analysis may expand and refine these findings.

3. Data Description

The analysis uses data from two sources: 1) the DOD's Defense Manpower Data Center (DMDC) Civilian Employer Information (CEI) database that matches firm-level data to up-to-date, individual-level data on reservists, including activation/deactivation dates; and 2) the Dun and

Bradstreet Data Universal Numbering System (DUNS) which provides financial and firm demographic data. The DMDC data were provided through the sponsorship of the Office of the Assistant Secretary of Defense for Reserve Affairs [OASD(RA)].[4]

DOD established a database of employer information that is submitted by Reserve members. When the database was established in 2001, participation was voluntary; however, a new DOD initiative made reporting mandatory beginning in August 2004. By August 2006, the compliance rate for reporting data to the database was 91 percent for the Selected Reserve and 30 percent for the Individual Ready Reserve and Inactive National Guard. There are some concerns about the validity of the information contained in the database, particularly concerning the updating process. Employment changes of reservists and their employers may not be updated in a timely fashion, and although Dun and Bradstreet verifies the accuracy of new firm data submitted, it is unable to verify changes in many small businesses or to update any reservist job changes until reported in a new survey.

Using these data sources, we can identify differences in the characteristics of reservist employers. Compared with the employers of non-activated reservists and otherwise similar civilians, are the employers of activated reservists more or less likely to be small businesses? Are activated reservists concentrated in particular occupations? Are there any differential impacts on firms in particular industries?

Personnel Data Overview

The Reserve Personnel dataset consists of yearly demographic information on all reservists between September 11, 2001, and the end of fiscal year 2007. In total there are 9,590,659 records with 2,391,221 unique individuals. The dataset contains individuals from all Guard/Reserve components, including the Air National Guard, Navy Reserve, Army Reserve, Coast Guard Reserve, Air Force Reserve, Marine Corps Reserve and Army National Guard. The Reserve components are under the command of the Federal Government, while the Guard components fall under the authority of individual states.

Figure 1 shows the number of reservists for each component by year. The Army Reserve and the Navy Reserve both decreased over the period, while the other components stayed relatively the same.

[4] The Civilian Employer Information database, the Reserve Activations database and the Reserve Master File all require a DOD sponsor for access.

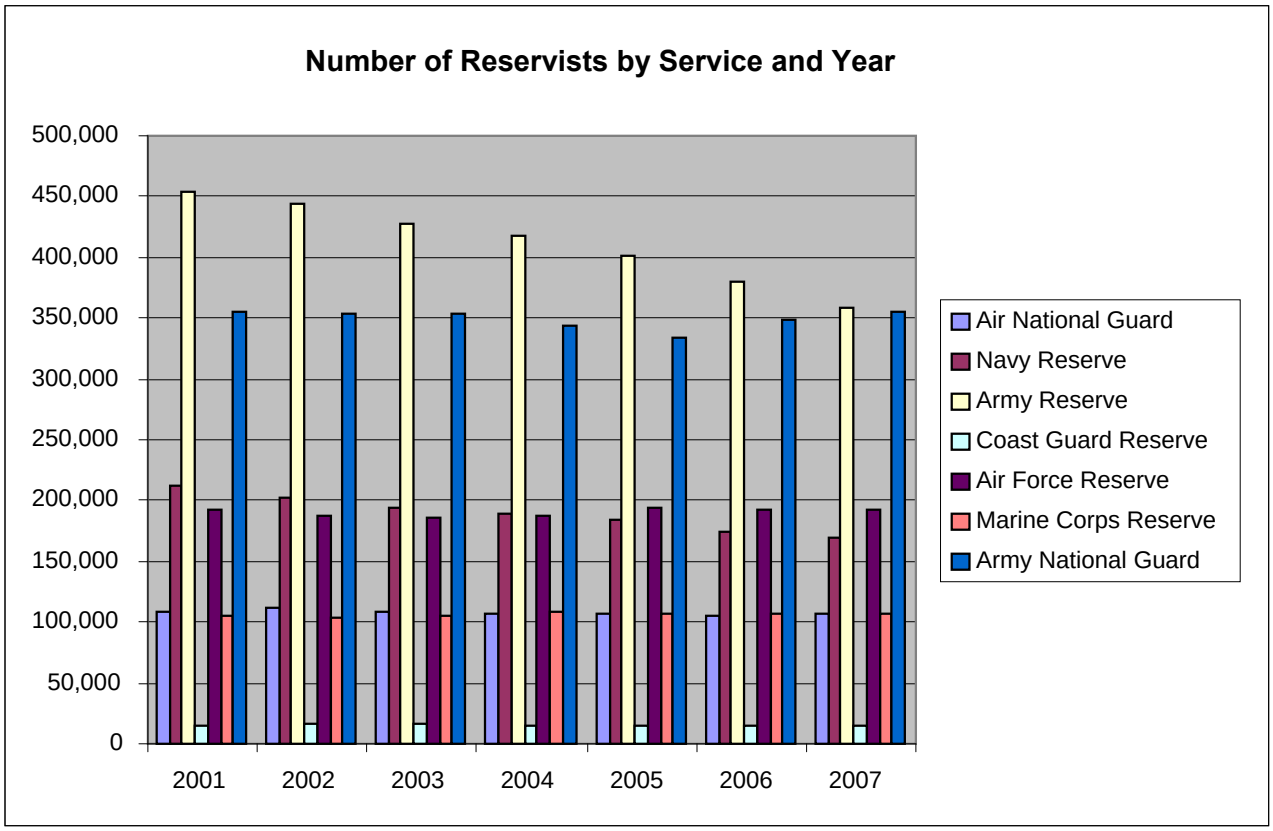

Figure 1: Number of Reservists by Service and Year

Table 1 shows the ratio of total active component members to total Reserve component members from 2002 until 2007. The Uniformed Services Almanac was used to determine the total for active duty military personnel. In 2002 the Army's force was split nearly evenly between Active and Reserve members, while the Coast Guard had over twice as many Active as Reserve members. Overall, the Army, Navy and Coast Guard have seen a decrease in the proportion of reservists in their total force. The Marine Corps and Air Force have maintained relatively stable proportions in the number of active duty to Reserve personnel.

Table 1: Ratio of Active to Reserve Component Personnel

Year	Army	Navy	Marine Corps	Air Force	Coast Guard
2002	1.08	1.84	1.66	1.86	2.20
2003	1.13	1.96	1.66	1.96	2.34
2004	1.18	1.99	1.64	1.97	2.46
2005	1.23	2.00	1.66	1.92	2.50
2006	1.28	2.04	1.67	1.82	2.55
2007	1.40	2.03	1.67	1.79	2.67

The change in the number of Reserve and Guard members between 2002 and 2007 can be seen in Table 2. Overall, there was a decline in all components, with the Navy Reserve and Army Reserve decreasing the most. The Marine Corps Reserve experienced the largest increases, primarily in the two years following the start of Operation Iraqi Freedom.

Table 2: Change in Reservist Count by Component and Year

Year	Air National Guard	Navy Reserve	Army Reserve	Coast Guard Reserve	Air Force Reserve	Marine Corps Reserve	Army National Guard
2002	3.31%	-5.18%	-2.11%	1.64%	-2.67%	-1.10%	-0.47%
2003	-3.51%	-4.14%	-3.75%	0.57%	-0.97%	1.07%	-0.28%
2004	-1.22%	-2.00%	-2.16%	-1.79%	1.54%	2.94%	-2.51%
2005	-0.37%	-3.06%	-4.07%	-0.08%	2.92%	-1.26%	-2.81%
2006	-0.73%	-4.72%	-5.40%	-0.28%	-0.99%	0.79%	4.00%
2007	0.56%	-3.11%	-5.51%	-3.60%	0.27%	0.26%	1.98%
Total	-1.95%	-22.20%	-23.00%	-3.53%	0.11%	2.71%	-0.08%
Average	-0.32%	-3.70%	-3.83%	-0.59%	0.02%	0.45%	-0.01%

On average over all years, the Army Reserve and Army National Guard make up the largest portions of the Reserve and Guard forces, 30.02% and 25.52%, respectively. The Air Force Reserve and Navy Reserve make up 13.89% and 13.81% of total Reserve force, and the Air National Guard and Marine Corps Reserve make up 7.87% and 7.76%, respectively. The Coast Guard Reserve is the smallest component of the total Reserve and Guard forces at 1.14%. These data are reflected in Table 3 below.

Table 3: Percent of Total Force by Component and Year[5]

Year	Air National Guard	Navy Reserve	Army Reserve	Coast Guard Reserve	Air Force Reserve	Marine Corps Reserve	Army National Guard
2001	7.52%	14.74%	31.43%	1.08%	13.31%	7.27%	24.65%
2002	7.90%	14.22%	31.30%	1.11%	13.18%	7.31%	24.97%
2003	7.79%	13.93%	30.79%	1.15%	13.34%	7.55%	25.44%
2004	7.79%	13.83%	30.52%	1.14%	13.72%	7.88%	25.12%
2005	7.93%	13.69%	29.90%	1.16%	14.43%	7.94%	24.94%
2006	7.99%	13.23%	28.69%	1.18%	14.49%	8.12%	26.31%
2007	8.15%	13.00%	27.49%	1.15%	14.74%	8.26%	27.21%
Average	7.87%	13.81%	30.02%	1.14%	13.89%	7.76%	25.52%

Personnel Demographics

The data provided by DMDC originally had 25 different education categories. These were aggregated into 6 values, which include: less than high school, high school diploma, some college, BA/BS degree, graduate school or more, and unknown. A crosswalk between the 25 original education categories and the 6 aggregated categories can be viewed in Table 13 in Appendix A. The Coast Guard Reserve data is from 2004 until 2007.

For the period of this study, the Air National Guard had the highest level of education, with about 10% of their force having only high school diplomas and approximately 90% having at least some college education. On the other hand, the Marine Corps Reserves had the lowest level of education,

[5] Can also be seen in Figure 5 in Appendix A.

with approximately 84% of their force having only high school degrees and about 15% having at least some college. It is important to note that the Marine Corps Reserves also have the highest ratio of enlisted personnel to officers, with approximately 10 enlisted to each officer. Generally speaking, enlisted personnel are required to have a high school diploma, and officers are required to have a four-year degree, respectively. The educational breakout by service is presented in Table 4 below.

Table 4: Education by Service

Year	Air National Guard	Navy Reserve	Army Reserve	Coast Guard Reserve	Air Force Reserve	Marine Corp Reserve	Army National Guard
Less than High School	1.15%	1.80%	3.45%	1.31%	0.51%	0.46%	7.05%
High School Diploma	9.69%	51.74%	56.15%	52.68%	55.22%	83.95%	67.66%
Some College	69.32%	12.09%	9.39%	23.02%	9.51%	2.85%	11.42%
BA/BS Degree	13.72%	19.30%	15.91%	14.16%	20.41%	9.44%	11.12%
Graduate School	4.61%	8.29%	7.63%	2.78%	13.37%	2.70%	2.66%
Unknown	1.50%	6.77%	7.47%	6.06%	0.98%	0.59%	0.08%

Marital status shows very little variation between 2001 and 2007. On average over all years, 38.32% of all reservists were never married, 52.15% were married, and 6.61% were divorced. On average, females made up 16.49% of the Reserve and Guard total force.[6] By component, the Marine Corps Reserve had the lowest percent of females, 5.49%. The Air Force Reserve had the largest proportion of females, 20.88%.

The percentage of enlisted reservist and Guard members who are married increases with pay grade, which we assume is due to the fact that pay grade is a close proxy for age. For example, enlisted members are overwhelmingly new high school graduates (age 18) at pay grade E01, so it is not surprising that almost 90% of these individuals are unmarried.[7] In contrast, nearly 85% of members at pay grade E09 (age 40+) are married. Officers show less variation in marital status across pay grade.[8] This is most likely because of a higher starting age due to the college degree requirement. Warrant officers probably have higher levels of marriage due to the increased age that is required to hold these positions.[9]

On average, 39.34% of reservists had no children, 19.68% had one child, 13.28% had two children, 13.66% had three children, 5.72% had four children, 1.81% had five children, 0.68% had six or more children, and 5.84% had an unknown number of children. Overall, each reservist had an average of 1.24 children. As age increases, indicated by higher pay grades, so does the prevalence of dependents. Enlisted personnel show the greatest degree of variation: almost 85% of E-1s have no dependents, while less than 10% of E-9s have none.[10] The number of dependents also increases for commissioned and warrant officers, but the variation across pay grades is much more modest.[11]

[6] Can be seen in Figure 7 in Appendix A.
[7] Can be seen in Figure 8 in Appendix A.
[8] Can be seen in Figure 9 in Appendix A.
[9] Can be seen in Figure 10 in Appendix A.
[10] Can be seen in Figure 11 in Appendix A.
[11] Can be seen in Figures 12 and 13 in Appendix A.

Enlisted pay grades for the Reserve and Guard range from E01 to E09. The primary composition for the enlisted ranks is E04s through E06s, with the E04s being the largest single grade for enlisted personnel.[12] The Air National Guard and Air Force Reserve, which require their enlisted personnel to have stronger technical skills, have a personnel composition that weighs more heavily on E05s through E07s. Other components, such as the Marine Corps Reserve, have a larger proportion of more junior enlisted personnel.

The officer and warrant officer pay grades range from O01 to O08 and W01 to W05, respectively, with some services excluding some or all of the warrant officer grades. Most commissioned officers are in pay grades O03 through O05.[13] The Army National Guard has a higher percentage of O01 and O02 than the other components. The majority of warrant officers in the Reserve and Guard units are WO2s through WO4s.[14]

Activation Data Overview

The activation dataset contains 1,047,773 records of 633,893 unique individuals in the Reserve and Guard who were activated between September 1, 2001, and February 29, 2008.[15] This data provide the start and end dates of each activation. A length of activation field was created using the difference in the start date and the end date for each record. Records for individuals with activation periods of less than one month were censored. Finally, we assumed that individuals without end dates were still activated and they were given an end date of February 29, 2008 (the end of our sample period).

Figure 2 shows the distribution of activations by month. The average number of activations per month was 14,752 and the median was 12,000. The largest number occurred in February 2003 (75,165 activations), a month before the commencement of Operation Iraqi Freedom. The smallest number occurred in June 2002 (5,602 activations). The average length of activation was 267 days, while the median was 256 days. The maximum length of activation was 2,362 days. It is policy to restrict Reserve activations to two years or less.[16]

[12] Can be seen in Figure 14 in Appendix A.
[13] Can be seen in Figure 15 in Appendix A.
[14] Can be seen in Figure 16 in Appendix A.
[15] 44 records were deemed to be duplicates and were deleted.
[16] www.Army.com, June 9, 2008.

