THE IMPACT OF FAMILY INCOME ON MILITARY RESERVE RETENTION

THESIS

Dale C. Figart
Captain, USAF

AFIT/GSM/LSY/90S-9

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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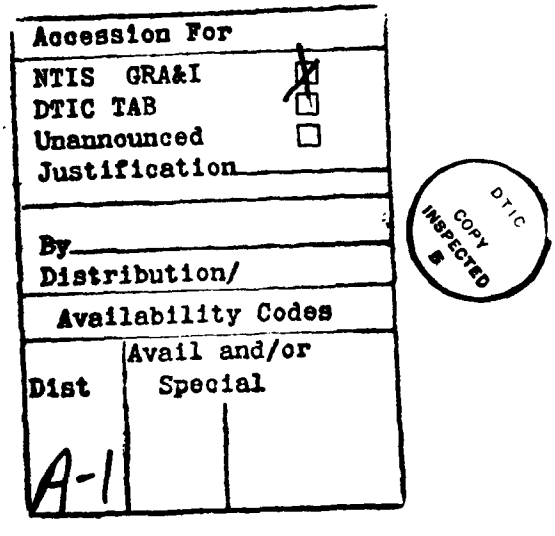

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THESIS

Presented to the Faculty of the School of Systems and Logistics

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Dale C. Figart, B.S.

Captain, USAF

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Dale C. Figart

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List of Abbreviations

Abbreviation	Meaning
IMAs	Individual Mobilization Augmentees
RC	Reserve Components
USAF	United States Air Force

Abstract

The purpose of this study is to examine the impact of family income on retention in the military reserves. There are five types of family income examined. They are income from the reserves, income from civilian employment, income from other sources, income from the wife's employment, and potential income from reserve retirement. The study is limited to married male reserve members with 6 years or less in the reserves.

THE IMPACT OF FAMILY INCOME ON MILITARY RESERVE RETENTION

I. Introduction

General Issue

Throughout the career of a reserve member he or she must make the decision to either continue with the reserves to retirement or leave. This career decision may be influenced by factors ranging from patriotism and job satisfaction to financial need and retirement benefits. This study focuses on the relationship of various sources of potential family income to reserve members' career decisions. The types of family income that are examined include income from the reserves, income from the reserve member's civilian job, income from the reserve member's wife's job, income from other sources, and potential income from reserve retirement. To simplify the analysis, this study is limited to married male reserve members and to reserve members with 6 years of service or less.

Origin and Purpose of the Reserve Components. There are two groups that form the Reserve Components of the United States, the National Guard and the Military Reserve. The Guard came into existence during the colonial years after

1607 (18:12). During this time the Guard was known as the militia and was composed of all able-bodied men in a particular settlement (18:12). The concept of the militia came to North America by the English colonist (18:12). During the colonial times, the militia's responsibilities were to protect local colonial settlements from hostile Indian attacks and other threats (18:12). The colonial militia evolved into the state militia as colonial states formed. In 1789, the Constitution of the United States codified the American militia system and allowed Congress to call the state militia into federal service during national emergency or war (18:15). Since then, the state militia has evolved into the National Guard of today. The National Guard has responsibilities to the state and the federal government. Their state role includes helping in any civil emergency like forest fires, floods, riots, and earthquakes. (9:18). Their federal role is to be mobilized in time of federal emergency or outbreak of war to supplement the regular active duty military forces.

The military reserves originated during World War I (18:21). The reserves were formed as a federal reserve force directly linked to the active duty military forces (18:21; 9:18). Their propose is to provide backup capability, independent of the Guard, to the Army, Navy, Air Force, and Marines (9:18).

After World War I the National Guard and the Reserves combined into one manpower pool called the Reserve Components of the United States. Both the Reserves and the National Guard are trained and supervised by the federal government and both must meet all regular military requirements of physical condition, education, and military standards (2:224). The major difference between the two organizations is in whom can call them into service. The Reserves are directly linked to the active Army, Navy, Air Force and Marines (9:18). They may be called to duty only by the federal government in time of national emergency or outbreak of war to supplement the regular active duty forces. The National Guard on the other hand, is linked to the state in which they reside. Thus, the Guard can be called into service by the state government. However, the Guard can also be called into service by the federal government. This gives the National Guard two roles, one for the state and one for the federal government. There are National Guard units in all 50 states as well as the District of Columbia, Puerto Rico, the Virgin Islands and Guam (9:18). Together, the National Guard and the Reserves furnish a large addition to the regular active duty military forces (2:224).

The Size of the Reserve Component's Role. The reserve components play a much larger role in our national defense

than many realize (9:18). Figure 1 shows the percentage of military manpower contained in the reserve units for years 1970 to 1988.

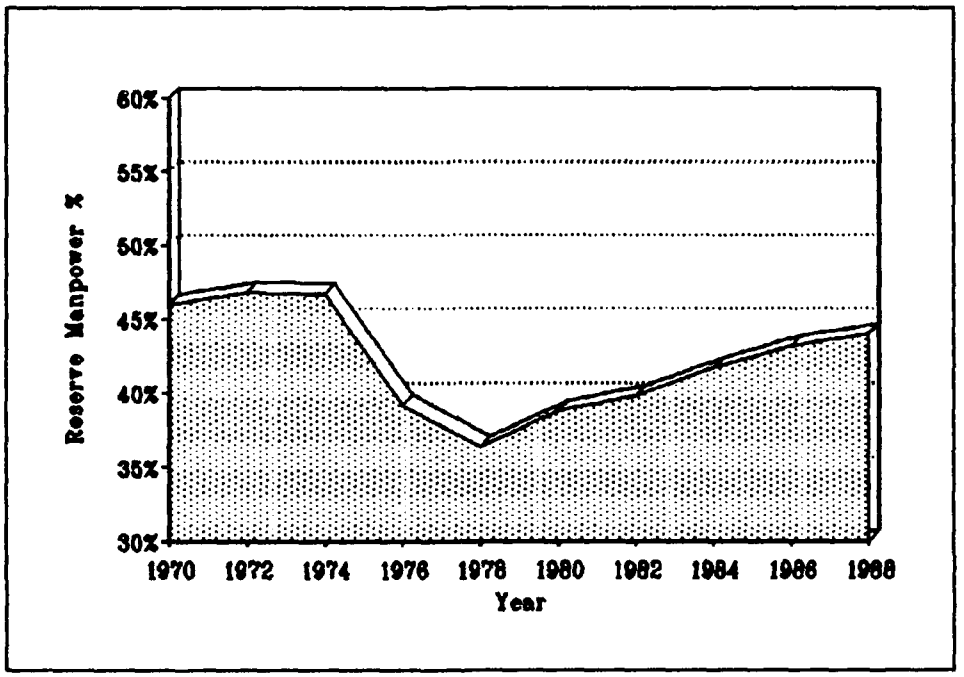

Figure 1. Reserve Manpower Percentage of Total Military Force (3:339,340,342)

From figure 1 it can be seen that for the past 20 years, the reserve's manpower strength has never represented less than 36% of total U.S. military manpower strength. For the years from 1970 to 1974 the reserves represented 46% of our manpower strength. From the low of 36% in 1978 the percent contribution to total military manpower has steadily increase to 44% for the late 1980s. These percentages show

that a large part of the total military manpower is contained within the reserve components.

Figure 2 below shows other military capabilities the reserve components are responsible for.

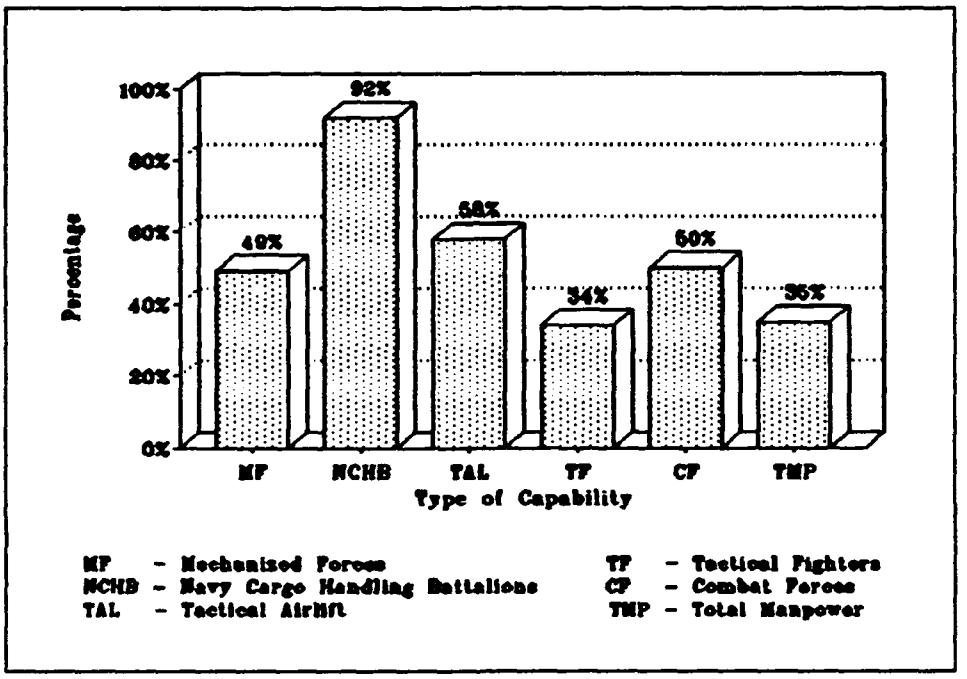

Figure 2. U.S. Military Capabilities in the Selected Reserve (11:70; 9:20)

From figure 2, it can be seen that the reserve components comprise the following military capabilities:

- 49% of the mechanized forces are in the Army Reserve and National Guard (11:70).
- 92% of the Navy cargo handling battalions are in the Naval Reserve (11:70).

- 58% of the tactical airlift aircraft belong to the Air National Guard and Air Force Reserve (11:70).
- 34% of the tactical fighters belong to the Air National Guard and Air Force Reserve (11:70).
- 50% of the Army combat troops are in the National Guard and Army Reserve (9:20).