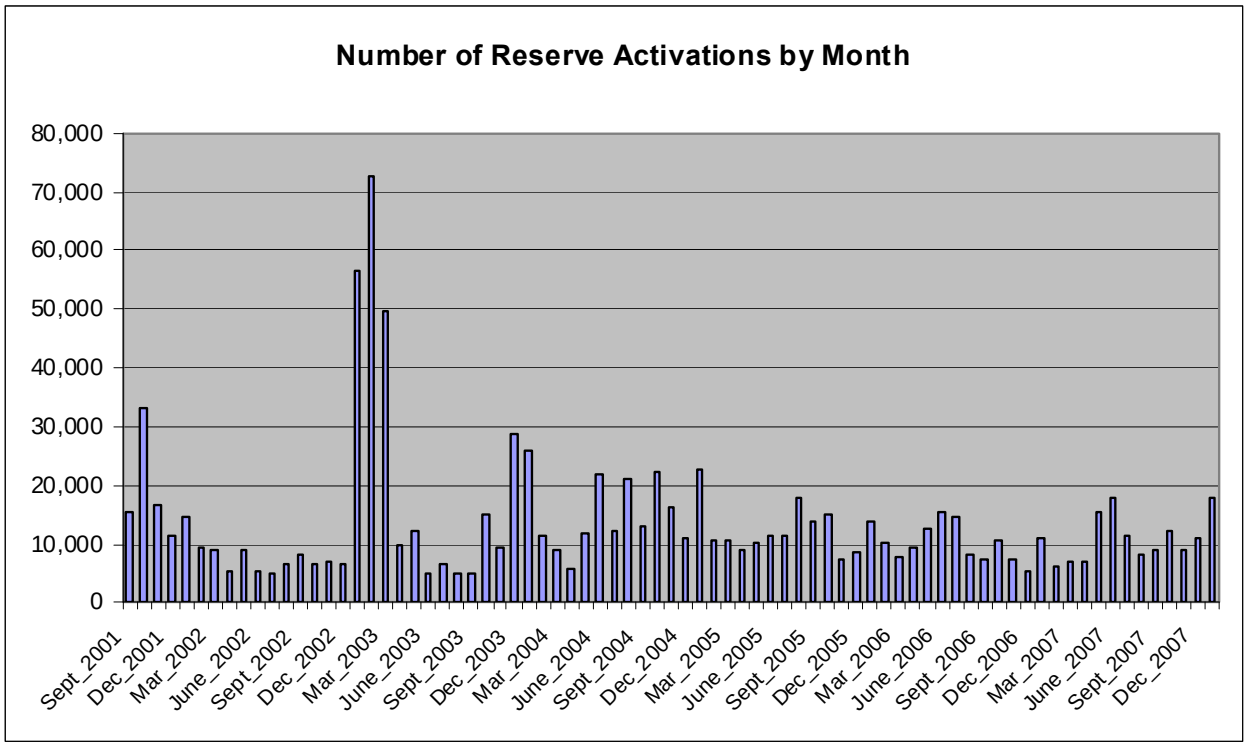

Figure 2: Number of Reserve Activations by Month

Table 5 shows the length of activation by component from 2001 through 2007. There is a large disparity in length of activation across components, mainly depending on the needs of the component service.[17] The Air National Guard and Air Force Reserve both have numerous short activations, with over 75% of all activations being for less than 6 months. The Navy Reserve and Marine Corps Reserve primarily have activations between 6 months and 1 year in duration, both with over 45% of all activations within this time frame. The Army Reserve and Army National Guard have the longest activations, with approximately 40% of all activations between 1 year and 1.5 years. The Coast Guard Reserve has the greatest number of activations over two years long, with over 17% within this time frame.

Table 5: Length of Activation by Component

Time Frame	Air National Guard	Navy Reserve	Army Reserve	Coast Guard Reserve	Air Force Reserve	Marine Corp Reserve	Army National Guard
Less than 6 Months	76.85%	18.75%	20.03%	32.16%	75.96%	16.98%	17.17%
6 Month to 1 Year	13.44%	55.06%	24.73%	13.52%	11.34%	46.78%	24.20%
1 Year to 1.5 Years	5.87%	15.42%	39.35%	29.20%	8.41%	23.73%	44.54%
1.5 Years to 2 Years	2.77%	8.07%	10.65%	7.32%	1.80%	6.67%	9.71%
Greater than 2 Years	1.08%	2.69%	5.24%	17.79%	2.49%	5.86%	4.37%

[17] Can be seen in Figures 17 through 24 in Appendix A.

The average length of activation increased in 2002, coincident with the beginning of operations in Afghanistan. The average length of activation increased from 273 days in 2000 to about 295 days in 2002. Increases in activations occurred almost immediately after September 11, 2001, in the Air National Guard, Air Force Reserve and Coast Guard Reserve.[18] Activations in the Army National Guard, Army Reserve and Marine Corps Reserves began to lengthen in 2003 as force levels in Iraq grew.

Employment Data Overview

The Civilian Employer Information (CEI) database used in this study is a dataset containing 1,151,763 records from a self-reported survey on employment information of Reserve and National Guard component members. DOD began collecting data after September 11, 2001, subsequent to an increase of activations of reservists. Participation was voluntary until it became mandatory in August 2004. Since becoming mandatory, the participation rate of reservists has increased, reaching 60% in 2005, and 77% in 2006, including 91% participation by the Selected Reserves.

Information collected through surveys is known to contain errors, and therefore it is important to scrutinize the validity of this dataset. Several errors are observed in the CEI data. First, there are only end dates of employment for 39,521 individuals. It appears that end dates are not updated when new employment is inserted for an individual who is already in the database. Second, total firm size fluctuates greatly between individuals who are employed by firms with the same DUNS number, which could be related to changes over time. Third, only 14% of records possess DUNS numbers, which could be a result of a large number of employers without DUNS Numbers.

Since checking the validity of each record would be cumbersome, broad rules were applied to create a subset of the total population of 698,853 records that have a valid Standard Occupational Code (SOC), Begin and End employment dates, and unique ID.[19]

The U.S. Census Bureau industry and occupation crosswalk was used to translate the SOC codes into Census Occupation Codes (COC).[20] Adding the COC consolidates the population to 460,451, which were divided into 3 industry groups as follows: 30.54% worked in professional settings, 40.53% in services and 28.93% in manufacturing. Overall, self-employed individuals make up only 6.5% of the all respondents with valid COC values. Self-employed individuals are more likely to work in the professional group than those not self-employed.[21] Self-employed individuals were also less likely to work in service industries, as opposed to those not self-employed.

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[18] Can be seen in Figure 25 in Appendix A.

[19] The actual logic on CEI restrictions follows. Records in the CEI data must agree with the all of the following rules to be considered valid.

Where SOC <> ('WW-WWWW' **or** 'ZZ-ZZZZ' **or** '00-0000' **or** '99-9999')
And Begin Date < 02/29/2008
And End Date < 02/29/2008
And (Begin Date < End Date **or** End Date = '00000000')
And ID > 0

[20] http://www.census.gov/hhes/www/ioindex/cens_900_975.html , 06/18/2008.

[21] Can be seen in Figure 26 in Appendix A.

Smaller firms (fewer than 100 employees) were the primary employers of those Selected Reserve members working in the private sector. According to DoD, nearly 70% of the employers of Selected Reserve members fit this definition of small businesses.[22] DoD data also indicate that 62% of private sector employers of reservists had fewer than 50 employees; 39% employed fewer than 10; and 28% had from 1 to 4 employees.[23]

The length of employment was calculated by finding the difference between the start and end date of employment. Individuals with null end dates were not included. In total, 39,521 individuals had both start and end dates, with an average length of employment of 4.2 years. Almost 50% of employment lasted 2 years or less, with the maximum employment being 52 years.[24]

Firm Data

The Dun and Bradstreet database consists of seven yearly datasets from 2001 until 2007. In each year there are 172,971 records with unique DUNS numbers. Many of these records, however, show zero employees and sales, and are filtered from the estimation dataset. Other records are consolidated with a Headquarters (HQ) DUNS record associated with a parent organization. The average number of records represented by a DUNS number was 91,359, of which on average 49,315 were attached to a HQ DUNS number. On average, there were 16,181 unique HQ DUNS numbers per year. This data are broken out by year in Table 6 below.

Table 6: Count of DUNS and HQ DUNS Numbers

Year	DUNS	HQ DUNS numbers	Unique HQ DUNS Numbers
2001	75,659	41,276	14,718
2002	81,843	45,143	15,558
2003	86,509	48,215	15,944
2004	92,419	50,416	16,499
2005	99,248	52,553	16,739
2006	102,092	53,646	16,903
2007	101,744	53,957	16,903
Average	91,359	49,315	16,181

Approximately 78% of the records represent small businesses with 100 or fewer employees, 14% were of medium-sized businesses with between 101 and 500 employees, and 9% represented large businesses with more than 500 employees.[25] The data for the HQ DUNS numbers provided much

[22] March 2007 DMDC data used by DOD in its *Interim Report to Congress of the Special Working Group on Transition to Civilian Employment of National Guard and Reserve Members Returning from Deployment in Operation Iraqi Freedom and Operation Enduring Freedom*, November 2007 (http://www.defenselink.mil/ra/html/publications.html). While an imperfect comparison, the Census Bureau's March 2007 Supplement to its *Current Population Survey* reported that 49% of private-sector employees work for firms with fewer than 100 employees (http://dataferrett.census.gov).

[23] August 2006 DMDC data as reported by the U.S. Government Accountability Office (GAO) in "Additional Actions Needed to Improve Oversight of Reserve Employment Issues," GAO-07-259, February 2007.

[24] Can be seen in Figure 29 in Appendix A.

[25] The Office of Advocacy, U.S. Small Business Administration, for research purposes usually defines small firms as those having fewer than 500 employees.

different size ratios as firms with fewer than 100 employees are much less likely to have multiple locations, with 18% being from small businesses, 30% from medium-sized businesses, and 52% from large businesses. To get a comprehensive view of the data, records were assigned HQ DUNS data when available and regular DUNS data when the headquarters data was absent. This was done in order to group all subsidiary businesses with their parent organization and to include firms without parent organizations. The combined data, seen in Figure 3, show that 72% of the records were from small businesses, 16% were from medium-sized businesses, and 13% were from large businesses.

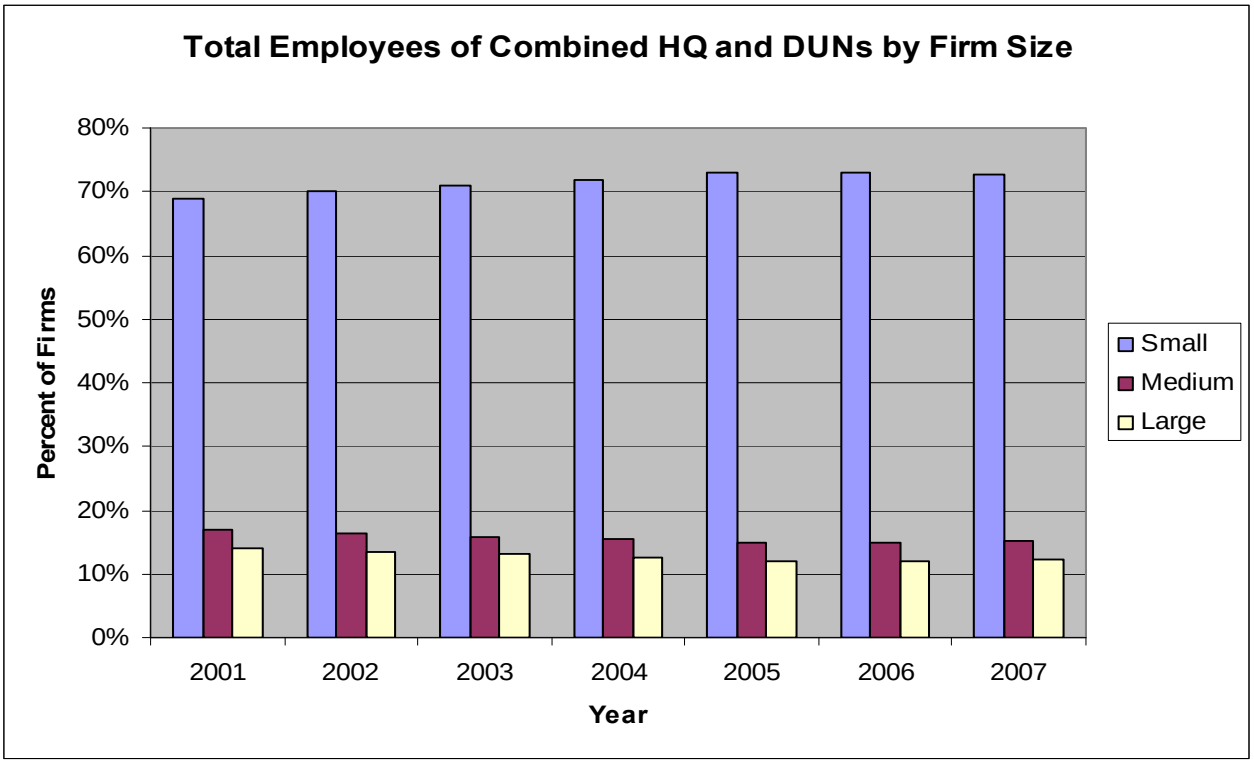

Figure 3: Total Employees of Combined HQ and DUNS by Firm Size

Firm sales were classified into categories of $100,000 or less, between $100,000 and $1 million, between $1 million and $10 million, between $10 million and $100 million, and $100 million or greater. When looking at data from records with individual DUNS numbers, approximately 76% of businesses had sales of $10 million or less per year, while only 7% had sales of over $100 million. Using the HQ DUNS data, approximately 78% of firms had sales of $10 million or more per year, while less than 4% had sales of less than $1 million. The combined data in Figure 4 show that 80% of firms had annual sales of between $100,000 and $100 million.

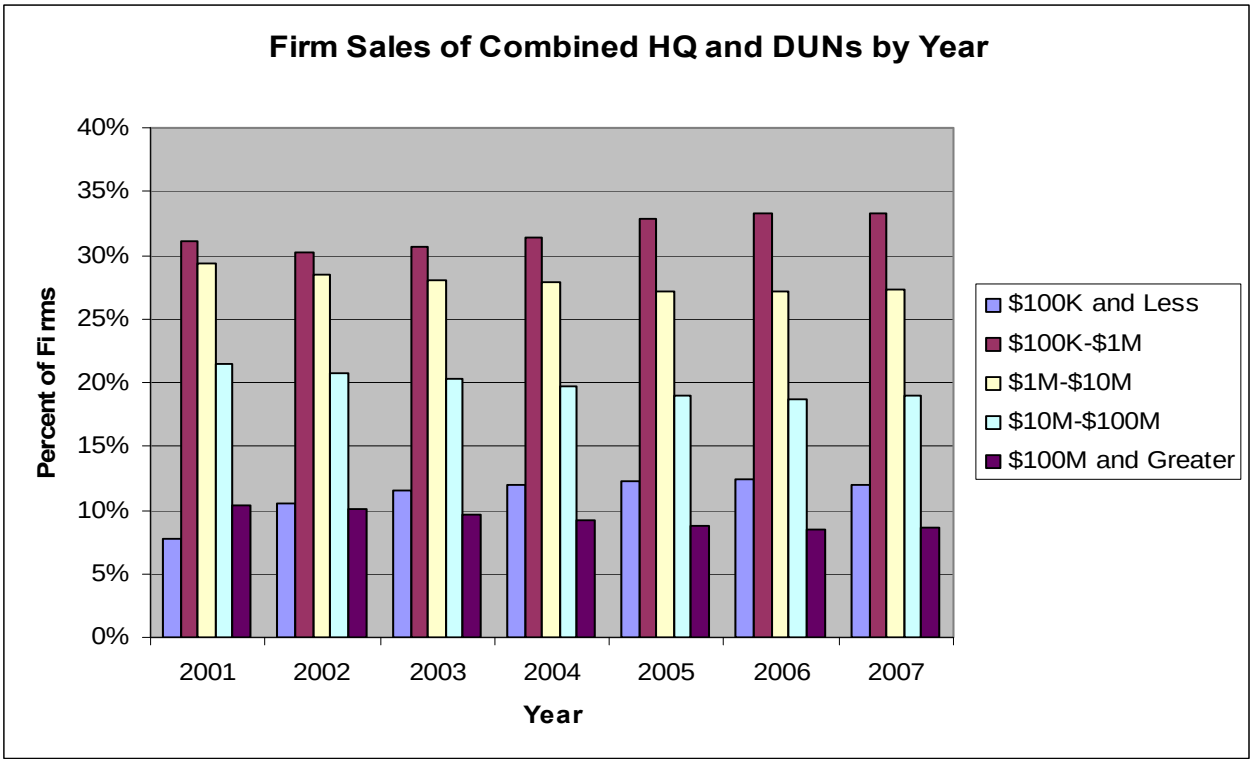

Figure 4: Firm Sales of Combined HQ and DUNS by Year

4. Hypothesis

The hypothesis that this study addresses is that extended absences by employees because of Reserve activation have a disproportionate impact on small businesses. Because they have fewer employees, small businesses face greater difficulties adjusting to extended absences and redistributing work when reservists return. There are measurable differences between the productivity effects of small and large firms in terms of income, profitability, or both when reservist employees are called to active duty. We address the hypothesis by comparing the characteristics of firms employing activated reservists with the characteristics of firms employing non-activated reservists and a sample of similar employees with no Reserve experience. We also estimate a model of firm performance as a function of Reserve activation.

5. Model Description

The Department of Defense maintains a database for reservists with employee-provided information on their employers. Reporting for this database was initially voluntary but is now mandatory for all Reserve personnel, and the Office of the Secretary of Defense (OSD) estimates that the database currently covers about 90 percent of members of the Selected Reserve. This database can be linked to other DOD data that identify which reservists have been activated and for how long.

In order to address the hypothesis that extended absences by employees because of Reserve activation have a disproportionate impact on small businesses we must analyze the differences in the characteristics of reservist employers. We assume that because they have fewer employees, small businesses face greater difficulties adjusting to extended absences and redistributing work when reservists return and that we shall be able to measure differences between the productivity effects of small and large firms in terms of income, profitability, or both when reservist employees are called to active duty. The DOD data do not contain a measurable performance metric for the employers affected by Reserve activation but OSD has attempted to merge the data with firm data from Dun & Bradstreet.

The Dun & Bradstreet Corporation (D&B) provides credit information on businesses and corporations using its Data Universal Numbering System (DUNS) identifiers, assigned to over 100 million global companies. These numbers are linked to business information reports that include data such as: credit terms, principal's history, financials, liens, sales, number of employees, etc. The DUNS system is used by all major banks and finance companies as well as by Federal agencies. A DUNS number is required for many U.S. Federal Government transactions and corporate research.

Using these two data sources, we can analyze differences in the characteristics of reservist employers as compared with the employers of non-activated reservists and otherwise similar civilians. Are the employers of activated reservists more or less likely to be small businesses? Does reservist activation have a proportionately more negative effect on small business? Are activated reservists concentrated in particular occupations?

Reservist activation may disproportionately affect small businesses in at least two ways. First, a higher number of activated reservists may be drawn from small firms than would be expected given their relative share of the total civilian workforce. Second, the average activation may have a greater relative impact on smaller firms in terms of productive hours lost. Previous work has shown that productivity losses from absenteeism are larger for small firms than larger firms. Employees who have no perfect substitutes within the local production unit cause productivity losses to their firms in excess of their wages. In firms with a small number of employees, those employees may be more likely to perform a large number of tasks and be more difficult to replace.

We develop a model of firm performance with particular emphasis on the effects of Reserve activation and firm size.

The initial step is to determine the percent activated by firm (i) and year(t)

$$\%\text{Activated}_{t,i} = \frac{\text{Number of Activated Reservists}_{t,i}}{\text{Total Number of Employees}_{t,i}}$$

where the Total Number of Employees is the reported total in the Dun & Bradstreet DUNS dataset. These numbers can be adjusted by changing the annual length of time activated (either 30 days or 180 days). Firm sizes of zero were removed from the sample. Next, we calculate the percent change in sales by firm and year.

$$\%\text{Change in Sales}_{t,i} = \frac{\text{Sales}_{t+1,i} - \text{Sales}_{t,i}}{\text{Sales}_{t,i}}$$

The general model is shown below, where dummy variables will be used for industry and firm size. Both are binary variables with a value of 1 for industry X or if the firm is a small business and 0 otherwise. Firm size can be adjusted by changing the definition of a small business (either under 100 employees or under 500 employees).

$$\%ChangeinSales_i = \alpha_1 FirmSize_i + \beta_1 \%Activated_i + \gamma_1 Ind1_i + \gamma_2 Ind2_i + ...\varepsilon_i$$

The dependent variable will be the change in sales during the relevant time period, and the independent variables will be firm size, percent activated, and industry-related demographic dummy variables. The model will also include an interaction variable between the percent activated and the small business term in order to determine whether the effect of Reserve activation is disproportionate on small firms. We will proceed to determine the effect of industry, firm size and percent activated on the financial well-being of the firms. The model is estimated using Ordinary Least Squares (OLS) regression.

We hypothesize that firm size has a positive effect on percent change in sales (i.e., small firms will show a greater share change in sales, which is most likely a sales loss, than large firms due to activation). We also expect that the percent activated will have a positive effect on percent change in sales (i.e., the more reservists activated as a percent of the firm's total employees, the greater the change in sales). Industry effects are less predictable, but we would expect that those industries which have higher activation rates, such as construction, security, and medical, will have greater percent changes in sales relative to other industries.

6. Results

Two primary data sources are used to explore the impact of reserve activations on businesses. These sources are Dun & Bradstreet, which provides the Data Universal Numbering System (DUNS) database, and the Defense Manpower Data Center (DMDC) which provides the Civilian Employer Information (CEI) database and the Activations database. The data in these databases ranges from 2001 to 2007.

The Dun & Bradstreet database provides firm information defined by DUNS numbers that are categorized by hierarchy. Local data are used for firms with a single location, but those firms with several locations are consolidated into one firm-wide data point for number of employees and sales figures. The variables of interest are year, total sales, and number of employees. Unique DUNS numbers extract these for the model for each year.

The Dun & Bradstreet data are used to create several variables. The first variable, DELTA_SA, is defined as the percentage change in sales this year compared with the sales of the previous year. The second variable, AVE_EMP, represents the average number of employees over the range of data where the firm has a positive number of employees. This variable is then used to define a dummy variable indicating whether the firm qualifies as a small business (SMALL100). The last

variable is BANKRUPT, a dummy variable that uses the bankruptcy date to determine if the firm filed for bankruptcy during that particular year.

The CEI database is filtered to determine which jobs individuals held each year. It is assumed that each individual holds only one job at a time; therefore, data for the current job are used for each corresponding year. The CEI-filtered data are cross-referenced to the Reserve Personnel database in order to confirm that individuals are active in the Reserves in each corresponding year.

The data from the CEI are used for two purposes: first, to connect the Dun & Bradstreet and Activation databases, and second, to determine the industry classification for each firm. Each firm is assigned a dummy variable to indicate the self-reported industry based on Standard Industrial Classification (SIC) codes.[26] Table 7 presents the distribution of industries by the firms in our sample.

Table 7: Firm Industry Distribution

Variable	Percent	Description
IND_1	2%	Agriculture, Forestry, and Fishing
IND_2	1%	Mining
IND_3	5%	Construction
IND_4	16%	Manufacturing
IND_5	7%	Transportation, Communications, Electric, Gas, and Sanitary Services
IND_6	8%	Wholesale Trade
IND_7	15%	Retail Trade
IND_8	6%	Finance, Insurance, and Real Estate
IND_9	41%	Services

The Activations database is used to create two variables indicating the count of individuals who are activated each year for at least 30 or 180 days. The Activations database is connected with the CEI and Dun & Bradstreet databases to provide these counts by each individual firm. The variables for percent activated (PERACT30 and PERACT180) are calculated by dividing the firm's number of activated individual reservists by its number of employees.

When examining the percent change in sales variable (DELTA_SA), we found what were assumed to be two validity problems. First, some sales totals had no variation over several years. We assumed that this occurred because no new data were reported for the current year. Second, some sales totals showed extreme variation across years, resulting in a change of several hundred percent or more. We assume that there was an error in either reporting or recording the magnitude of sales figures for firms with excessively large changes in sales. Therefore, we filtered records that had no change in sales or that more than doubled over a one-year period in order to eliminate some of these validity problems.

Table 8 presents the primary variables used in the model and their means. Results are provided for both an unfiltered and filtered dataset. The unfiltered dataset has average sales of approximately

[26] The CEI database reports both NAICS codes and the older SIC codes. SIC was chosen due to the availability of a crosswalk table that was used in a previous SBA report.

$141 million and an average number of employees of 2,640. When the filters described above are applied to the data, average sales and average employees increased to approximately $181 million and 3,878 employees per firm. The bankruptcy variable shows that approximately one in every 1,000 businesses filed for bankruptcy over the range of the dataset, and small businesses of 100 or fewer employees made up approximately 32% of the sample. About two out of every 1,000 employees were activated for 30 days or more in the unfiltered data, with about one out of 1,000 in the filtered data. The interactive variable has a mean that was approximately the same for both the unfiltered and filtered datasets. The change in sales was approximately 45 times the previous year's sales in the unfiltered data, which caused concern over the validity of this variable. The change in sales variable, now normalized between 1 and –1 in the filtered data, has an average change of positive .1%.

Table 8: Variable Description and Means

Variable Name	Description	Unfiltered Mean	Filtered Mean
SALES	Sales ($K)	141,060,916	181,279,616
DELTA_SA	Change in sales	45.1856	0.0013
BANKRUP0	Bankruptcy dummy variable	0.0097	0.0012
EMP	Number of employees	2,640.1	3,878.5
PERACT30	Percent activated 30 days and over	0.0025	0.0014
INTACT30	Equal to PERACT30*SMALL100	0.0021	0.0036
SMALL100	Businesses with 100 or less employees	0.3161	0.3057

The OLS model is used to estimate the percent change in sales (DELTA_SA) as the dependent variable. The model includes the following explanatory variables: percent activated for 30 days or more (PERACT30), small business with 100 employees or fewer (SMALL100), the interaction term (INTACT30), and industry dummy variables. Industry 9 is assigned as the omitted dummy for all model runs. The interaction term is included to determine whether the effect of activations is different for small firms.

The results of the estimation, shown in Table 9, provide support for our initial hypothesis. First, we find that the percentage of employee activation of 30 days or more had a negative effect on change in sales. Second, businesses of 100 or fewer employees are more likely to experience negative sales growth compared with large firms. Third, we see a positive, significant coefficient on the interaction term, meaning that activations have a smaller effect on small firms than on large firms. The typical small business saw a 3.2 percentage point decrease in sales relative to an otherwise similar large firm. The marginal effects of reserve activations were very small in absolute terms: a 100% increase in the percent activated results in a .05 percentage point decrease in sales.

Table 9: Change in Sales - Filtered Interactive

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	0.0035078	0.0031891	0.2714
PERACT30	-0.9188452 *	0.2895303	0.0015
SMALL100	-0.0324184 *	0.0057890	0.0000
INTACT30	0.7856073 *	0.3255108	0.0158
IND_1	-0.0779210 *	0.0242496	0.0013
IND_2	0.0010921	0.0310107	0.9719
IND_3	0.0148720	0.0104076	0.1530
IND_4	-0.0044524	0.0057328	0.4374
IND_5	0.0334771 *	0.0077838	0.0000
IND_6	0.0114311	0.0083053	0.1687
IND_7	0.0031103	0.0074029	0.6744
IND_8	0.0190667 *	0.0094441	0.0435

R-squared = 0.0027139

* Significant at the .05 level

The coefficient on the interaction term suggests that small firms are less affected by Reserve activations than are large firms. That is, the positive coefficient on the interaction term partially offsets the negative effects of the coefficient on PERACT30. However, recall that Reserve activations are measured in relative terms (percent of workforce activated), and one of the reasons for our original hypothesis was that each reservist activated had a larger relative impact on a small business employer than on a large business. To test this contention, we simulated the effects of a single reservist activation on typical small and large firms from our sample. Using the means of the explanatory variables for small and large firms in the sample, we calculated the marginal effect on sales of activating one additional employee for each type of firm.

Not surprisingly, the change in *percent* activated was much larger for the average small firm. Small firms have an average of 0.15 employees per firm activated in a given year; larger firms have about 2.4 employees per firm activated. However, in relative terms, a higher proportion of small-firm employees (0.36% versus 0.05%) are activated. Adding one more employee per firm increases the percent activated in small firms to 2.6% but only increases the percent activated in large firms to 0.06%. There was a correspondingly large impact on sales of small firms: an increase of one employee activated had a negative effect of 0.30 percentage points on the change in sales. The impact on large firms was also negative, but only 0.02 percentage points. In other words, the negative sales impact of activating an employee is about 15 times greater for the typical small firm compared with the average large firm in our sample.

In addition to the main specification discussed above, we tested several alternative specifications of the Change in Sales model. We also estimated two binary probability models to determine whether activations had an effect on the probability that a firm would declare bankruptcy or realize at least a 5% decrease in sales. These two models are referred to as the Probit Bankruptcy model and the Probit 5% Loss model.

Several OLS models were run using the unfiltered data and can be viewed in Table 16 through Table 20. These models used the normal OLS model, an OLS lagged model, OLS with the 180

percent activated variable, OLS with year variable, and OLS with the interactive variable. None of the models using the unfiltered data returned significant results for the explanatory variables.

The filtered data provided much more significant results. An OLS Change in Sales model, shown in Table 10, had similar significant coefficients as the primary model, which included the interaction term. Again, we find that percentage of employee activation of 30 days or more has a negative effect on change in sales and that businesses with 100 or fewer employees are more likely to experience negative sales growth. The marginal effect of the explanatory variables was calculated by inserting the mean values into the model. This indicated that small businesses had a 1.9 percentage point decrease in sales relative to larger firms, while an increase in percent activated of 10% had a –3.7 percentage point change in sales.

Table 10: Change in Sales – Filtered

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	0.0103138 *	0.0030879	0.0008
PERACT30	-0.3703531 *	0.1279291	0.0038
SMALL100	-0.0191772 *	0.0055720	0.0006
IND_1	0.0079956	0.0245763	0.7449
IND_2	0.0086260	0.0301768	0.7750
IND_3	0.0101819	0.0100822	0.3125
IND_4	-0.0027402	0.0055623	0.6223
IND_5	0.0302667 *	0.0075357	0.0001
IND_6	0.0091315	0.0080557	0.2570
IND_7	0.0047118	0.0071880	0.5121
IND_8	0.0187088 *	0.0091599	0.0411

R-squared = 0.0015436

* Significant at the .05 level

An additional OLS Change in Sales model with filtered data was estimated using the percent activated variable of 180 days or greater. The results shown in Table 22 are similar to our findings for the other specifications using filtered data. Both the percent activated and small business variables show significant negative coefficients. In this excursion, the marginal effect of being a small business caused a 3.0 percentage point decrease in sales. While the coefficient of percent activated at 180 days or more was significant, it would take a 1,000% increase in activations at this level to cause a 0.04 percentage point decrease on change in sales.

The Probit Bankruptcy model is estimated using the binary dependent variable, BANKRUPT, which indicates whether the firm declared bankrupt during the time period. Similar to the OLS Change in Sales model, it uses the following independent variables: PERACT30, SMALL100, and the industry dummy variables.

Table 11 shows the results of the Probit Bankruptcy model. Only two explanatory variables, Industries 4 and 5, were found to have significant results. The positive coefficient indicates that firms in manufacturing and transportation have an increased probability of filing for bankruptcy.

Table 11: Probit Bankruptcy

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	-3.0966664*	0.1227597	0.0000
PERACT30	0.8593904	0.7760742	0.2681
SMALL100	-0.2312401	0.1778953	0.1936
IND_1	-4.6950045	191,654.8060000	1.0000
IND_2	-4.7021193	212,262.4870000	1.0000
IND_3	0.1102880	0.3275048	0.7363
IND_4	0.3971233*	0.1542231	0.0100
IND_5	0.5488454*	0.1671664	0.0010
IND_6	-0.0282511	0.3168516	0.9290
IND_7	0.1463795	0.2152213	0.4964
IND_8	0.3360701	0.2237248	0.1331

Chi Squared 19.0675900

* Significant at the .05 level

An additional Bankruptcy excursion, seen in Table 23, was run with the variable PERACT180 substituted in place of PERACT30. This was done in order to determine the effect of extended activations. Industry 4 and 5 remained the only significant explanatory variables. Both retained their positive coefficients.