From the above data, it is apparent that the Reserve Components of the United States play a significant role in our nations military strength.

Reserve units have been used in World War I, World War II, the Korean War, and for maneuvers in Central America and Europe (9:19). During the initial stages of the hostilities in Korea, starting in June 1950, heavy calls for reserve components, including the National Guard, were made. Eight National Guard divisions were called to service (2:225). The whole Air National Guard was called out along with large numbers of individual officers and personnel from the Army, Navy, Marine Corps, and Air Force reserve components (2:225). Without the reserve components the rapid build up of U.S. forces in Korea could never have been accomplished in time.

The Reserve Component's Growing Role. As mentioned in the previous paragraph, the role of the reserve components is to supplement the regular active duty military forces in times of emergency and outbreak of war (2:224). However,

the size of this role is growing. As shown below in figure 2, except for a small build-up from 1980 to 1986, the active duty military force has decreased in size since the end of the Vietnam War.

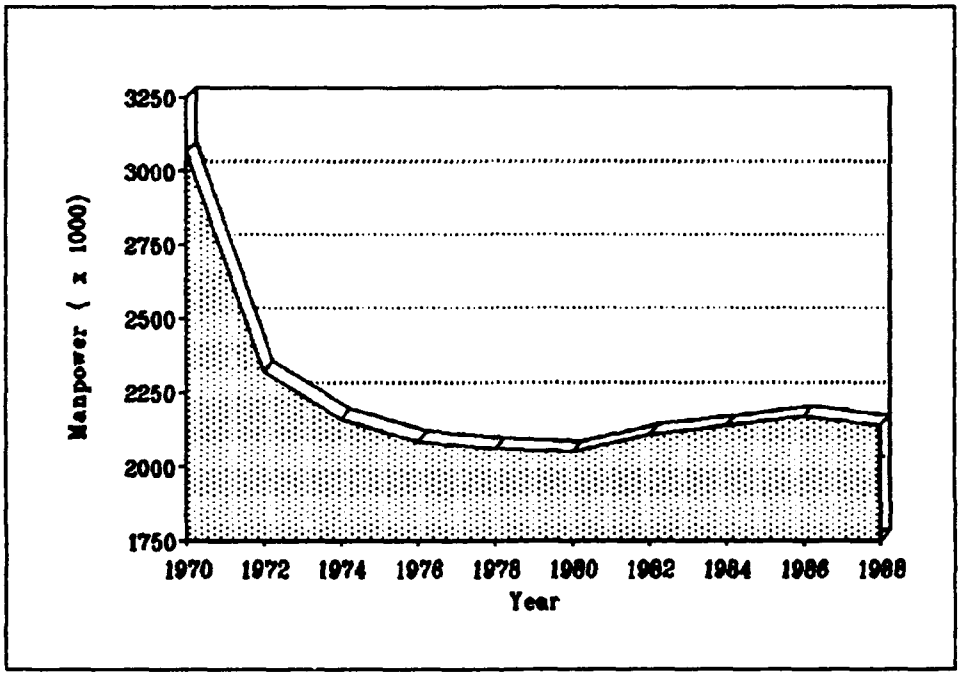

Figure 3. U.S. Active Duty Manpower from 1970 to 1988 (3:339)

This decrease in the active military places an increased reliance on the reserve components to supplement the active duty in time of national emergency or war. With the recent events in Europe, such as the opening of the Berlin wall and democratic reform in communist block countries, the decrease in the size of the active duty military force will most

likely continue for the coming years. This will place an even greater burden on reserves to provide the potential of a strong military force in the future. Because of this reliance on the reserves forces now and in the future, retention in the reserves components is an important issue within the Department of Defense (DOD).

Trends in Reserve Component Retention. Figure 4 shows that from 1970 to 1974 the reserve forces declined in strength from 2,612,000 to 1,182,000 (3:338). This decrease was in line with the decreasing active duty

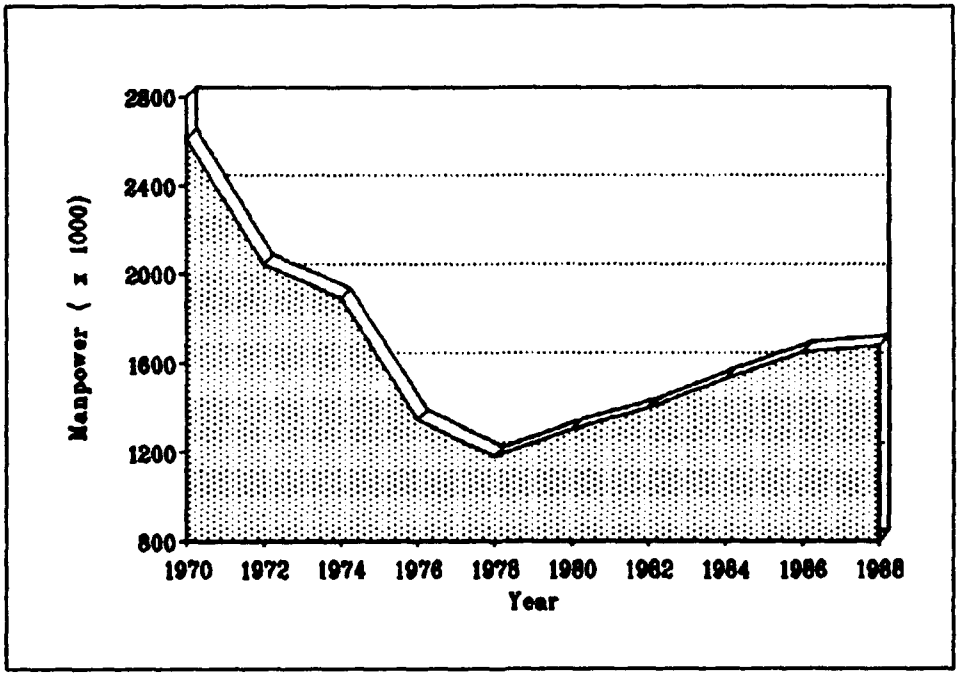

Figure 4. U.S. Ready Reserve Manpower from 1970 to 1988 (3:340,342)

manpower strength from 1970 to 1974. Recall that figure 1 shows a level reserve manpower percentage around 46% from 1970 to 1974. However after 1974, figure 4 shows that the reserve manpower strength continued to decrease rapidly while the active duty forces, shown in figure 3, started to level off. The result was a reduced reserve manpower strength of 1,144,000 in 1978. This 1978 reserve manpower strength represented only 36.4% of the military manpower, a drop of 9.6% from 1974. This percentage decrease in reserve manpower percentage from 1974 to 1978 was not intended and triggered significant attention to reserve manpower issues (14:1-11). In 1976, President Ford directed a review of the effectiveness of reserve compensation in meeting manpower objectives (14:1-11). This increase in management attention along with expanded recruiting resources and new bonus authorities helped reverse the declining reserve manpower trends (14:1-11). In 1980 the reserve manpower strength increased and in 1988 it reached 1,680,000. This was an increase of 536,000 men over 8 years and increased the reserve's contribution of total military manpower strength to 44%, just 2% short of the 1974 reserve percentage. Because of the reliance our nation places on the reserves, retention in the reserves is very important. Thus, this study will attempt to examine the factors which affect retention in the reserves.

Research Objective

According to the 1986 Reserve Components Survey, reservists cited both intangible factors and financial considerations as the main reasons for staying in the reserves (14:8-2). Table 1 shows that the intangible items

Table 1

Percentage Indicating That a Reason Made a Major Contribution to Staying in the Reserves

Reasons for Staying In	Enlisted	Officers
Intangible Reasons		
Serve country	55%	59%
Serve with people in unit	33	32
Use military equipment	19	12
Challenge of training	32	24
Travel, get away	28	20
Just enjoy Guard/Reserve	33	40
Pride in own accomplishments	47	51
Financial Reasons		
Use educational benefits	20	7
Training for civilian job	19	6
Credit towards retirement	50	62
Promotion opportunities	31	33
Need money for basic family expenses	34	23
Extra money to use now	35	25
Save money for future	22	20

received the highest number of major contribution responses. "Serve Country" and "Pride in own accomplishments" were

frequently chosen by both enlisted and officers as major contributors to staying in the reserve. However, financial considerations also appear to be important in the decision to stay in the reserves. "Earning credit towards retirement" was chosen by 50% of the enlisted and by 62% of the officers. "Needing money for basic family expenses" and "Extra money to use now" were also important considerations among the enlisted.

Because financial considerations are important, this study will attempt to determine the extent to which family income influences the reserve member's decision to quit the reserves. The following questions will be addressed in this study with regard to potential income:

1) How does income from the member's reserve duties affect reserve retention?

2) To what degree does income from the reserve member's civilian job affect career decisions?

3) Does income from other source, such as stocks and interest, affect reserve retention?

4) How does income from the wife's civilian job affect reserve retention?

5) To what degree does potential income from reserve retirement affect the retention decision?

6) How might changes in family income and retirement benefits affect career retention?

Scope

The analysis presented in this paper is based on the 1986 Department of Defense Reserve Component Surveys conducted by the Defense Manpower Data Center in Arlington, VA. The 1986 Reserve Component Surveys surveyed Officer and Enlisted personnel in the Selected Reserve components and their spouses. Approximately 12,000 officers and 63,000 enlisted personnel responded to the survey. Of these, approximately 7000 officer/spouse and 22,000 enlisted/spouse couples answered all the questions necessary to do the analysis in this thesis.

Assumptions

In order to simplify the analysis, certain groups in the selected reserve components are excluded. The full time reservists are not included. The analysis considers only part time reserve members. To simplify wage earning calculations, the small number of Warrant Officers in the sample (1,128) are not included. In order to simplify the discussion of the results, the study is limited to families with male reserve members and female spouses. Also, families with the wife or both husband and wife in the reserves are not included. Since relatively new reserve members are presumably less committed to a reserve career, the study is limited to reserve members with 6 good years of reserve service or less. A "good year" of reserve service

is any year of service that counts towards retirement. To have a good year of reserve service, the member must attend a minimum amount of training for that year. This means attending about one weekend of training per month and two weeks of training per summer. Figure 5 show the mean response of career intentions verses the number of good years of service a reserve member has. From this figure we see that the reserve members with 6 good years or less are not as inclined to stay in as the members with more than 6 good years.