The Probit 5% Loss model creates a dummy variable indicating whether a firm had a 5% loss in the DELTA_SA variable or not. Similar to the previous models, the explanatory variables were: PERACT30, SMALL100, and the industry dummy variables.

Table 12 shows the results for the Probit 5% Loss model. Several of the explanatory variables returned significant results. PERACT30 returned a positive coefficient indicating that firms with larger percentages of activation have a higher probability of having change in sales of 5% loss or greater. SMALL100 returned a negative coefficient indicating that small businesses had a lower probability of having change in sales of 5% loss or greater. Industries 1, 7 and 8 had significant negative coefficients while industries 3 and 4 had significant positive coefficients.

Table 12: Probit 5% Loss

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	-1.3728556 *	0.0090091	0.0000
PERACT30	1.3715580 *	0.2160303	0.0000
SMALL100	-0.2031728 *	0.0128598	0.0000
IND_1	-0.3300386 *	0.0545459	0.0000
IND_2	-0.0924595	0.0741500	0.2124
IND_3	0.1142412 *	0.0257341	0.0000
IND_4	0.1390919 *	0.0152927	0.0000
IND_5	-0.0016587	0.0221866	0.9404
IND_6	0.0091607	0.0211749	0.6653
IND_7	-0.2018023 *	0.0183054	0.0000
IND_8	-0.0946447 *	0.0247309	0.0001

Chi Squared = 712.8361000

* Significant at the .05 level

Final Comments

We discovered several problems with the available data that required us to censor a number of observations. The CEI database did not have consistent quit dates for the employment records and the self-employed indicator was inconsistent. There also may have been some confusion by the reservists on some survey questions, as many indicated that they were employed full-time by the Reserves but reported a civilian work address and vice-versa.

The DUNS database also had several gaps in the sales data annual coverage, many of which were amended by simply carrying over the previous year's data. The absence of small firms and self-employed firms that do not belong to the DUNS subscription service also leaves a large amount of unreported data that could be useful.

To remedy these and other shortcomings it may be necessary to obtain a more complete dataset. One promising alternative is the Longitudinal Employer-Household Dynamics (LEHD) database, which contains employer-employee data linked by SSN and elements of state unemployment data. Rather than rely on voluntarily self-reported data, the LEHD includes firm-reported data on sales figures, start and quit dates of employment, self-employment, periods of unemployment, and annual updates on all data. This would resolve most problems that we encountered pertaining to gaps in the data and inaccuracies in employee-reported firm characteristics. Additionally, the use of state unemployment data substantially improves the ability to track individual job tenure.

While we have covered some new and unexplored territory with this analysis, several questions remain to be answered before major policy changes should be proposed. Our results must be qualified because of significant concerns regarding the quality of the data available for this research. We were unable to determine the extent of job changes for many reservists due to gaps in the self-reported employment data. There are missing firms in the DUNS data, mostly small businesses, since many have no interest in or use for subscribing to that database. There is also very limited

information on the number of self-employed reservists in the CEI employer database and no information at all on the effect of activation on employers' sales receipts.

We recommend additional study in order to determine the proper level of government policy adjustment to offset the detrimental effects of Reserve activation on small business. Further study should include special emphasis on the self-employed and those reservists who either change jobs or work at multiple jobs during the study period.

7. Conclusion

The results of this research could have immediate policy relevance due to the continued need for reservist deployment in Iraq and Afghanistan. The analysis indicates that smaller firms are the primary private-sector employers of Reserve and National Guard component members, with about 70% of these employers having fewer than 100 employees. We also show that activation of Reserve employees causes a negative effect on business overall, but that the activation of an additional employee has a disproportionately larger (negative) impact on small businesses than on large businesses.

We began with the hypothesis that extended absences by employees because of Reserve activation had a disproportionate impact on small businesses, and our econometric model found a 1.9 percentage point decrease in sales relative to larger firms for those activated 30 days or more and a 3.0 percentage point decrease in sales for those activated 180 days or more.

We also estimated a model of firm performance as a function of Reserve activation with an interaction variable to account for the effect of activation on small business and found that the marginal effect of one additional employee being activated was a decrease of 0.30 percentage points on small businesses and a decrease of 0.02 percentage points for large businesses. This 15-fold difference in the magnitude of the activation effects would seem to indicate that small businesses bear a heavier burden than large businesses when reservist employees are activated.

This study represents one of the first attempts to analyze the effects of Reserve activation from the employer side of the equation using reservist data from the Department of Defense and employer data from Dun & Bradstreet. By combining activation data from DOD with sales data from D&B we were able to show the relationship between Reserve activation and changes in the firm's finances. In subsequent studies we hope to avoid some of the self-reporting problems that were encountered in the data by using data from databases such as the LEHD where reporting is mandated by law.

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Appendix A – Demographics and Length of Activations for Reservists

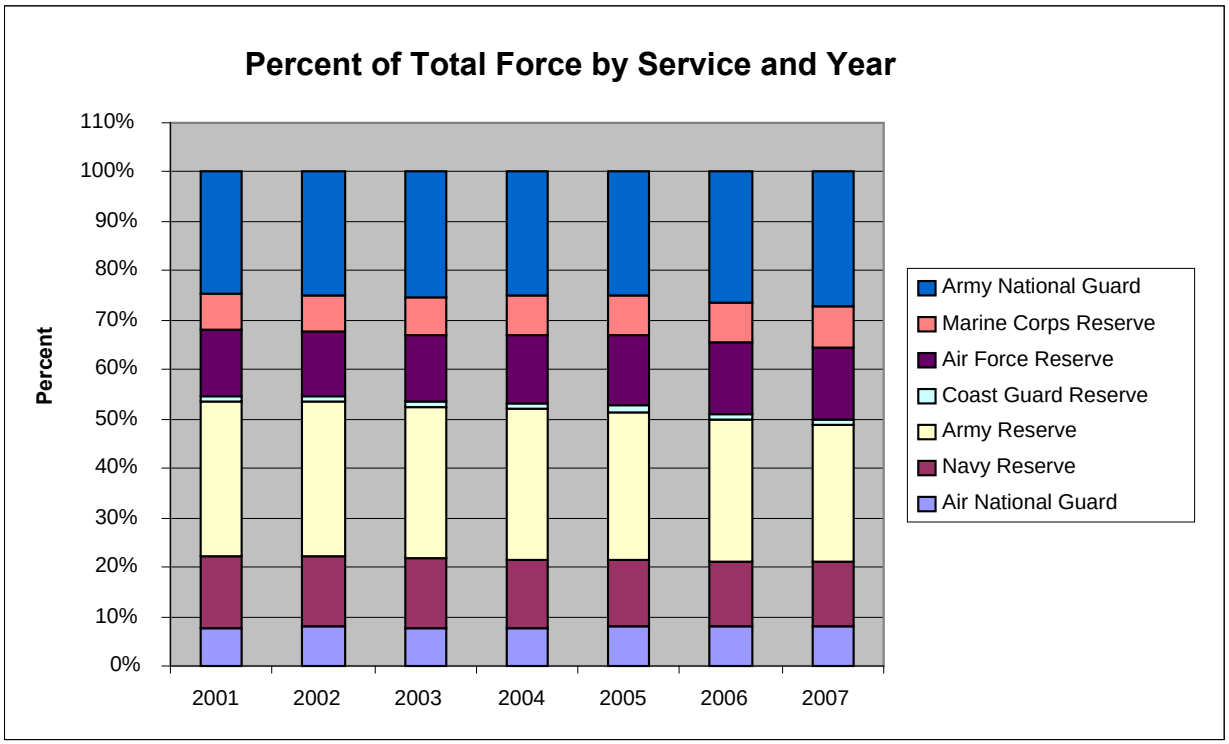

Figure 5: Percent of Total Force by Service and Year

Table 13: Crosswalk of Variables for Education

Less than High School	Secondary Credential Near Completion Non-High School Graduate Attending High school, Junior or Less Attending High School, Senior
High School Diploma	High School Diploma Completed High School, No Degree Adult Education Diploma Non-Traditional High School Credential Home Study Diploma ARNG Challenge Program GED Certificate Test-Based Equivalent Diploma Correspondence School Diploma High School Certificate of Attendance
Some College	Associate Degree Occupational Program Certificate 1-2 Year College, No Degree Professional Nursing Diploma Completed One Semester of College, No High School Diploma
BA/BS Degree	Baccalaureate Degree
Graduate School	Doctorate Degree Master's Degree First Professional Degree Post Doctorate Degree Post Master's Degree
Unknown	Unknown