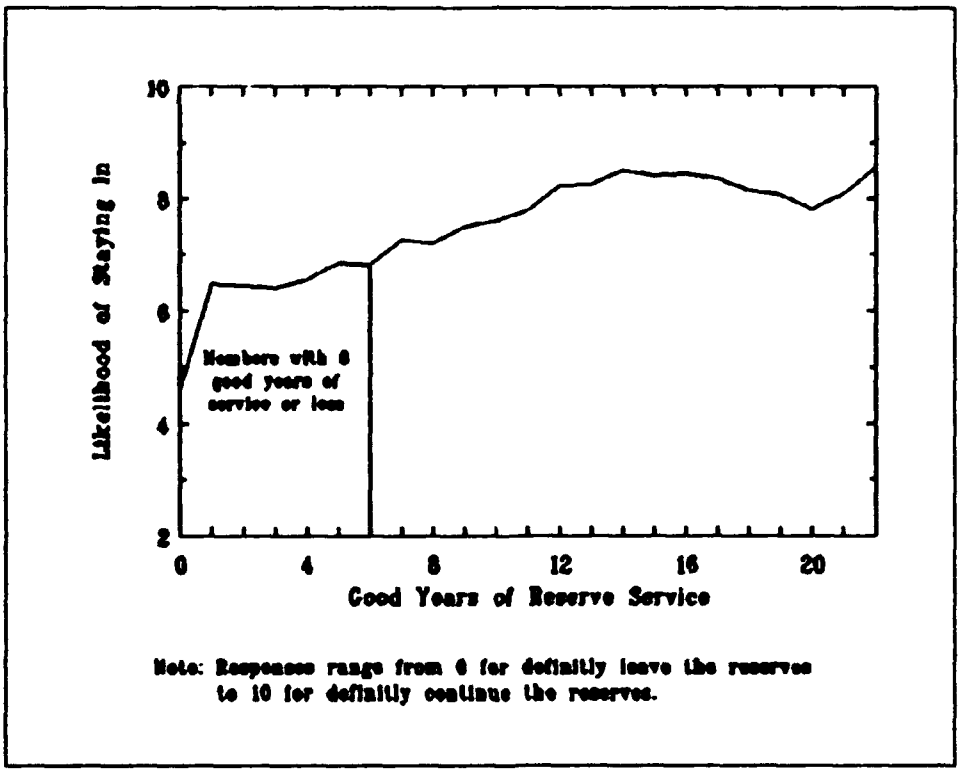

Figure 5. Mean Response of Career Intentions vs. Good Years of Service

Previous Studies

Reserve Studies. A number of studies have been published concerning the factors that affect retention in the reserves. In 1977 a report titled "A Study of Issues Related to Accession and Retention of Enlisted Personnel in the Reserve Components" Lisa Squadrini found that retention strategies based on social and vocational self actualization, family involvement, family acceptance, and pride in the Guard/Reserves are the most important factors influencing retention (17:xiii).

Maj Gen. Stanford Smith published an article in "Army Magazine" dated November 1988 that states family issues are critically important in the retention of reserve components soldiers (16:33). Issues such as changes in training schedules, training on holidays, delays in pay for extra drills, and commissary privileges are among the most important issues (16:34). Changes in training schedules tends to disrupt family plans and civilian work schedules. Mother's day and Easter Sunday are also disrupted with reserve training. Pay for extra duty and short active duty service are sometimes several months late (16:34). These types of issues are the ones the family is concerned about and shapes the overall family attitude toward reserve participation.

Two articles in the 1988 September issue of "Soldiers" cite personal satisfaction, caring leadership, and meaningful training as significant factors affecting retention in the Army National Guard and Reserve (20:22, 13:23).

In his thesis titled "An Analysis of Retention of First-Term Enlisted personnel in the Selected Reserves" dated June 1988, Donald Fithian Jr. found that the coefficient of marital status was positive and significant at the 10% level for the Army National Guard and Reserves (4:69). This implies that married members of the Army National Guard and Reserves are more likely to remain in the reserves than non-married reserve members. He also found that quality of life, education, training and availability of opportunities for promotion and leadership were significant factors in retention (4:71-72)

With regard to these previous studies, the majority find that intangible factors such as personal satisfaction, family attitudes, pride and self actualization are the most significant factors influencing retention in the reserve components. However, one study by Daniel O'Donohue found that reserve income has a statistically significant and positive impact on Selected Marine Corp Reserve retention. In his thesis titled "First-term Retention of Enlisted Selected Marine Corps Reservists" dated December 1988,

O'Donohue found that the coefficient of reserve income is significant at the 10% level and positive. However, civilian income was found not to be significant. Education, civilian job-related training, and retirement benefits were found to be relatively important in retention of first term reservists (15:74).

With regard to O'Donohue's study, he did not include all the reserve components or all family financial income factors. Thus, the need exists to examine how the husbands civilian income, the wife's income, other income, reserve income, and retirement income affects retention in all reserve components.

Active Duty Studies. For the active duty military studies, one study by Maj. Gerald F. Murray (USAF) found a relationship between officer retention and the wife's type of job. The more professional or managerial the job held by the wife, the more likely the active duty officer was to continue with his military career (18:10). This implies that the wife's income may have an affect on retention if one assumes that more professional jobs earn a higher income than less professional jobs.

Another study was performed by Dr. Leroy Gill of the Air Force Institute of Technology (5:1). Dr. Gill's study found that the greater the ratio of a wife's lifetime earnings married to a civilian spouse compared to those of a wife

married to a military spouse, the less likely her military husband is to plan a full military career. For example, if this ratio were increased by 20% then retention would decrease from 71.7% to 65.6% (5:19).

Overview

The next chapter will describe the methodology used, give a description of 1986 Reserve Components Survey's sample, and describe the sample used in this study. Chapter III presents the wage equations used to estimate the potential income of the reserve family. Wage equations for the husband's reserve income, the husband's civilian income, the husband's reserve retirement income, the wife's civilian income, and the income from other sources are presented. Chapter IV presents the results of this thesis. It discuses and explains reserve retention based on the above mention permanent income streams and other factors that affect family income. Finally, concluding remarks and recommendations are presented in Chapter V.

II. Methodology and Sample Description

Methodology

For this study an econometric analysis is used. Wage equations for each income source of the reserve family, are estimated using multiple regression analysis. The wage equations are estimated for income from civilian employment, income from reserve participation, income from stocks and interest, and income from reserve retirement. Once the wage equations are estimated, they are used to forecast the potential lifetime earnings of the reserve family. The significance of these earnings on retention is analyzed using a maximum likelihood logit analysis. Finally, a sensitivity analysis is performed on income variables of interest to determine their potential effect on the percentage of officers and enlisted retained in the reserves.

1986 Reserve Component Survey Description

The data used for this study is from "The 1986 Reserve Components Surveys" (1986 RC Surveys). The 1986 RC Surveys were conducted for two reasons. First to study family issues relating to retention. Second to study the impact of a wide range of personnel issues relating to retention (14:2-2). The Deputy Secretary of Defense was interested in retention effects of family issues while, the Department of

Defense was interested in how personnel issues affected retention (14:2-2). Because there was a great deal of overlap in the information needed for both purposes, the two requirements were merged into one study, "The 1986 Reserve Components Surveys" (14:2-2).

In 1985, the Deputy Assistant Secretary of Defense asked the Defense Manpower Data Center to conduct "The 1986 Reserve Components Surveys" (14:2-2). The surveys had the multiple objectives of studying; the financial issues that face the Guard and Reserve families, the responses to changes in military compensation and benefits, the factors that affect preparedness and retention, the relationships between civilian occupation and military occupation, the availability of medical and health coverage to Reserve families from non-Reserve source, the impact of employer policies and attitudes on Reserve participation, and the role of the family in Reserve participation (14:2-3).

The 1986 RC Surveys consisted of three separate survey instruments, two for the reserve components members (one for officers and one for enlisted) and one for their spouses (14:2-5). The reserve member's survey sampled selected reserve unit members, Individual Mobilization Augmentees (IMAs), and Military Technicians (14:2-5). IMAs are not assigned to a reserve component unit. They train with the active duty components. Military Technicians are Selected

Reserve members who are also employed by the reserve unit as a full time civilian employee. All seven reserve components (Army National Guard, Army Reserve, Naval reserve, Marine Corps reserve, Air National Guard, Air Force Reserve and Coast Guard Reserve) were included in the surveys (14:2-5). The 1986 RC Spouse Survey was a census of the spouses of all reserve members sampled in the "1986 RC Member Survey" (14:2-6).

The survey instruments were questionnaires designed to collect reliable information in the following seven major sections (10:E-1,E-40)

1. Military Background
2. Military Plans
3. Military Training, Benefits and Programs
4. Individual and Family Characteristics
5. Civilian Work
6. Family Resources
7. Military Life

The 1986 RC Surveys are the first comprehensive surveys of all reserve component members and the first major survey of the spouses. While each of the reserve units had conducted small-scale surveys for specific military family issues, a single cross-service study had never been conducted (6:2-2).

Military Population Frame/Sample. The population for the 1986 RC Surveys consisted of Selected Reserve trained officer and enlisted personnel and their spouses (14:2-6). The Reserve Components Common Personnel Data System ,as of 30 October 1985, was used to initially define the population frame on which the samples were drawn (14:2-6). The population frame was stratified by reserve components, reserve category, officer or enlisted status, and sex (14:2-6). The reserve categories are Unit Members, Non-Unit Members (IMAs), and Military Technicians. Table 2 shows the basic sample sizes selected to participate in the 1986 Reserve Components Surveys.

Description of Sample Used in This Study

This study focuses on the married reserve members and their spouses. The sample for this study is limited to the following reserve families:

a. Only couples that have male reserve members and non-military female spouses were included.
b. The non-unit members (IMAs) and the military technicians were excluded from the study.
c. Warrant officers were excluded from the sample.
d. All full-time reserve members are excluded from this study.