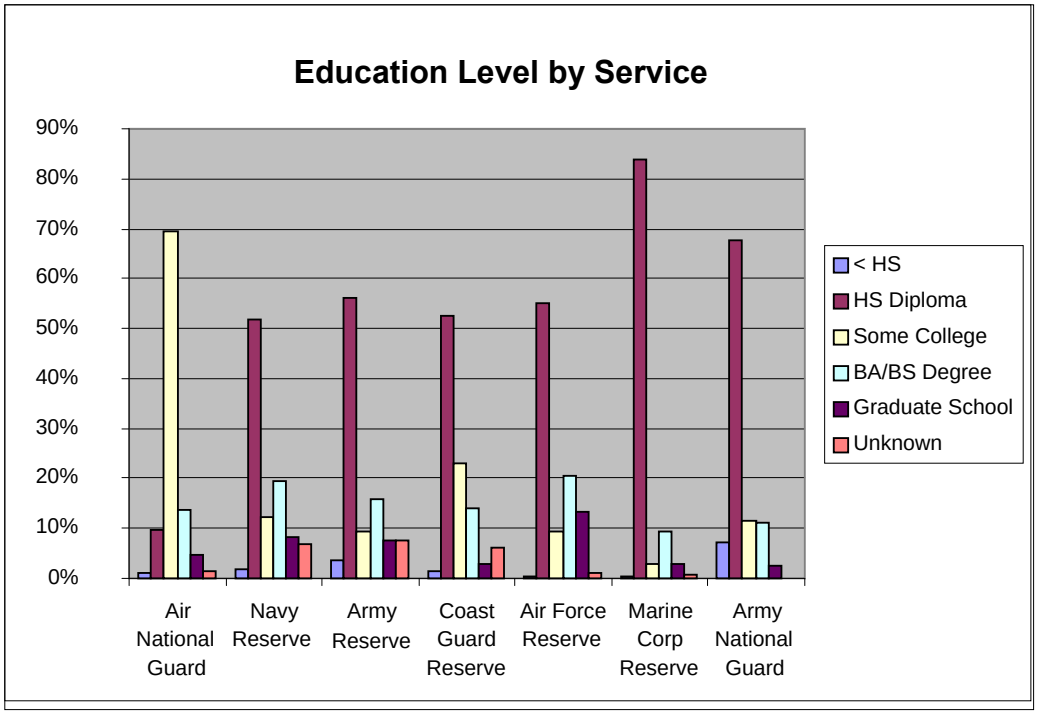

Figure 6: Education Level by Service

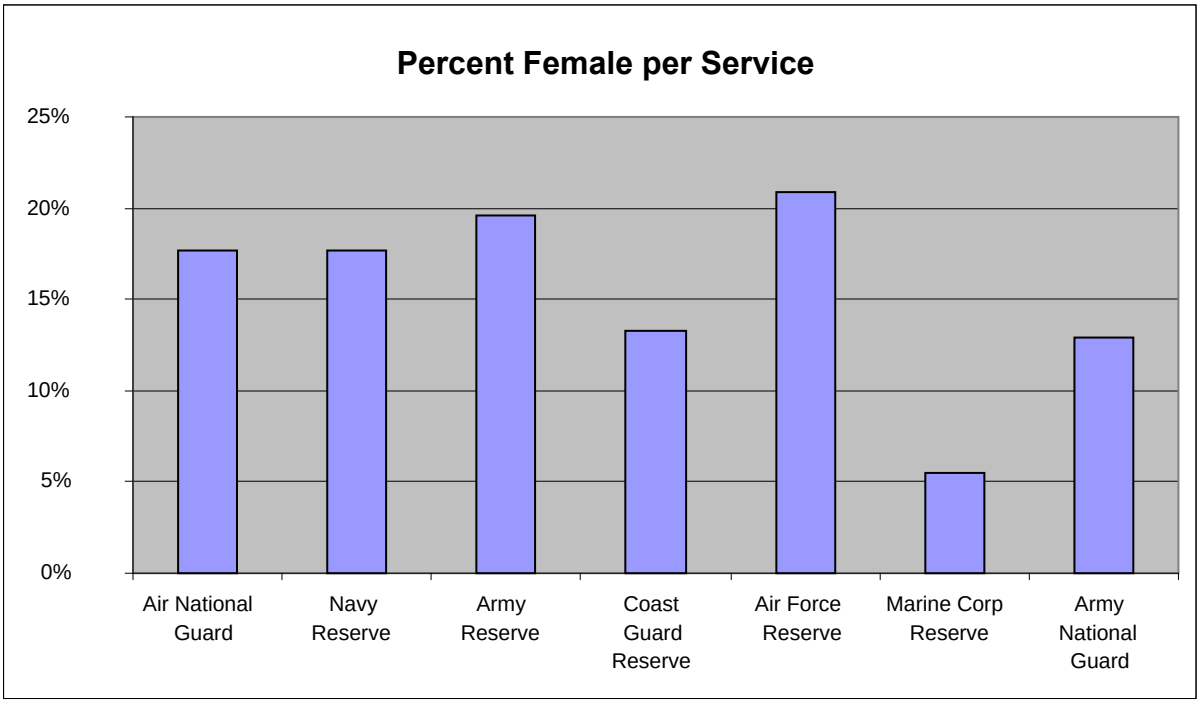

Figure 7: Percent Female per Service

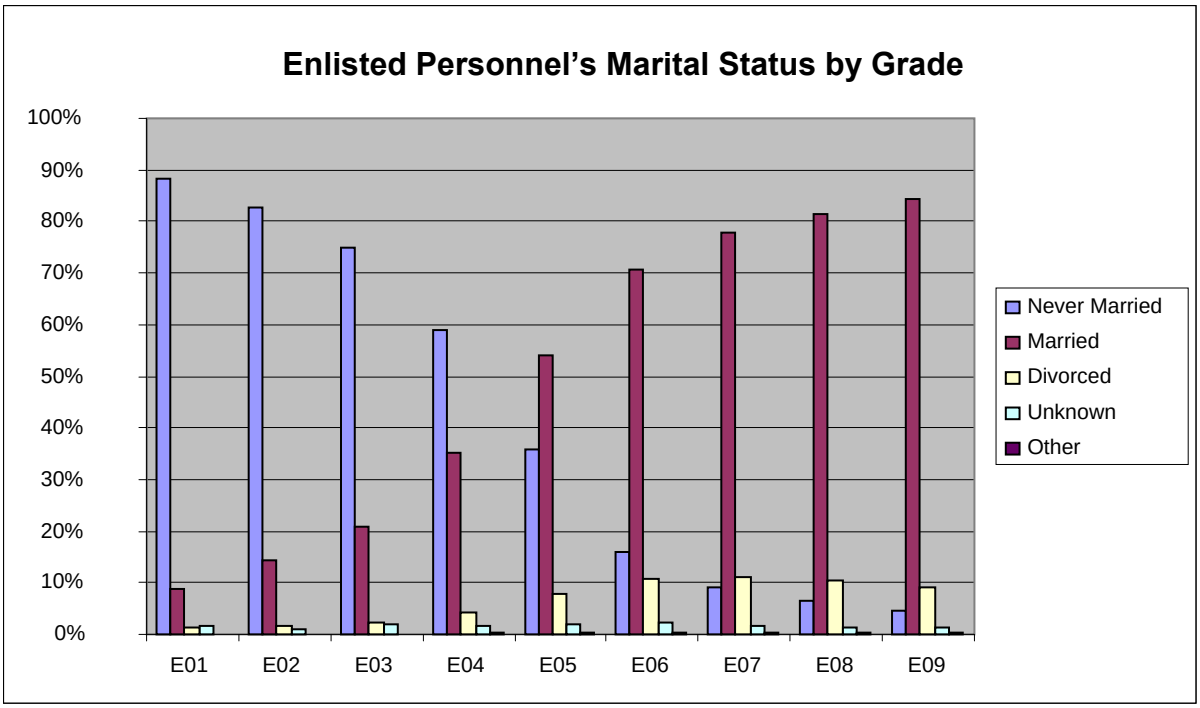

Figure 8: Enlisted Personnel's Marital Status by Grade

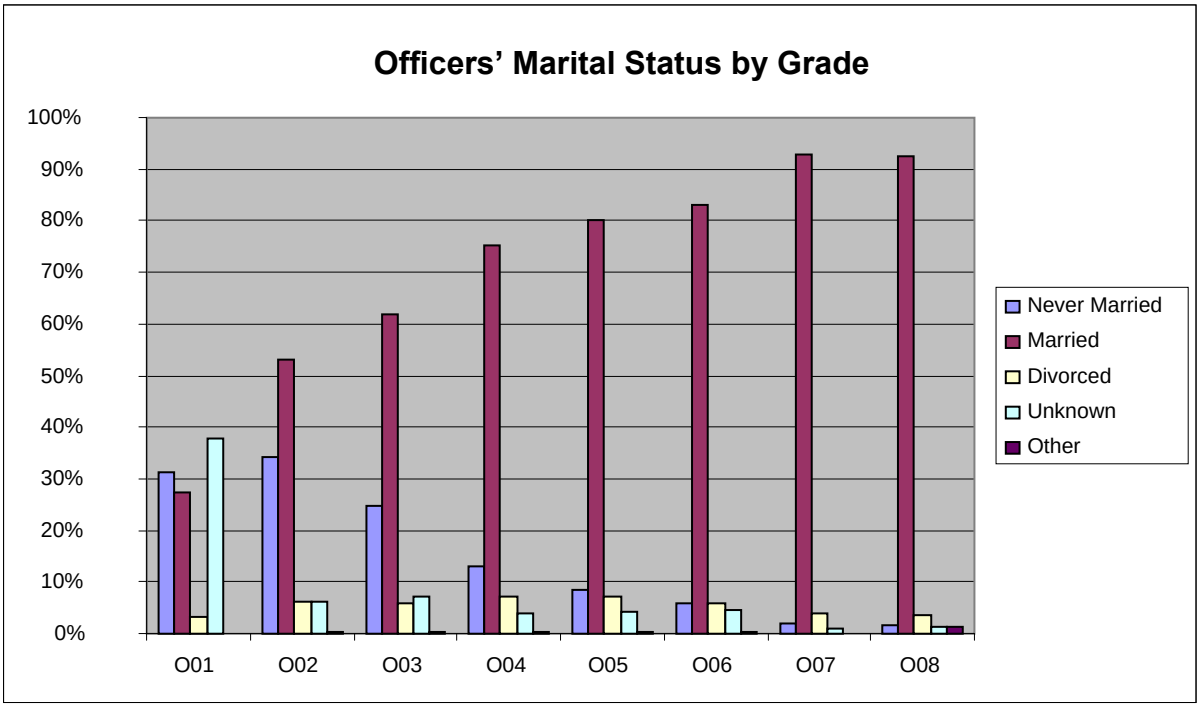

Figure 9: Officers' Marital Status by Grade

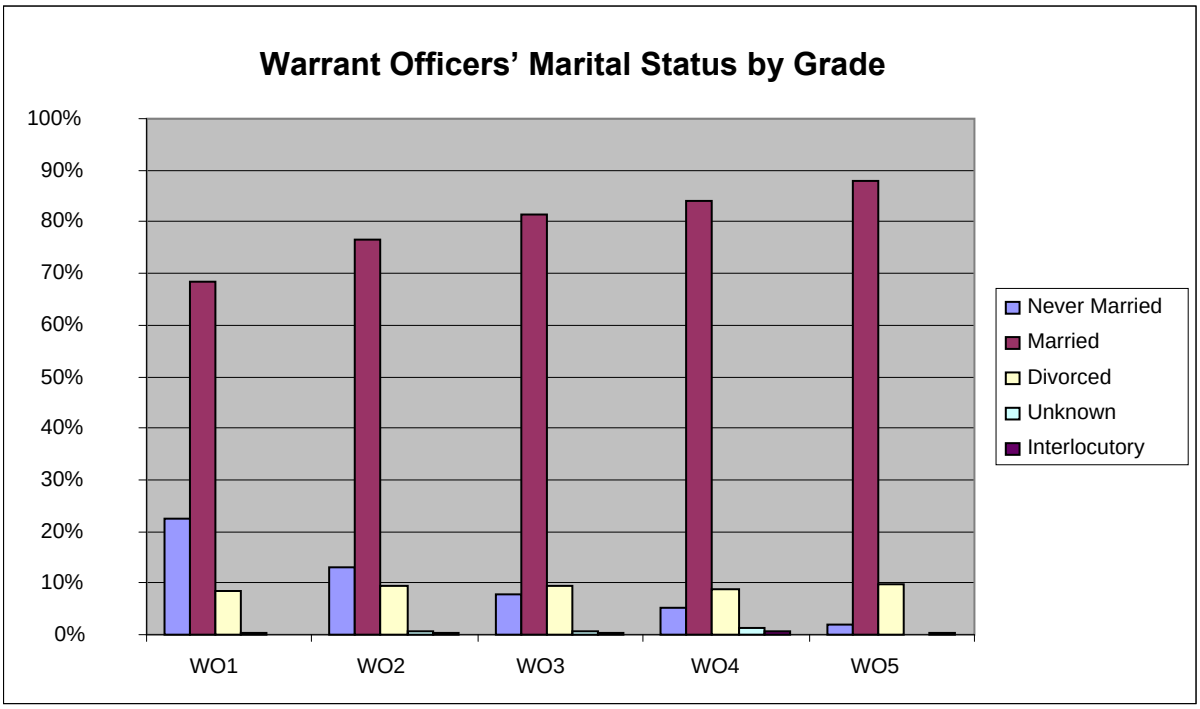

Figure 10: Warrant Officers' Marital Status by Grade

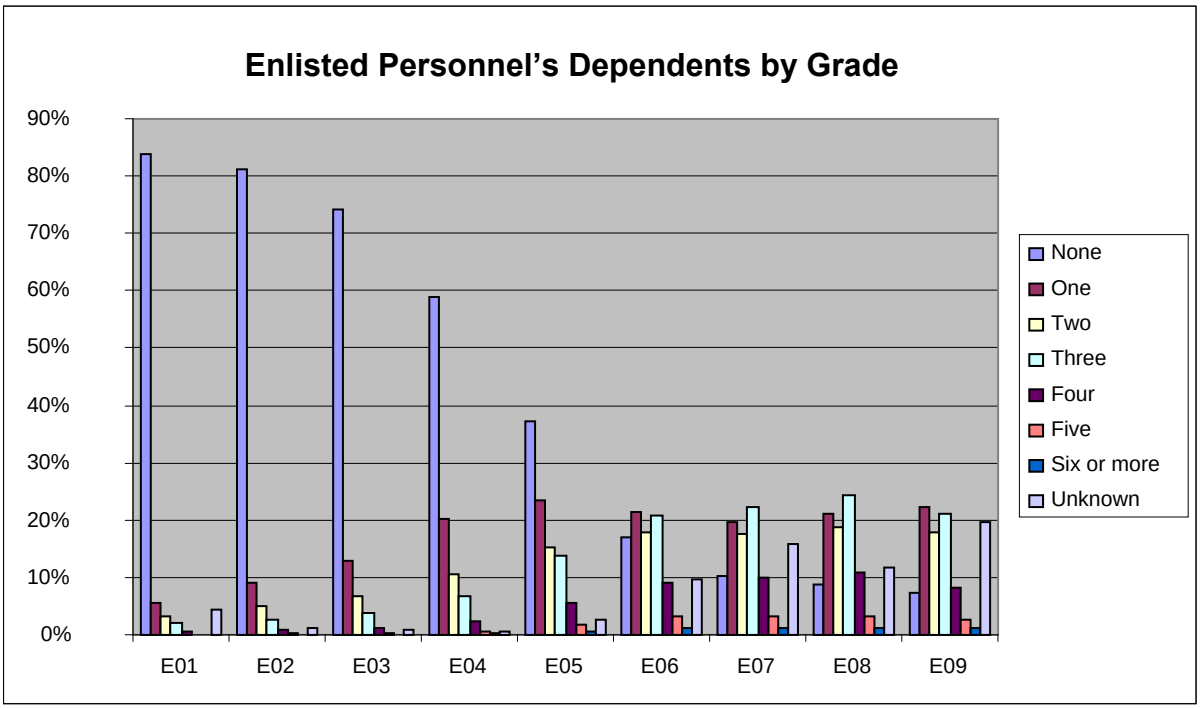

Figure 11: Enlisted Personnel's Dependents by Grade

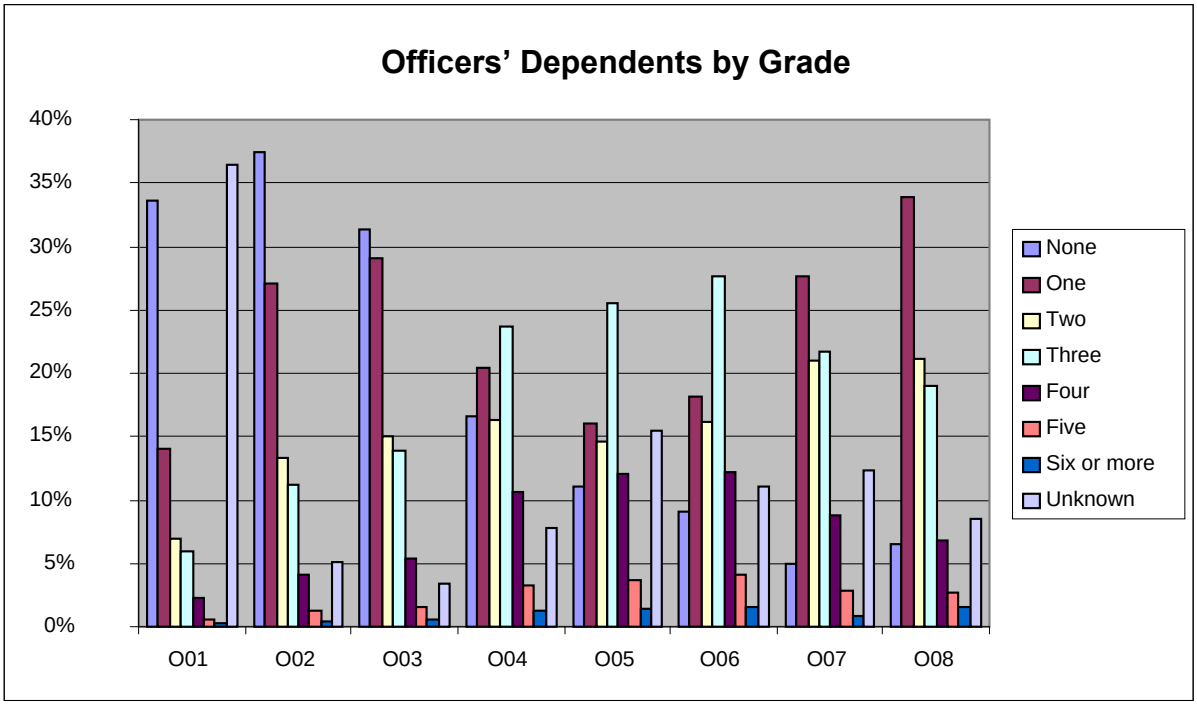

Figure 12: Officers' Dependents by Grade

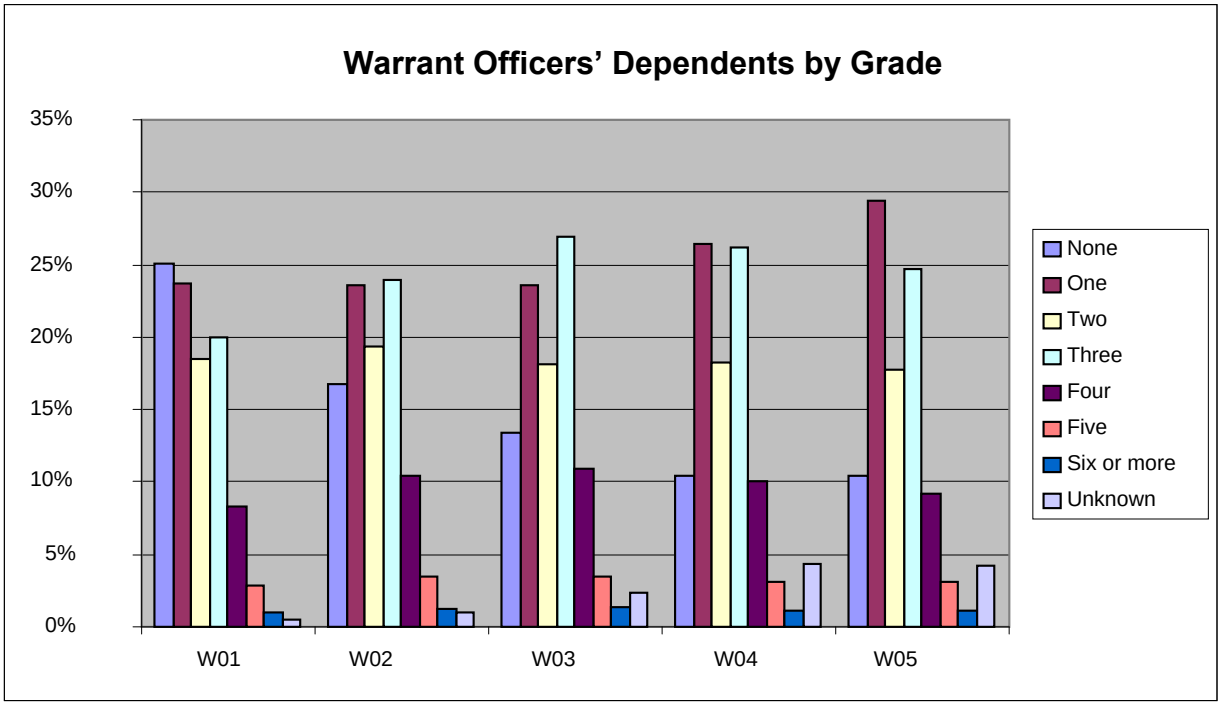

Figure 13: Warrant Officers' Dependents by Grade

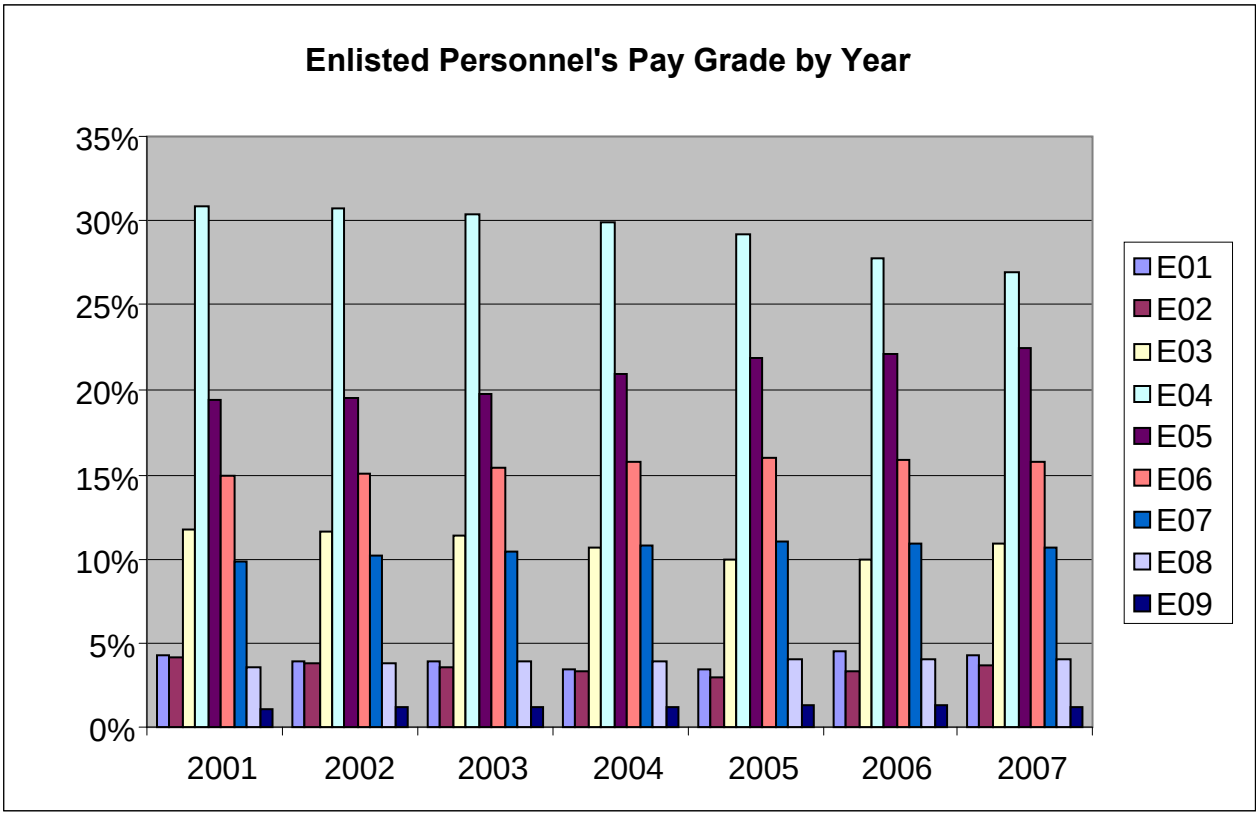

Figure 14: Enlisted Personnel's Pay Grade by Year