Table 2

Basic Sample Size of Military Members Selected for Participation in "The 1986 Reserve Components Surveys" (14:2-8)

	Reserve Component*							
	ARNG	USAR	USNR	USMCR	ANG	USAFR	USCGR	Total
Unit Members								
Officers								
Male	3,175	3,345	1,872	976	935	584	890	11,777
Female	385	1,340	331	46	163	309	74	2,648
Enlisted								
Male	30,785	15,826	7,650	6,040	5,971	3,729	2,890	72,891
Female	1,408	3,164	899	224	777	852	300	7,624
Non-Unit Members (IMAs)								
Officers								
Male	-	795	64	208	-	651	-	1,718
Female	-	94	9	39	-	164	-	306
Enlisted								
Male	-	291	4	97	-	347	-	739
Female	-	42	2	13	-	85	-	142
Technicians								
Officers								
Male	531	96	-	-	187	77	-	891
Female	31	13	-	-	9	7	-	60
Enlisted								
Male	1,548	243	-	-	1,790	672	-	4,253
Female	141	29	-	-	162	55	-	387
Total	40,014	26,384	12,354	7,925	10,644	7,592	4,154	109,067

* ARNG - Army National Guard
USAR - Army Reserve
USNR - U.S. Naval Reserve
USMCR - U.S. Marine Corps Reserve
ANG - Air National Guard
USAFR - U.S. Air Force Reserve
USCGR - U.S. Cost Guard Reserve

Table 3 below presents some descriptive statistics of the above reserve sample. The reserve husband's average age is 37.15. The wife's average age is 35.75. About 2 years younger than the husband. The husband's average reserve earnings are $3,922.00 per year and his average civilian earnings are $30,074.00 per year. The wife's average civilian earning are $15,020.00 per year. This is half what the husband earns in his civilian job. The average reserve

Table 3

Descriptive Statistics of Reserve Family Characteristics

Characteristics	Mean	Std Dev	Minimum	Maximum
Husband's Statistics				
Age	37.15	8.57	17	60
Active Duty Years	2.51	3.55	0	20
Years in Reserves	10.73	7.46	0	42
Years of Schooling	13.97	2.56	1	20
Reserve Earning/year	3,922	3,083	0	59,196
Civilian Earnings/year	30,074	23,701	0	207,948
Wife's Statistics				
Age	35.75	8.33	16	68
Years of Schooling	13.31	2.31	1	20
Civilian Earnings/year	15,020	15,049	0	207,948
Family Statistics				
Years Married	12.21	8.52	0	49
Dependents Under 18	2.93	1.14	1	11
Other Income	1,126	2,016	0	9,999

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and other income. In the civilian sector the enlisted member earns about 60% of what the officer earns. The wife of the enlisted member earns about 80% of what the officer's wife earns. Although the wage equations are utilized in the study of the full sample, they are estimated on a sub-sample which observe the following limitations:

a. The reserve member must earn at least $1791.00 per year from the reserves, work at least 35 hours per week and 50 weeks per year in their civilian job, have civilian earnings of at least $122.00 per week and $5,978.00 per year.

b. The wife's must earn work at least 35 hours per week and 50 weeks per year in a civilian job, have earnings of at least 122.00 per week and $5,978.00 per year.

III. Wage Equations

The purpose of this thesis is to study the impact of the different sources of family income upon reserve retention. In order to do this, five income streams are estimated for each reserve family. The husband contributes three income streams; income from the reserves, income from civilian work, and income from reserve retirement. The wife contributes the fourth income stream from her civilian job. Income from stocks and interest makes up the fifth income stream.

The income streams are estimated using wage equations derived from regression analysis. The wage equations use the semi-logarithmic form. In this form coefficients of non-dummy independent variables show percentage contribution to earnings. For zero/one dummy independent variables percent contribution of the variable is given by the equation: Percent Change = $e^c - 1$ (7:474). The letter "e" represents the natural logarithm base and "c" represents the variable coefficient.

Husband's Income

Reserve Earnings. In attempting to explain retention, it is hypothesized that decisions are a function of "permanent income". Permanent income represents the annuitized value of income which could potentially be earned over the remainder

of the working life (or actual life in the case of retirement income). To calculate the present value of the husbands potential lifetime income, certain assumptions are made. For reserve earnings, it is assumed that the husband stays in the reserves for the maximum number of years. This maximum is age 60 or whenever total military time reaches 32 years. For civilian earnings, the assumption is made that the reserve member works until age 60. For retirement income, it is assumed that it is received from age 60 to 80. Also, after age 60 only retirement income is estimated. All of the present value estimates refer to 1985 dollars. Although the reserve component survey was conducted in 1986, the income questions in the survey referred to earnings in 1985. So, the present value estimates refer to 1985 dollars.

For the members reserve wage equation, the sample is limited to those who earned at least $1791.00 in 1985. This value is the 10% quantile of the sample. For the member's civilian wage equation, a minimum wage of $3.5[illegible]/hr is used to calculate minimum earnings. This resulted in using only respondents that earned at least $122.00 per week and $5,978.00 per year. These minimum civilian income figures also assume full-time employment. Full time employment is defined as working at least 35 hours per week and 50 weeks per year.

Table 5 presents the semi-logarithmic wage equation coefficient estimates for the officer's annual reserve earnings. As shown in Table 5, 3,343 reserve male officers answered the questions needed to estimate the equation. This sample included only reserve members that earn at least $1791.00 per year from the reserves. The age coefficient (AGE) is significant at the 1% level and positive as expected. Age squared (AGE2) is significant at the 1% level and negative. This means that income increases at a decreasing rate with age. The variable DTYDAYS refers to the number of annual training days attended. Its coefficient is significant at the 1% level and positive. Reserve members receive pay based on the number of annual training days attended. The variable NOANNTRG is a zero-one dummy variable. It indicates that the reserve member did not attend annual training in 1985. Its coefficient is not significant. The coefficient for the dummy variable BLACK, which refers to the persons race, is not significant. The variable SCHOOL refers to the number of years of schooling completed. Its coefficient is significant at the 5% level and positive as expected. This means that the more schooling a reserve member has the more income he will tend to earn. However, the school squared (SCHOOL2) coefficient is significant at the 5% level and negative. The negative influence of school squared means the reserve member will

make more income as schooling increases but at a decreasing rate. The variable GOODYRS refers to the number of years a

Table 5

Officer's Wage Equation for Military Reserve Income

Dependent Variable: ln(Husband's Annual Reserve Income)
Sample Size = 3343
Adjusted R-Square = .4307

Variable	Coefficient Estimate	t	Prob > t
INTERCEP	5.207204	12.078	0.0001
AGE	0.089019	8.799	0.0001
AGE2	-0.000957	-7.940	0.0001
DTYDAYS	0.028588	30.767	0.0001
NOANNTRG	-0.049607	-1.075	0.2826
BLACK	0.003388	0.071	0.9436
SCHOOL	0.100471	2.188	0.0287
SCHOOL2	-0.002972	-2.203	0.0276
GOODYRS	0.019711	13.271	0.0001
ANG	0.154793	6.242	0.0001
AR	-0.019526	-0.883	0.3772
NR	0.060869	2.638	0.0084
MCR	0.073493	2.599	0.0094
AIRNG	0.217297	8.408	0.0001
CGR	-0.196426	-7.256	0.0001
ACADEMY	0.116871	5.872	0.0001
PRIOR	0.034737	2.247	0.0247

reserve member has that count towards retirement. The coefficient of GOODYRS is significant at the 1% level and

positive. The next six variables are zero-one dummy variables that represent the reserve and guard units other than the Air Force Reserve. Five of the six are significant at the 1% level. The Air Force Reserve is left out of the equation so that the remaining reserve unit coefficient estimates are relative to the Air Force Reserve. The results imply that members in the Army National Guard (ANG) make 16.7% more income than members in the Air Force Reserve. The Air National Guard (AIRNG) makes 24.3% more than the Air Force Reserve. The Coast Guard Reserve (CGR) members make 17.8% less than members in the Air Force Reserve. The coefficient for the Army Reserve (AR) is insignificant. These results may reflect omitted variables such as special pays which differ between reserve components. The variable ACADEMY is a zero-one dummy variable used to indicate the member attended a military academy. Its coefficient is significant at the 1% level and positive. Academy graduates make 12.39% more reserve income than non-academy graduates. The variable PRIOR is a zero-one dummy variable and refers to whether the member has prior active duty service time. Its coefficient is significant at the 5% level and positive. Prior service reserve members make 3.53% more than non-prior service members.

Table 6 presents the semi-logarithmic wage equation coefficient estimates for the enlisted reserve member's

annual earnings. A total of 9,317 enlisted male reserve members answered the questions necessary to estimate the wage equation. The first four variables, AGE, AGE2, and DTYDAYS have the same significance and sign as the officer parameter estimates. Age is significant at the 1% level and positive. Age squared (AGE2) is significant at the 1% level and negative. As with officers, the income of the enlisted reserve member increases at a decreasing rate with age. DTYDAYS is significant at the 1% level and positive. Again, NOANNTRG is a dummy variable that indicates whether the reserve member attended annual training in 1985. Its coefficient is not significant. For the enlisted, the coefficient for the BLACK variable is significant at the 1% level and negative. The coefficient for the variable SCHOOL is significant at the 1% level and positive. The school squared (SCHOOL2) coefficient is significant at the 1% level and negative. Enlisted income increases at a decreasing rate with the amount of schooling obtained. The coefficient for the number of good years (GOODYRS) is significant at the 1% and positive. The next six variables, denoting the type of reserve service, have coefficients opposite in sign from the officer's except for the Coast Guard Reserve. Four of the six are significant at the 1% level. The results imply that members in the Army Reserve (AR) make 2.9% more income than members in the Air Force Reserve. Navy Reserve (NR) members

make 9.4% less than the Air Force Reserve members. Marine Corp Reserve (MCR) coefficient is significant at the 5%

Table 6

Enlisted Wage Equation for Military Reserve Income

Dependent Variable: ln(Husband's Annual Reserve Income)
Sample Size = 9317
Adjusted R-Square = .4159

Variable	Coefficient Estimate	t	Prob > t
INTERCEP	6.696591	62.511	0.0001
AGE	0.014685	5.634	0.0001
AGE2	-0.000142	-4.385	0.0001
DTYDAYS	0.011693	32.789	0.0001
NOANNTRG	0.027538	1.324	0.1856
BLACK	-0.029823	-2.660	0.0078
SCHOOL	0.069864	5.173	0.0001
SCHOOL2	-0.002204	-4.684	0.0001
GOODYRS	0.021935	46.729	0.0001
ANG	-0.012809	-1.360	0.1738
AR	0.028372	2.718	0.0066
NR	-0.098760	-8.922	0.0001
MCR	-0.039595	-2.235	0.0255
AIRNG	-0.062042	-6.164	0.0001
CGR	-0.177707	-13.325	0.0001
PRIOR	0.009118	1.546	0.1220

level. Marine Corp Reserve member makes 3.9% less than the Air Force Reserve member. The Air National Guard (AIRNG)

members makes 6.0% less then an Air Force Reserve member. The Coast Guard Reserve (CGR) members make 16.3% less than members in the Air Force Reserve. The coefficient for the Army National Guard (ANG) is insignificant. Again, these results may reflect omitted variables such as special pays which differ between reserve components. The zero-one dummy prior service coefficient (PRIOR) is insignificant for the enlisted. The prior service coefficient was significant for the officers.

Civilian Earnings. Table 7 shows the semi-logarithmic wage equation coefficient estimates for weekly civilian earnings of officers and enlisted. All the variable coefficients, except for father's schooling (FSCHOOL), are significant at the 1% level. As expected the age coefficient is positive and the age squared coefficient is negative. This shows that the member will most likely increase his earnings the older he becomes but, at a decreasing rate. The amount of schooling is positive with schooling squared negative. The next three variables (BA, MA, PHD) are zero-one dummy variables that show the receipt of degrees has a positive effect on earnings apart from that of years of schooling. This is often referred to as the "sheepskin effect". The variable BA represents a bachelors degree. The variable MA represents a masters degree, and PHD represents a doctoral degree. The sheepskin effect for all three degrees

is significant at the 1% level and positive. The coefficient of BA implies that members with a bachelors degree make

Table 7

Wage Equation for Civilian Income
of Reserve Officers and Enlisted Combined

Dependent Variable: ln(Husband's Weekly Civilian Income)
Sample Size = 13129
Adjusted R-Square = .3058

Variable	Coefficient Estimate	t	Prob > t
INTERCEP	2.860006	19.840	0.0001
AGE	0.078941	21.617	0.0001
AGE2	-0.000764	-16.689	0.0001
SCHOOL	0.171228	9.262	0.0001
SCHOOL2	-0.004661	-7.156	0.0001
BA	0.101247	7.478	0.0001
MA	0.210650	9.537	0.0001
PHD	0.495804	15.077	0.0001
BLACK	-0.087562	-5.300	0.0001
ENGLISH	0.043807	2.587	0.0097
ACADEMY	0.198502	9.617	0.0001
FSCHOOL	0.001945	2.397	0.0166

10.65% more than members without a bachelors degree. Members with doctoral degrees make 64.18% more than members without any degree. The dummy variable BLACK has a coefficient that is significant at the 1% level and negative. The variable ENGLISH is a zero-one dummy variable and denotes whether the

husband speaks english as his main language. The coefficient for the ENGLISH variable is significant at the 1% level and has a positive effect on civilian income. English speaking husbands make 4.48% more civilian income than non-english speaking husbands. The indicator variable ACADEMY denotes graduation from a service academy. As in the officers reserve income equation (Table 5), the zero-one dummy coefficient for ACADEMY is positive. However, the ACADEMY coefficient for civilian earnings (Table 7) is larger than the one for reserve officer earnings. Academy graduates make 21.96% more than non-academy graduates in the civilian sector. The variable FSCHOOL refers to the level of education the reserve member's father obtained. Its coefficient is significant at the 5% level and has a positive effect on civilian income.

Retirement Income

To calculate retirement income, the retiring rank of the reserve member has to be estimated. The officers were asked to estimate their most likely retirement rank. The results of this question are used to determine the reserve officers retirement rank. For the enlisted, the most likely retirement rank question was not asked and therefore, it is necessary to estimate their final rank. This is done by first estimating a "rank" equation which explains their rank as a function of their personal characteristics including

age. It is assumed that the member would stay in the reserves until the age of 60 or whenever total time in the military reached 32 years. Given these assumptions, their final rank is estimated using their assumed age and number of years of service at that point in time. Table 8 shows the parameter estimates for the rank equation.

Table 8

Rank Equation for Enlisted Reserve Members

Dependent Variable: RANK
Sample Size = 9317
Adjusted R-Square = .4604

Variable	Parameter Estimate	t	Prob > t
INTERCEP	-0.914797	-2.486	0.0129
AGE	0.101889	9.975	0.0001
AGE2	-0.001061	-8.351	0.0001
SCHOOL	0.393797	8.353	0.0001
SCHOOL2	-0.011955	-7.273	0.0001
GOODYRS	0.124064	25.997	0.0001
PRIOR	0.024498	1.227	0.2198

A total of 9,316 enlisted reserve members answered the questions needed to estimate the parameters for the rank equation. As expected, age is significant at the 1% level and has a positive relationship with enlisted rank. The age squared (AGE2) coefficient is significant at the 1% level and is negative. The amount of schooling is significant at the

1% level and has a positive relationship with rank. The schooling squared (SCHOOL2) coefficient is significant at the 1% level and is negative. The number of good years toward retirement (GOODYRS) is significant at the 1% level and has a positive affect on rank. The coefficient for good years squared GOODYRS2 is significant at the 1% level and is negative. Prior service (PRIOR) does not have a significant effect on enlisted rank.

After the retirement rank of the reserve member is estimated, the monthly retirement income is calculated using the following formula (1:2):

$$\text{Retirement Income} = \frac{\text{Points}}{360} * 0.025 * \text{Base Pay}$$

The variable "Base Pay" is the 1985 active duty military base pay for 20 years of service. The reserves use the same base pay schedule as the active duty military personnel. But, the reserves only receive pay per day of service where the active duty receive pay for a month of service. The variable "Points" is the total number of points the reserve member accumulates during his reserve service. The average number of point a reserve member makes a years is around 77 (8). With this information, the total number of points is calculated using the following formula:

```
Active Years * 360
   Good Years * 77
 +       Years * 77
--------------------
 =            Points
```

The variable "Active Years" is the number of active duty years the reserve member served. Reserve members with active duty service receive 1 point for each day of active duty served, up to 360 points per year. The variable "Good Years" is the number of years that count towards retirement. A reserve member must earn at least 50 points per year to have a year count as a good year toward retirement. The variable "Years" is the number of years the reserve member continues to serve after the survey taken. This is modeled by assuming all reserve members continue in the reserves to the age of 60 or when 32 years of total military tenure, including active duty, has been reached. The reserve member must leave the reserves at the age of 60 or when total military time reaches 33 years.

Wife's Income

To calculate the present value of the wife's income streams, certain assumptions are made. The present value of the wife's civilian earnings are calculated to age 60. It is assumed that after age 60, only retirement income from the reserve member is earned. The requirement used for full time

employment is working at least 35 hours per week and 50 weeks per year, and earning at least $122.00 per week and $5.978.00 per year. The minimum wage of $3.50 per hour is used to determine the minimum earnings per week and per year. A total of 3,576 wives met these requirements and are used to estimate the wage equation in Table 9.

The wife's wage equation is used to measure the opportunity cost of working outside the home for all wives with a given set of personal characteristics. It is applied to all wives in the sample regardless of whether they are currently employed.

Table 9 below shows the semi-logarithmic wage equation coefficient estimates for the wife's weekly civilian earnings. The coefficient of the AGE variable is significant at the 1% level and positive as expected. Age squared's (AGE2) coefficient is significant at the 1% level and negative. The variable TENURE refers to the amount of tenure the wife has at her current job in years. Its coefficient is significant at the 1% level and has the largest positive affect on income. For one more year of tenure the wife will increase her income by 5.8%. The tenure squared (TENURE2) coefficient is not significant. The variable SCHOOL is the amount of education in years the wife has. Its coefficient is not significant. The coefficient for school squared (SCHOOL2) is significant at the 1% level and positive. The

negative coefficient of SCHOOL and positive coefficient of SCHOOL2 are unexpected. This shows that schooling initially has a negative affect on income but becomes positive at the 7th grade level due to the positive school squared term. This could be the result of unmeasured personal characteristics within the sample. The coefficient for BLACK is not significant for the wife's civilian income.

Table 9

Wage Equation for the Wife of the Reserve Member (Officer and Enlisted)

Dependent Variable: ln(Wife's weekly civilian income)
Sample Size = 3576
Adjusted R-Square = .2727

Variable	Coefficient Estimate	t	Prob > t
INTERCEP	4.377154	20.120	0.0001
AGE	0.034131	5.255	0.0001
AGE2	-0.000377	-4.133	0.0001
TENURE	0.057863	3.508	0.0005
TENURE2	-0.002277	-1.119	0.2631
SCHOOL	-0.030828	-1.195	0.2322
SCHOOL2	0.004297	4.784	0.0001
BLACK	0.007325	0.257	0.7971

Other Income

Income from stocks, bonds, and interest is defined as "other income" for the purpose of this study. Income from

other sources such as alimony, pensions, welfare, food stamps, and social security were excluded from the regression analysis used to estimated the wage equation parameters. For those who did not respond to having income from stocks, bonds, or interest, other income is estimated for families with their characteristics.

Table 10 shows the semi-logarithmic coefficient estimates for other income. There were 6,494 reserve members that answered the necessary questions needed the estimate the coefficients of the equation. The coefficient of AGE is significant at the 1% level and positive. The reserve members age squared (AGE2) is not significant. The reserve members wife's age (SAGE) has a is significant coefficient at the 5% level and is positive. The wife's age squared (SAGE2) coefficient is not significant. The education level of the husband, represented by the variable SCHOOL and SCHOOL2 is not significant. The wife's education level (SSCHOOL) is not significant. But, her education squared (SSCHOOL2) is significant. The coefficient of SSCHOOL2 is significant at the 5% level and positive. The number of dependents, represented by DEPEND, is significant. The DEPEND coefficient is significant at the 1% level and negative. Each dependent the family has decreases other income by 10.64%. The variable OWNHOME is a zero-one dummy variable that represents home ownership. Its coefficient is

significant at the 1% level and has a large positive effect on other income. Families that own their home have 24.5% more other income than families that do not own their home.