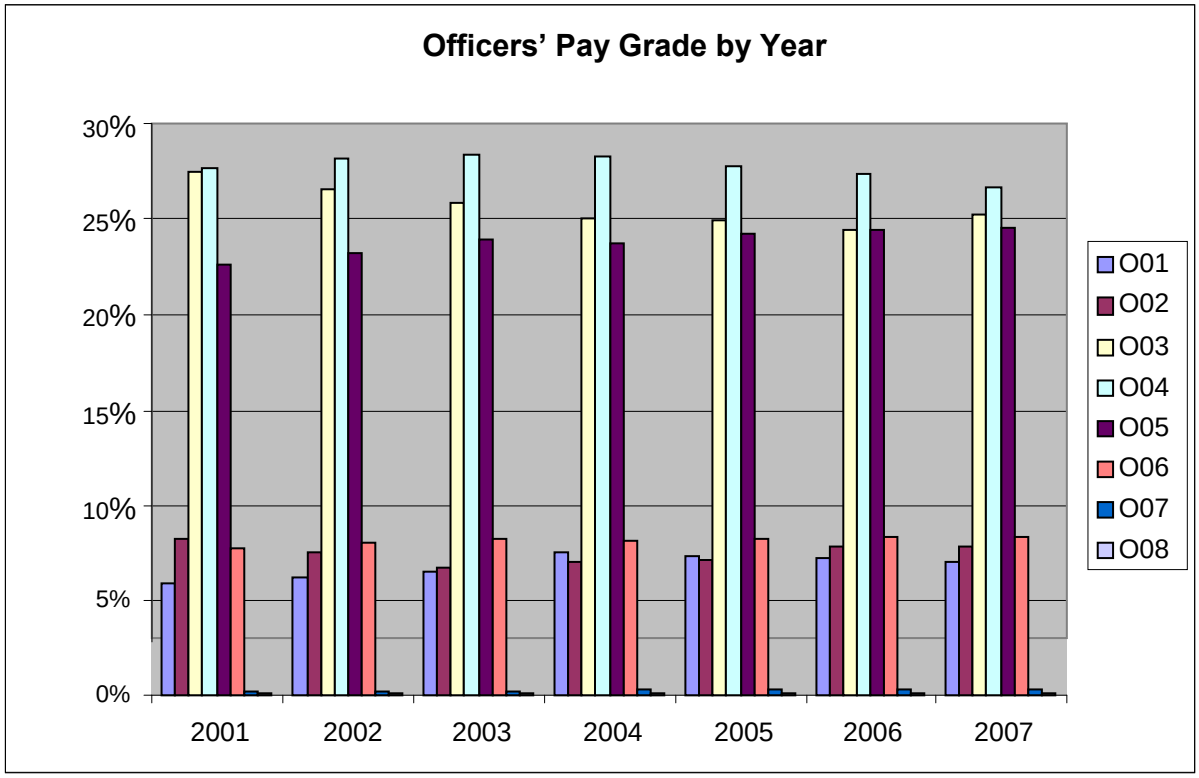

Figure 15: Officers' Pay Grade by Year

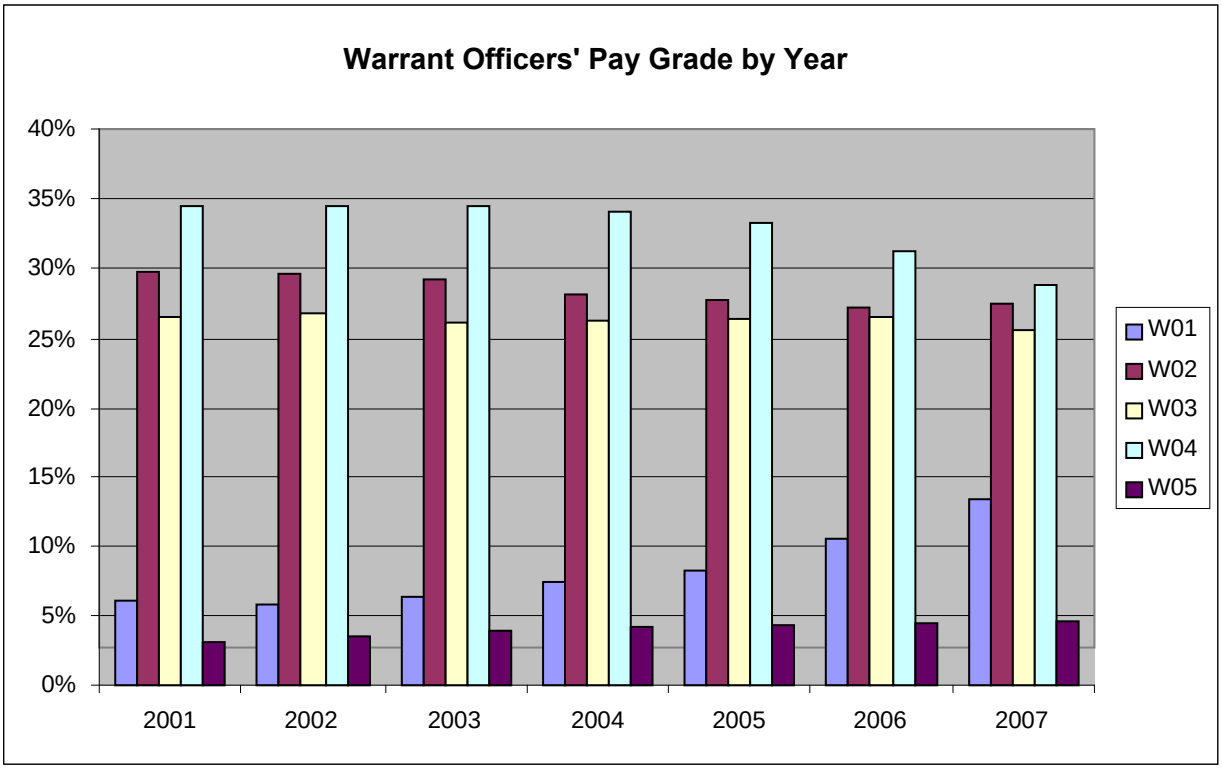

Figure 16: Warrant Officers' Pay Grade by Year

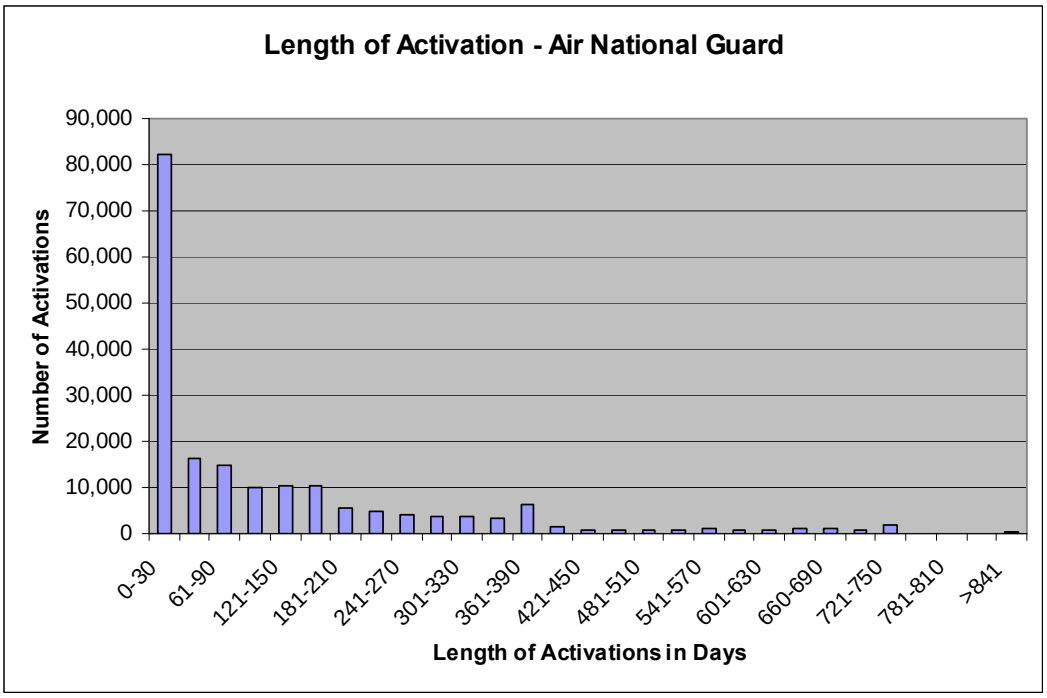

Figure 17: Length of Activation – Air National Guard

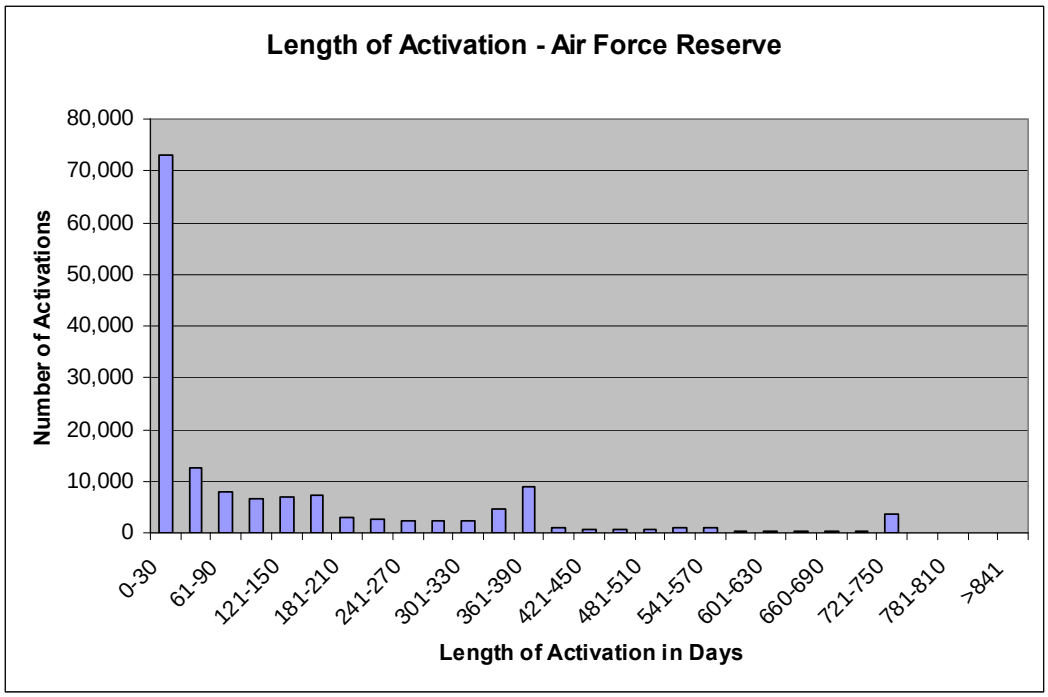

Figure 18: Length of Activation - Air Force Reserve

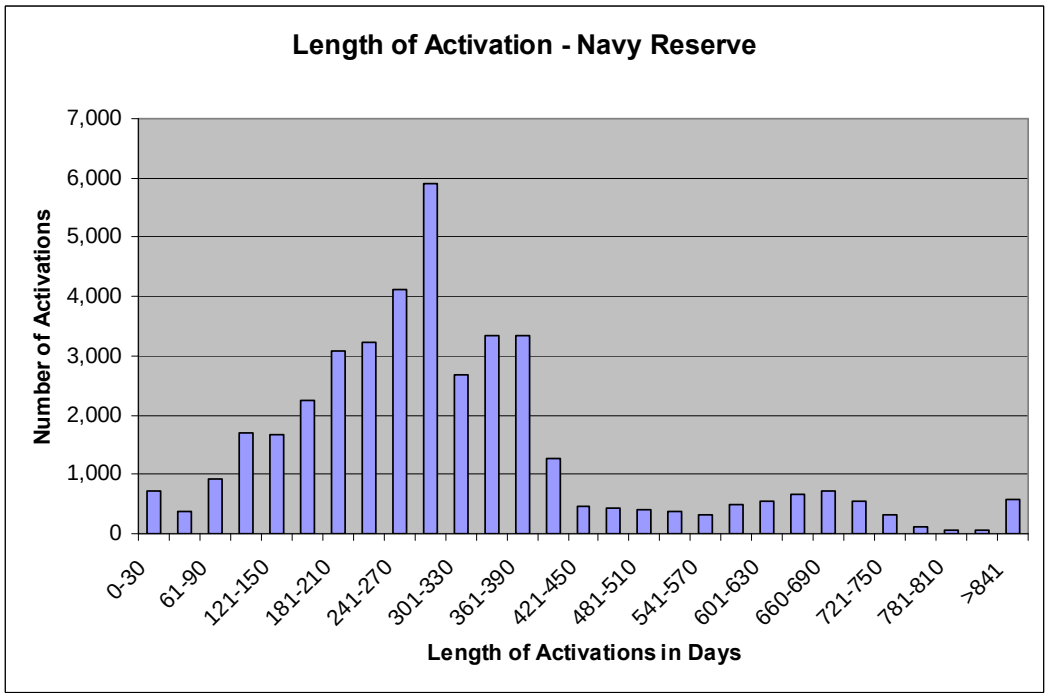

Figure 19: Length of Activation - Navy Reserve

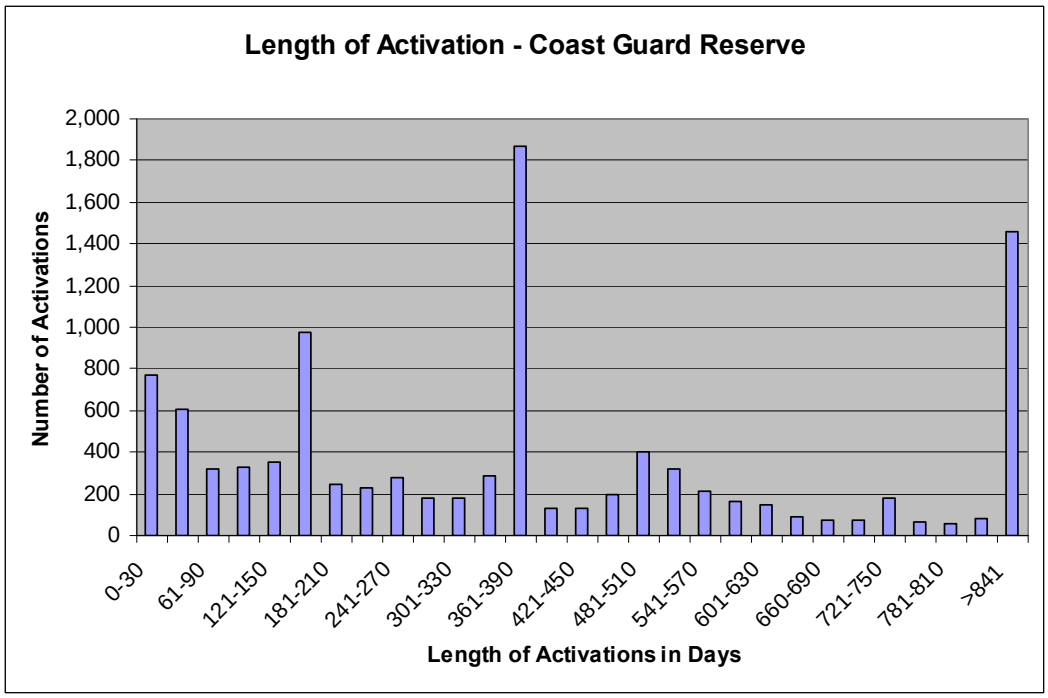

Figure 20: Length of Activation - Coast Guard Reserve

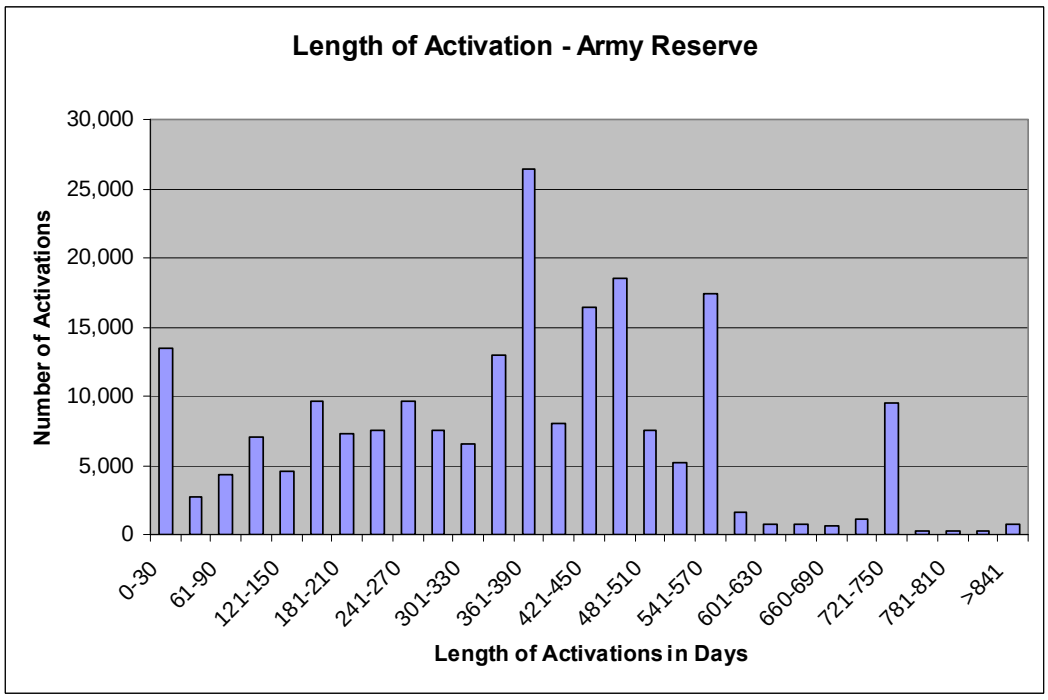

Figure 21: Length of Activation - Army Reserve

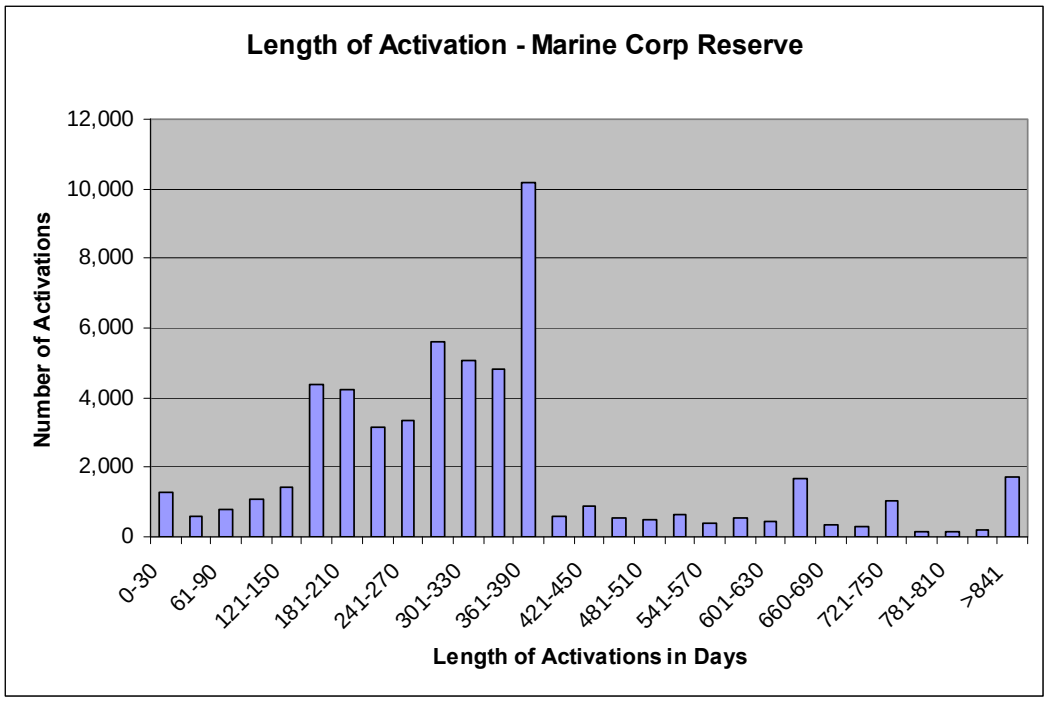

Figure 22: Length of Activation - Marine Corp Reserve

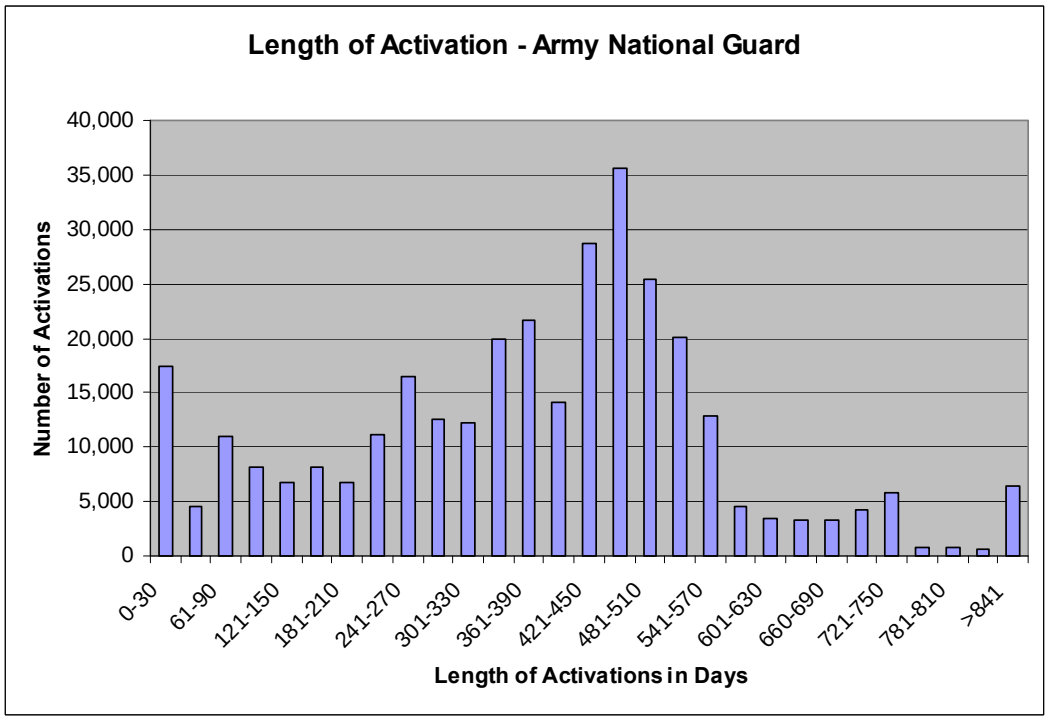