Table 10

Income Equation for Other Income Sources of the Reserve Family

Dependent Variable: ln(Annual Other Income)
Sample Size = 6494
Adjusted R-Square = .1537

Variable	Parameter Estimate	t	Prob > t
INTERCEP	0.106491	0.122	0.9028
AGE	0.090557	2.691	0.0071
AGE2	-0.000622	-1.517	0.1294
SAGE	0.061843	2.031	0.0423
SAGE2	-0.000583	-1.510	0.1312
SCHOOL	0.121858	1.419	0.1558
SCHOOL2	-0.000053016	-0.019	0.9849
SSCHOOL	-0.062516	-0.854	0.3930
SSCHOOL2	0.005077	1.998	0.0457
DEPEND	-0.106429	-6.819	0.0001
OWNHOME	0.219176	3.090	0.0020

Table 11 shows descriptive statistics for the income variables. All the income variables shown are calculated using the wage equations described above. All values are in 1985 dollars. A 3% discount rate is used for present value calculations. The 3% discount rate assumes that net effects of inflation on financial investments is 3%.

Table 11*

Descriptive Statistics of Income Variables
in 1985 Dollars

Variable	Mean	Std Dev	Minimum	Maximum
Husband's Civilian Income				
Civilian Income/Year	33,369	7,228	14,614	86,143
Total Lifetime Income	505,755	158,561	25,646	1,488,827
Annuitized CV Income	35,592	8,704	16,155	115,770
Officer's Reserve Income				
Reserve Income/Year	6,718	2,528	1,675	48,943
Total Lifetime Income	75,172	31,235	3,060	415,247
Annuitized	7,518	3,156	1,765	57,977
Enlisted's Reserve Income				
Reserve Income/Year	3,185	759	1,598	14,327
Total Lifetime Income	38,531	12,134	2,409	140,181
Annuitized	3,528	1,054	1,679	16,368
Husband's Reserve Retirement Income				
Total Points Earned	3,335	1,101	0	7,200
Retirement Income/Year	5,965	3,706	0	29,458
Total Lifetime Income	49,073	34,929	0	330,413
Annuitized	3,298	2,348	0	22,209
Wife's Civilian Income				
Civilian Income/Year	11,277	5,370	1,334	36,255
Total Lifetime Income	282,876	88,393	8,772	667,261
Annuitized	17,017	4,460	4,584	35,847
Other Family Income				
Other Income/Year	886	483	143	3,744
Total Lifetime Income	9,591	5,522	347	45,327
Annuitized	710	446	90	7,483

*A 3% real discount rate is assumed in calculating present value amounts.

IV. Reserve Retention

This chapter studies the sensitivity of officer and enlisted retention decisions to economic variables which determine family income. For the purpose of this study reserve retention is studied in two ways. First, long term retention (staying in the reserves until retirement) is studied. Next, short term retention is analyzed. Short term retention is defined (for the purpose of this paper) as reenlisting at the end of the current term for the enlisted and staying in after the current obligation for officers. For each retention definition (long term or short term), the significant variables of family income are presented and the impact these variables have on reserve retention is examined.

Long Term Retention

Definition of Dependent Variable. The dependent variable for long term retention is CAREER. It is a zero/one dummy variable. Due to the well known statistical problems associated with the estimation of equations which have zero/one dependent variables, the maximum likelihood logit model is used (12:15). CAREER equals one if the reserve member indicated he will most likely continue in the reserves until retirement. If CAREER equals zero the reserve member will most likely leave the reserves before retirement. The value and meaning of the CAREER variable is based on

questions asked of the reserve member's career intentions. Table 12 shows the questions asked of the officer and enlisted reserve member and the possible responses.

The officer's long term retention question has 11 possible responses that range from "No chance" to "Certain". Those who responded "Does not apply/have already qualified" are not included in the analysis. The members that responded to the questions with "No chance, Very slight possibility, or Slight possibility" are assigned a CAREER value of zero. These members are assumed unlikely to stay in the reserves until retirement. Members that marked responses from "Some possibility to Certain" are assigned a CAREER value of one.

The long term retention question for the enlisted member has four possible responses. They are "I have already qualified", "Yes", "No", and "Don't know/am not sure". Those who responded "I have already qualified" and "Don't know/am not sure" are deleted from the analysis. Enlisted member's responding with "No" are assigned a CAREER value of zero. Members responding with "Yes" are assigned a CAREER value of one.

Maximum Likelihood Logit Analysis. Table 13 shows the maximum likelihood parameter estimates for officers with 6 years of reserve service or less. The zero/one dummy variable CAREER, as defined above for long term officer retention, is used. The variable CIV_EARN represents

Table 12

Career Questions Asked of the
Reserve Member (10:E-25,E-6)

Officer's Long Term Retention Question (10:E-25)

How likely are you to stay in the Guard/Reserve until retirement? Assume that all special pays which you currently receive are still available. Mark one

__ Does not apply, I have already qualified for retired pay

__ (0 in 10) No chance
__ (1 in 10) Very slight possibility
__ (2 in 10) Slight possibility
__ (3 in 10) Some possibility
__ (4 in 10) Fair possibility
__ (5 in 10) Fairly good possibility
__ (6 in 10) Good possibility
__ (7 in 10) Probable
__ (8 in 10) Very probable
__ (9 in 10) Almost sure
__ (10 in 10) Certain

Enlisted Members Long Term Retention Question (10:E-6)

Do you plan to stay in the Guard/Reserve long enough to qualify for retired pay?

__ I have already qualified
__ Yes
__ No
__ Don't know/am not sure

annuitized civilian earnings of the reserve member. The variable RES_EARN represents annuitized reserve earnings. The variable OTHER_EARN represents annuitized income from

Table 13

Maximum Likelihood Logit Analysis of Reserve Officers with 6 Years of Service or Less Officers Long Term Retention Question

Response variable: CAREER (Stay in until retirement)
Response variable mean = 0.9625668
Sample size = 561

Effect	Parameter Estimate	Standard Error	Chi-Square	Prob
INTERCEPT	0.8469	1.8294	0.21	0.6434
CIV_EARN	-0.000026	0.000035	0.56	0.4533
RES_EARN	-0.000067	0.000177	0.14	0.7068
OTHER_EARN	0.00075	0.00107	0.49	0.4825
RET_PAY	0.00072	0.000247	8.40	0.0038***
WIFE_EARN	0.00003	0.0[illegible]081	0.10	0.7507
NET_ASSETS	-0.000023	0.000037	0.40	0.5282
DEPEND18	0.4153	0.1977	4.41	0.0357**
WIFE_WORK	-0.6673	0.7852	0.72	0.3954
PRIOR	-0.8563	0.6584	1.69	0.1934

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

stock and interest. The variable RET_PAY represents annuitized earnings from reserve retirement. The annuitized

earnings from the wife is represented by the variable WIFE_EARN. The variable NET_ASSETS represents the net assets the reserve family has in stocks, bonds, or savings. The number of dependents under 18 years of age is represented by the variable DEPEND18. Whether the wife works or not is represented by the zero/one dummy variable WIFE_WORK. The variable PRIOR is a zero/one dummy variable that denotes whether the reserve member served in active duty service.

There are two variables that are statistically significant. They are RET_PAY (Annuitized retirement pay) and DEPEND18 (Number of dependents under 18). The coefficient of the variable RET_PAY is significant at the 1% level and has a positive effect on retention in the reserves. This is an important finding, because retirement pay amount is one variable that can be controlled by the Government. This means the Government can control the amount of long term reserve retention, to some degree, by selecting a retirement amount that corresponds to a particular retention rate. The sensitivity analysis in the next section shows exactly how retirement pay and long term retention are related for officers and enlisted members. The coefficient of the variable for the number of dependent under 18 (DEPEND18) is significant at the 5% level and positive.

Table 14 show the maximum likelihood parameter estimates for the enlisted reserve personnel. The zero/one dummy

variable CAREER, as defined for long term enlisted retention, is used. The enlisted logit analysis uses the same independent variables that the officer logit analysis used plus two additional, REC_BONUS and REUP_BONUS. The variables REC_BONUS and REUP_BONUS are reenlistment bonus variables. The variable REC_BONUS is a zero/one dummy variable and denotes whether the member has received a bonus in the past for reenlisting. The variable REUP_BONUS is a zero/one dummy variable and denotes whether the member is eligible to receive a bonus for reenlisting.

There are four variables that are statistically significant for long term enlisted retention. They are RET_PAY (Annuitized earnings from reserve retirement), NET_ASSETS (Net family assets), DEPEND18 (Number of dependents under 18), and PRIOR (Prior active duty military service). Earnings from reserve retirement (RET_PAY) is significant at the 1% level and has a positive effect on retention. Again, as this finding was for the reserve officer, this is an important finding for long term enlisted retention. The coefficient for family net assets (NET_ASSETS) is significant at the 10% level and positive. The coefficient for the number of dependents under 18 (DEPEND18) is significant at the 1% level and positive. The prior active duty coefficient, denoted by the variable (PRIOR) is significant at the 5% level and positive.

Table 14

Maximum Likelihood Logit Analysis of Reserve
Enlisted with 6 Years of Service or Less
Enlisted Long Term Retention Question

Response variable: CAREER (Stay in until retirement)
Response variable mean = 0.8845
Sample size = 1611

Effect	Parameter Estimate	Standard Error	Chi-Square	Prob
INTERCEPT	-0.0459	0.9319	0.00	0.9607
CIV_EARN	-3.909E-6	0.000033	0.01	0.9059
RES_EARN	0.00009	0.000205	0.21	0.6444
OTHER_EARN	0.00064	0.00082	0.60	0.4370
RET_PAY	0.00063	0.000204	9.61	0.0019***
WIFE_EARN	-0.000015	0.000036	0.16	0.6886
NET_ASSETS	0.00003	0.000014	3.30	0.0693*
DEPEND18	0.2355	0.0618	14.54	0.0001***
WIFE_WORK	-0.0240	0.2020	0.01	0.9054
REC_BONUS	0.0269	0.1750	0.02	0.8777
REUP_BONUS	-0.2178	0.1889	1.33	0.2489
PRIOR	0.6352	0.2486	6.53	0.0106**

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

Sensitivity Analysis. The sensitivity analysis uses the coefficients estimates of the maximum likelihood logit analysis to predict retention probabilities. The retention

probabilities are predicted using the following logit probability equation (12:22):

$$\text{Probability of Retention} = \frac{e^{cx}}{1 + e^{cx}}$$

Where

e = The base of the natural logarithm.
c = A vector of the coefficient estimates of each variable.
x = A vector of the mean values of each independent variable.

From the above equation, the probability of retention can be calculated for different values of specific independent variables while holding all other independent variables constant. Thus if the means of all independent variables are used and only retirement pay is varied, the probability of retention as a function of retirement pay can be plotted.

In the following paragraphs the impact of retirement pay and number of dependents under 18 on long term officer/enlisted retention is presented. Retirement pay is selected for further analysis because it is controlled by government policy. This makes it important to government policy makers that might wish to see the affect changes in retirement pay have on reserve retention. The number of dependents under 18 is chosen for further analysis because it perhaps reflects a perceived need for extra income. Although

net assets and prior active duty service are significant with respect to long term enlisted reserve retention, no further analysis is performed.

Retirement Pay. Figure 6 shows the impact of retirement pay on long term retention for officers with 6 good years of service or less. For the current system the mean officer retirement pay is $5629.71/year. A 10% increase in retired pay would increase the probability of long term officer retention from 96.3% to 97.1%. This is a relatively small increase due to the fact that under the current system 96.3% of the reserve officers intend to stay in the reserves. Figure 6 also shows that if retirement pay where eliminated completely, long term retention would decrease from 96.3% to 65.4%. This analysis shows that long term officer retention is very sensitive to the existence of retirement pay. By varying retirement pay alone, long term officer retention can vary from a hypothetical high of 100% to a low of 65.4%. It should be noted that the Y axis title "Probability of Long Term Retention" of figure 6, is relative to the arbitrary definition of "Long Term Retention" for officers. This is due to the fact the officer's long term retention question has 11 possible responses. In this case "Long Term Retention" represents the reserve officer's indication of at least some possibility of staying in the reserves until retirement.

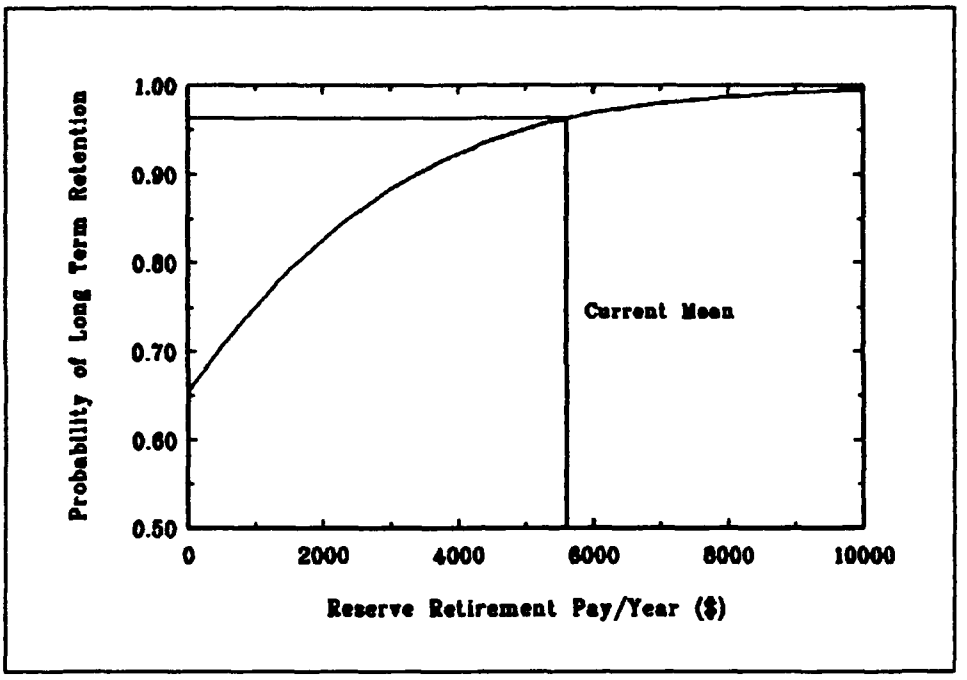

Figure 6. Probability of Long Term Retention for the Reserve Officer vs. Retirement Pay Amount

Figure 7 shows the impact of retirement pay on long term retention for the enlisted member with 6 good years of service. The current mean for enlisted retired pay is $2259.77/year. A 10% increase in enlisted retired pay would increase the probability of retention from 88.5% to 89.9%. Again, this is a relatively small increase due to the fact that, under the current system, 88.5% of enlisted reserve intend to stay in until retirement. If retirement pay for the enlisted reserve member were eliminated, career retention would decrease to 64.9%. This is close to the same retention rate for reserve officers if retirement pay were eliminated.

Again, as with the reserve officer, long term enlisted retention is very sensitive to retirement pay amount. Enlisted reserve retention can vary from a theoretical high of 100% to a low 65% depending only on the amount of retirement pay.

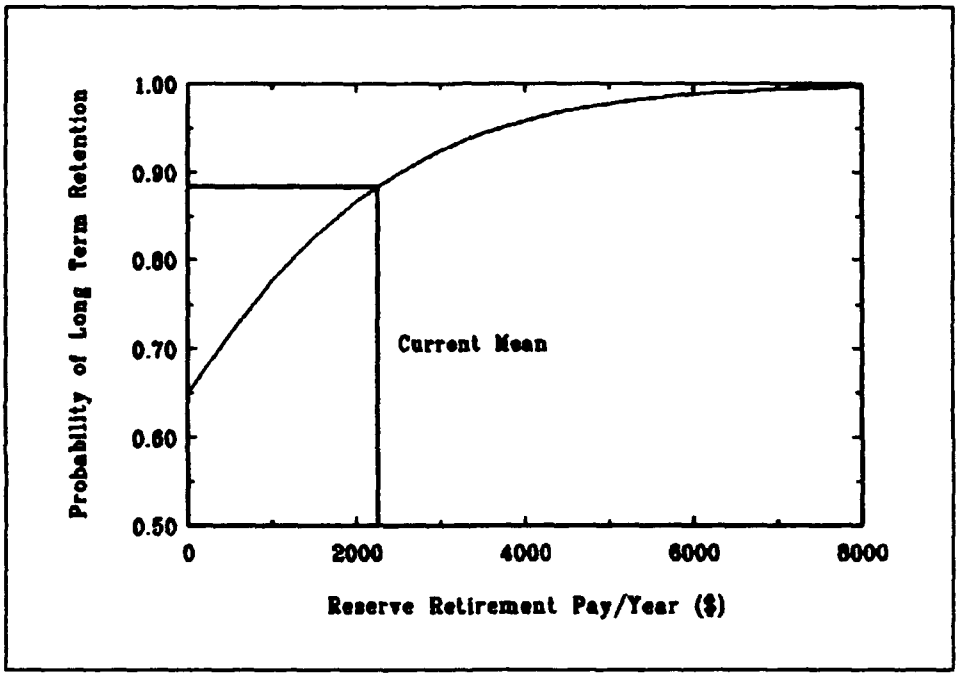

Figure 7. Probability of Long Term Retention for the Enlisted Reserve Member vs. Retirement Pay Amount

Dependents Under 18. Figure 8 show the impact of the number of dependents under 18 has on long term reserve officer retention. From Figure 8 it can be seen that the current mean of 2.15 dependents under 18 results in a officer retention rate of 96.3%. Holding all other variables

constant and increasing the number of dependents under 18 by one, the probability of long term retention increases from 96.3% to 97.5%. For married reserve officers with no dependents under 18 the retention rate is 91.3%. This shows that long term officer retention is not as sensitive to the number of dependents under 18 as it is to the amount of retirement pay.

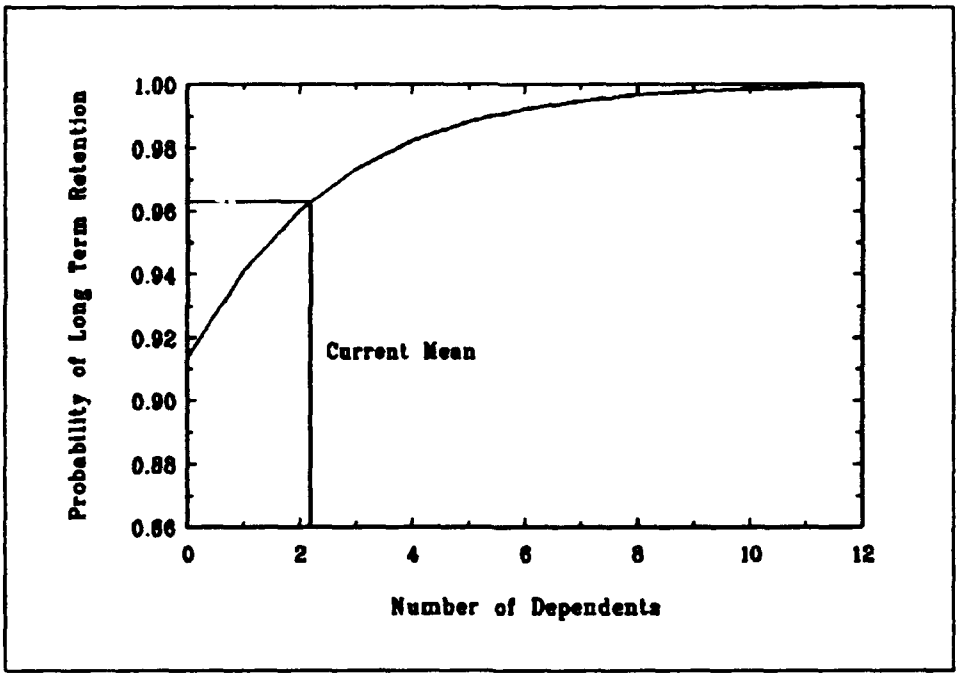

Figure 8. Probability of Long Term Retention for the Reserve Officer's vs. Number of Dependents Under 18