Figure 23: Length of Activation - Army National Guard

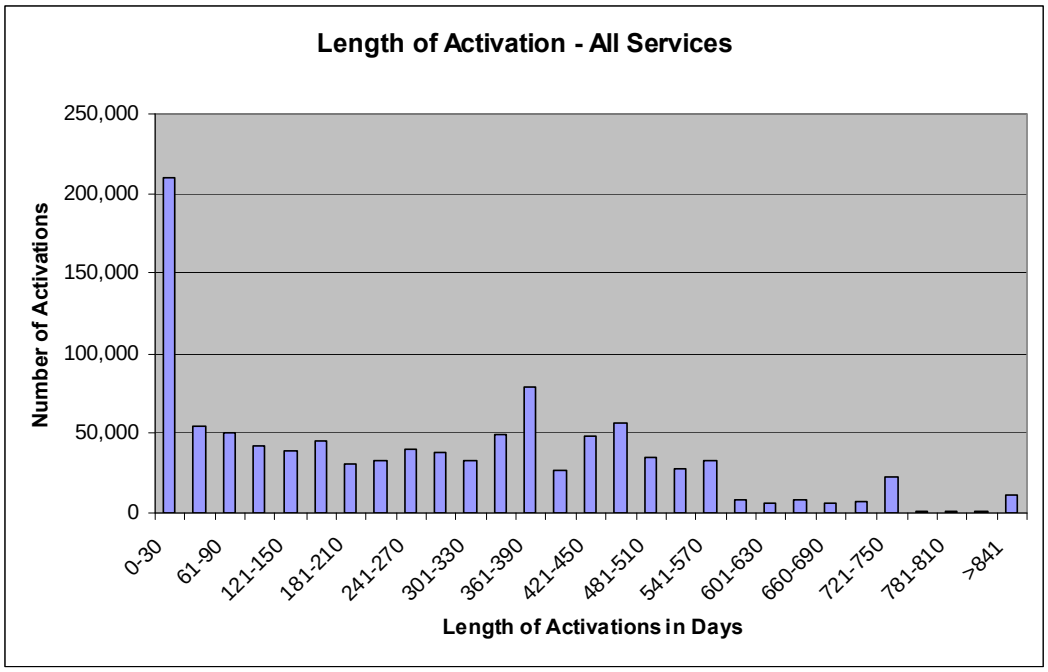

Figure 24: Length of Activation - All Services

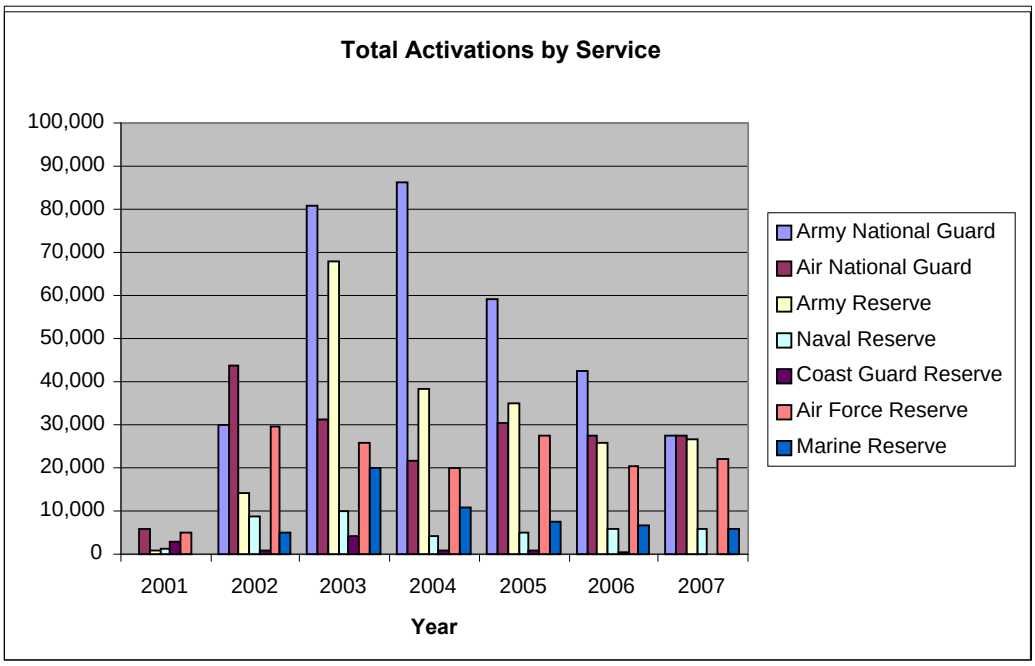

Figure 25: Total Activations by Service

Table 14: Percent of Total Activations by Component

Year	Air National Guard	Navy Reserve	Army Reserve	Coast Guard Reserve	Air Force Reserve	Marine Corps Reserve	Army National Guard
2001	36.36%	7.53%	5.25%	18.16%	31.46%	0.30%	0.93%
2002	33.08%	6.62%	10.68%	0.76%	22.34%	3.81%	22.72%
2003	13.00%	4.10%	28.37%	1.77%	10.77%	8.28%	33.71%
2004	11.88%	2.32%	20.99%	0.53%	11.00%	6.01%	47.26%
2005	18.33%	2.96%	21.18%	0.58%	16.62%	4.56%	35.76%
2006	21.18%	4.52%	19.91%	0.32%	15.92%	5.31%	32.84%
2007	23.83%	5.16%	23.00%	0.00%	19.06%	4.92%	24.02%
Average	22.52%	4.74%	18.48%	3.16%	18.17%	4.74%	28.18%

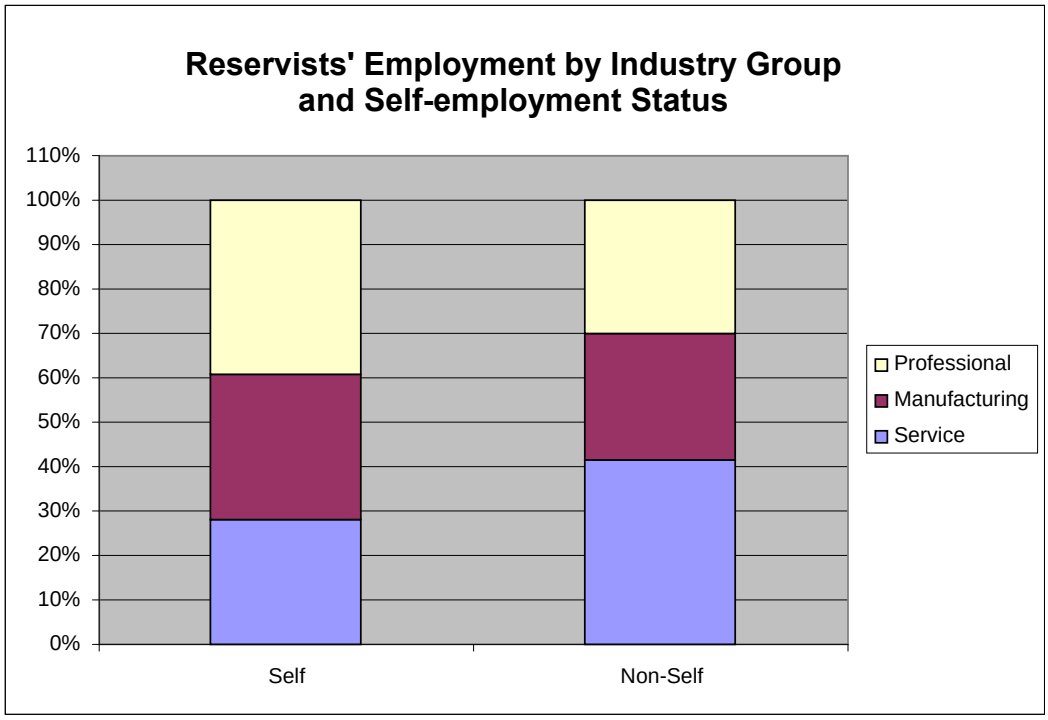

Figure 26: Reservists' Employment by Industry Group and Self-employment Status

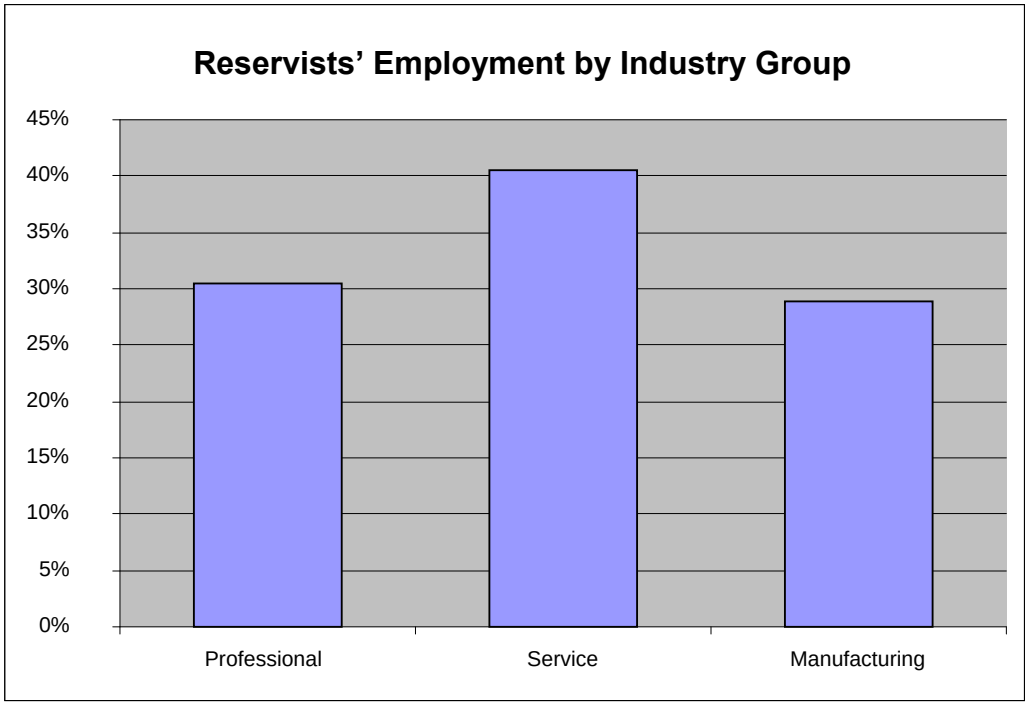

Figure 27: Reservists' Employment by Industry Group

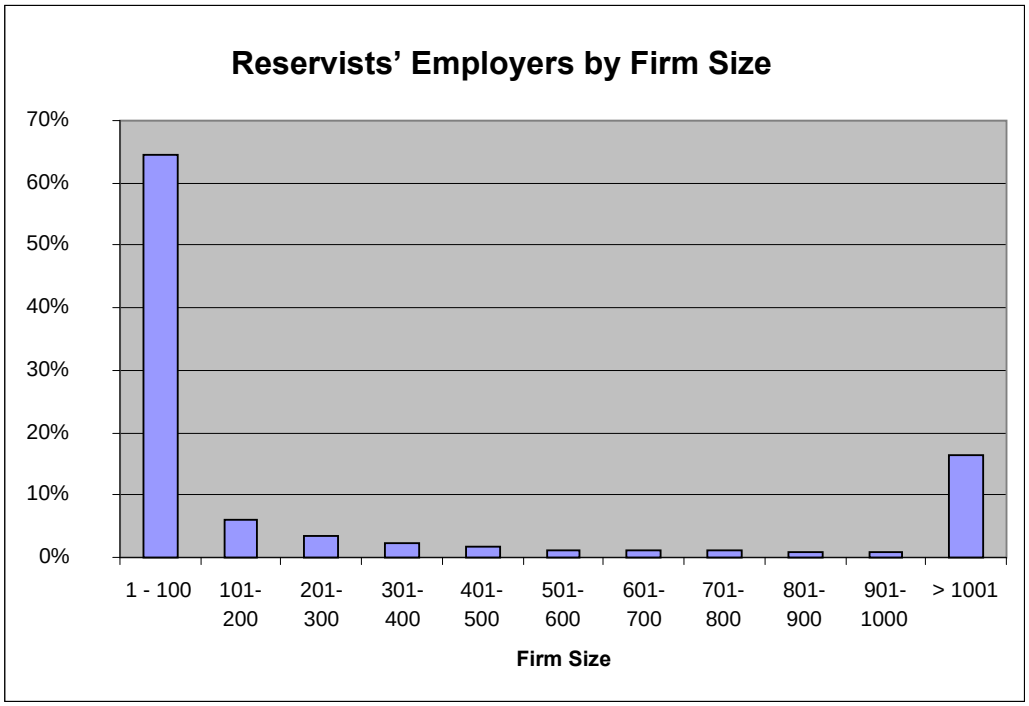

Figure 28: Reservists' Employers by Firm Size

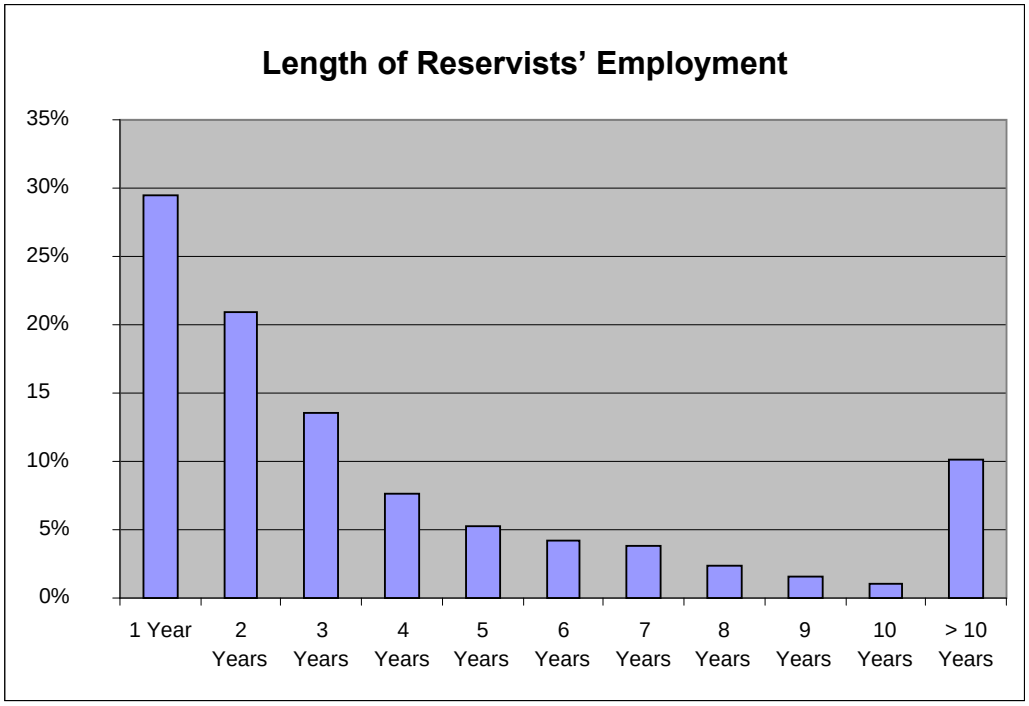

Figure 29: Length of Reservists' Employment

Appendix B – Alternative Analysis to Check Consistency

Table 15: Extended Variable Descriptions

Variable Name	Description	Unfiltered Mean	Filtered Mean
SALES	Sales	141060916.0000000	181279616.0000000
DELTA_SA	Change in sales	45.1856509	0.0012785
BANKRUP0	Bankrupt dummy variable	0.0097264	0.0011718
EMP	Number of employees	2640.0695400	3878.4790600
PERACT30	Percent Activated 30 days and over	0.0025733	0.0014370
PERACT180	Percent Activated 180 days and over	0.0014658	0.0008128
SMALL100	Businesses with 100 or less employees	0.3161006	0.3056810
INTACT30	Equal to PERACT30*SMALL100	0.0021338	0.0035954
INTACT180	Equal to PERACT180*SMALL100	0.0011990	0.0005997
IND_1	Agriculture, Forestry, and Fishing	0.0153087	0.0186031
IND_2	Mining	0.0060417	0.0065184
IND_3	Construction	0.0460042	0.0475941
IND_4	Manufacturing	0.1563030	0.1558190
IND_5	Transportation, Communications, Electric, Gas, and Sanitary Services	0.0710057	0.0743390
IND_6	Wholesale Trade	0.0825763	0.0837138
IND_7	Retail Trade	0.1508089	0.1520349
IND_8	Finance, Insurance, and Real Estate	0.0635383	0.0662948
IND_9	Services	0.4081524	0.3947658

Table 16: Change in Sales

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	7.8012333	80.4831540	0.9228
PERACT30	-11.8115786	1395.6667400	0.9932
SMALL100	-36.0408381	153.6146240	0.8145
IND_1	28.4718466	600.0848270	0.9622
IND_2	2.2159203	690.1232760	0.9974
IND_3	4.7724689	271.0362770	0.9860
IND_4	273.8319310 *	143.1202070	0.0557
IND_5	2.7261412	196.3849450	0.9889
IND_6	5.2442629	210.9461550	0.9802
IND_7	4.2340117	170.6745460	0.9802
IND_8	6.4445522	252.8026870	0.9797

R-squared = 0.0002049

* Significant at the .10 level

Table: 17 Change in Sales Lagged

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	7.9024005	67.5848208	0.9069
PERACT30	265.2160340	1105.9847100	0.8105
SMALL100	-44.7104788	123.8758700	0.7182
IND_1	23.8356895	496.9428200	0.9617
IND_2	-0.4831966	577.9162010	0.9993
IND_3	3.6662055	223.7831870	0.9869
IND_4	233.3471810 *	120.4302140	0.0527
IND_5	1.7211251	164.8983380	0.9917
IND_6	4.0952666	173.1420350	0.9811
IND_7	2.6986454	140.2582330	0.9846
IND_8	2.0122128	209.8891790	0.9924

R-squared 0.0001970

* Significant at the .10 level

Table 18: Change in Sales – 180

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	9.8261189	124.3653840	0.9370
PERACT180	-11.7952684	2345.1027200	0.9960
SMALL100	-51.5959333	252.9824010	0.8384
IND_1	39.6338942	882.8620570	0.9642
IND_2	4.9407918	1106.5856600	0.9964
IND_3	5.7449038	440.9905650	0.9896
IND_4	419.6722090 *	221.3923010	0.0580
IND_5	3.7019096	301.1567890	0.9902
IND_6	6.7887376	338.7077750	0.9840
IND_7	4.7792861	268.0079040	0.9858
IND_8	9.7057171	405.5053770	0.9809
R-squared	0.0003114		

* Significant at the .10 level

Table 19: Change in Sales - 180 Lagged

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	9.8135243	104.8664440	0.9254
PERACT180	161.0611780	1872.1334200	0.9314
SMALL100	-52.6645945	203.8168330	0.7961
IND_1	34.6851206	728.8231770	0.9620
IND_2	0.8696514	925.6639280	0.9993
IND_3	4.6279499	361.2652680	0.9898
IND_4	359.2625760 *	187.0766250	0.0548
IND_5	-2.0458269	254.3277450	0.9936
IND_6	5.0688348	279.0374000	0.9855
IND_7	3.9576617	222.1107570	0.9858
IND_8	4.6538899	336.7835450	0.9890
R-squared	0.0002989		

* Significant at the .10 level

Table 20: Change in Sales - 180 Year

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	64.6355329	308.4192390	0.8340
YEAR	-12.5860713	64.8097635	0.8460
PERACT180	-17.7375797	2345.3847200	0.9940
SMALL100	-50.5314305	253.0506630	0.8417
IND_1	38.6423088	882.9078360	0.9651
IND_2	8.1350475	1106.7467700	0.9941
IND_3	6.3218231	441.0160620	0.9886
IND_4	418.2259130 *	221.5253010	0.0590
IND_5	3.0793320	301.1844310	0.9918
IND_6	7.0819492	338.7230390	0.9833
IND_7	8.0481133	268.5453560	0.9761
IND_8	10.4430483	405.5373960	0.9795

R-squared 0.0002989

* Significant at the .10 level

Table 21: Change in Sales – Interactive

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	10.7967453	124.7317550	0.9310
PERACT180	-591.1778420	6133.4500600	0.9232
SMALL100	-58.1331647	260.9478390	0.8237
INACT180	679.0019800	6641.8442100	0.9186
IND_1	39.4829942	882.8951840	0.9643
IND_2	4.7260765	1106.6276300	0.9966
IND_3	7.2481491	441.2515710	0.9869
IND_4	419.9022770 *	221.4117360	0.0579
IND_5	5.1447022	301.4981640	0.9864
IND_6	7.8905638	338.8914390	0.9814
IND_7	5.1326459	268.0398730	0.9847
IND_8	9.1473868	405.5568010	0.9820

R-squared 0.0003122

* Significant at the .10 level

Table 22: Change in Sales – Filtered 180

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	0.0031654	0.0031850	0.3203
PERACT18	-0.5040024 *	0.1696011	0.0030
SMALL100	-0.0304789 *	0.0056615	0.0000
IND_1	-0.0777262 *	0.0242502	0.0013
IND_2	0.0009979	0.0310112	0.9743
IND_3	0.0143206	0.0104062	0.1688
IND_4	-0.0045386	0.0057329	0.4285
IND_5	0.0327381 *	0.0077779	0.0000
IND_6	0.0110063	0.0083042	0.1850
IND_7	0.0029483	0.0074026	0.6904
IND_8	0.0190873 *	0.0094435	0.0433

R-squared = 0.0026429

* Significant at the .10 level

Table 23: Probit Bankruptcy 180

Variable	Coefficient	Standard Error	P[|Z|>z]
Constant	-3.0961954 *	0.1496594	0.0000
PERACT180	-0.4578350	2.6197680	0.8613
IND_1	-4.6950871	225649.9070000	1.0000
IND_2	-4.7029183	264360.6730000	1.0000
IND_3	0.2452296	0.3497650	0.4832
IND_4	0.4218674 *	0.1849948	0.0226
IND_5	0.5835889 *	0.1985133	0.0033
IND_6	0.0871292	0.3374465	0.7963
IND_7	0.1325636	0.2627981	0.6140
IND_8	0.3325928	0.2733614	0.2237
SMALL100	-0.0936195	0.2272484	0.6804

Chi Squared 13.1594500

* Significant at the .10 level