Figure 9 graphs the number of dependents under 18 versus predicted long term retention for the enlisted members. Long term retention of enlisted reserve members is more sensitive

to the number of dependents under 18 than long term officer retention. The current mean of 2.28 dependents under 18 results in a retention rate of 88.5%. If the number of

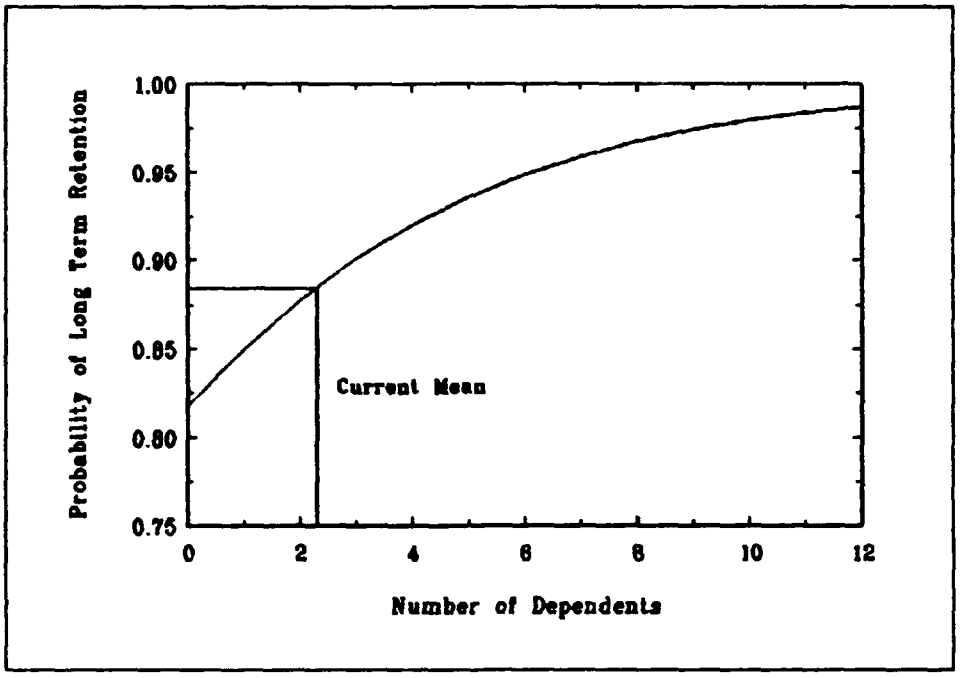

Figure 9. Probability of Long Term Retention for the Enlisted Reserve Members vs. Number of Dependents Under 18

dependents is increased by one, the probability of long term retention increases from 88.5% to 90.7%. This is a 2.2% increase in long term enlisted retention. For married enlisted reserve members with no dependents under 18, the long term retention probability is 81.7%: For reserve officers the comparable percentage is 91.3%.

Short Term Retention

Up to this point, only long term retention in the reserves, as defined by staying in until retirement, has been considered. Now short term retention in the reserves, as defined by reenlisting or staying in past the current obligation, is analyzed.

Definition of Dependent Variable. There are two dependent variables used for short term retention, STAY and REUP. The STAY dependent variable denotes reserve officer short term retention. REUP denotes reserve enlisted short term retention. They are zero/one dummy variables. When the STAY variable equals one the reserve officer will most likely stay in the reserves past his current obligation. If the variable STAY equals zero, then the reserve officer will most likely leave the reserves at the end of his current obligation. When REUP equals one the reserve enlisted member will most likely reenlist at the end of his current term of service. If REUP equals zero then the reserve enlisted member will most likely leave the reserves at the end of his current term of service. The value and meaning of the STAY and REUP variables are based on the questions in Table 15.

The reserve officer's short term retention question has 3 possible responses, "Yes", "No", and "Don't know". Members that responded "Yes" are assigned a value of 1 to the STAY variable. "No" responses are assigned a value of zero to the

Table 15

Career Questions Asked of the
Reserve Member (10:E-25,E-5)

Officer's Short Term Retention Question (10:E-25)

At the end of your obligation, do you intend to continue to participate in the Guard/Reserve?

__ Yes
__ No
__ Don't know

Enlisted's Short Term Retention Question (10:E-5)

How likely are you to REENLIST OR EXTEND at the end of your current term of service? Assume that all special pays which you currently receive are still available. Mark one

__ (0 in 10) No chance
__ (1 in 10) Very slight possibility
__ (2 in 10) Slight possibility
__ (3 in 10) Some possibility
__ (4 in 10) Fair possibility
__ (5 in 10) Fairly good possibility
__ (6 in 10) Good possibility
__ (7 in 10) Probable
__ (8 in 10) Very probable
__ (9 in 10) Almost sure
__ (10 in 10) Certain

STAY variable. The members that responded "Don't know" are deleted from the analysis.

The enlisted's short term retention question has 11 possible responses that range from "No chance" to "Certain". The members that responded to the questions with "No chance, Very slight possibility, or Slight possibility" are assigned a REUP value of zero. Members that marked responses from "Some possibility to Certain" are assigned a REUP value of one.

Maximum Likelihood Logit Analysis. Table 16 shows the maximum likelihood parameter estimates for reserve officers with 6 good years of service or less. The zero/one dummy variable STAY, as defined above for short term officer retention, is used. From the table it can be seen that the coefficient for reserve earnings (RES_EARN) is significant and positive at the 10% level. This is an important finding because reserve earnings are controlled by the Government.

Table 17 below shows the maximum likelihood parameter estimates for enlisted reserve members with 6 good years of service or less. The zero/one dummy variable REUP, as defined above for enlisted short term retention, is used. There are four variables that are statistically significant. They are OTHER_EARN (Annuitized earnings from stocks and interest), NET_ASSETS (Net family assets), DEPEND18 (Number of dependents under 18), and PRIOR (Prior active duty

military service). The amount of retirement pay is not significant for short term retention as it was for long term

Table 16

Maximum Likelihood Logit Analysis of Reserve Officers with 6 Years of Service or Less
Officer Short Term Retention Question

Response variable: STAY (Will Stay in Past Obligation)
Response variable mean = 0.9452
Sample size = 146

Effect	Parameter Estimate	Standard Error	Chi-Square	Prob
INTERCEPT	-1.0758	2.9280	0.13	0.7133
CIV_EARN	0.00003	0.000061	0.30	0.5848
RES_EARN	0.00066	0.000369	3.22	0.0726*
OTHER_EARN	0.00016	0.00233	0.00	0.9439
RET_PAY	-0.000231	0.000189	1.48	0.2235
WIFE_EARN	-0.000038	0.000164	0.05	0.8164
NET_ASSETS	-0.000028	0.000068	0.18	0.6755
DEPEND18	0.2818	0.3055	0.85	0.3562
PRIOR	1.1467	1.1794	0.95	0.3309

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

retention. The coefficient for earnings from other income (OTHER_EARN) is significant at the 10% level and negative. The coefficient for family net assets (NET_ASSETS) is significant at the 5% level and positive. The coefficient

for the number of dependent under 18 (DEPEND18) is significant at the 1% level and positive. The prior active

Table 17

Maximum Likelihood Logit Analysis of Reserve Enlisted with 6 Years of Service or Less Enlisted Short Term Retention Question

Response variable: REUP (Will Reenlist)
Response variable mean = 0.8652
Sample size = 2514

Effect	Parameter Estimate	Standard Error	Chi-Square	Prob
INTERCEPT	-0.3298	0.6685	0.24	0.6218
CIV_EARN	0.00003	0.000023	1.75	0.1859
RES_EARN	0.00013	0.000145	0.77	0.3810
OTHER_EARN	-0.000899	0.000484	3.45	0.0633*
RET_PAY	0.00014	0.000115	1.58	0.2091
WIFE_EARN	0.00004	0.000026	1.93	0.1645
NET_ASSETS	0.00002	0.00001	4.03	0.0447**
DEPEND18	0.1307	0.0443	8.71	0.0032***
WIFE_WORK	-0.0355	0.1485	0.06	0.8111
REC_BONUS	-0.1120	0.1268	0.78	0.3772
REUP_BONUS	0.1554	0.1451	1.15	0.2841
PRIOR	0.6212	0.1703	13.30	0.0003***

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

duty service (PRIOR) coefficient is significant at the 1% level and positive. These findings for short term enlisted

retention are somewhat discouraging. None of the significant variables are controllable by government policy. This tends to make their significance less important than significant variables that can be controlled by government policy.

Sensitivity Analysis. This sensitivity analysis for short term retention will include the variables RES_EARN, representing reserve earning for officers, and DEPEND18, representing the number of dependents under 18 for enlisted reserve members. Reserve earnings (RES_EARN) is an important significant variable for the reserve officer with respect to short term retention because it is controlled by government policy. No other variables were found to be significant for short term officer retention. Of the significant variables for the enlisted reserve member, none are controllable government policy variables. However, DEPEND18 (Number of dependents under 18) will be analyzed. This will provide for a comparison with the same DEPEND18 variable of the enlisted long term retention analysis.

Reserve Officer Earnings. Figure 10 shows the impact officer reserve earnings have on short term retention in the reserves. At the current reserve earnirgs mean of $5389.08, holding all other variables constant, 94.5% of the reserve officers are staying in past their current obligation. If reserve earnings are doubled, the short term retention would increase to 99.7% from 94.5%. If reserve earnings were

halved, the model predicts that short term retention would decrease to 79.8% from 94.5%. This a large decrease and shows that short term reserve officer retention is more sensitive to decreasing reserve earning than it is to increasing reserve earnings.

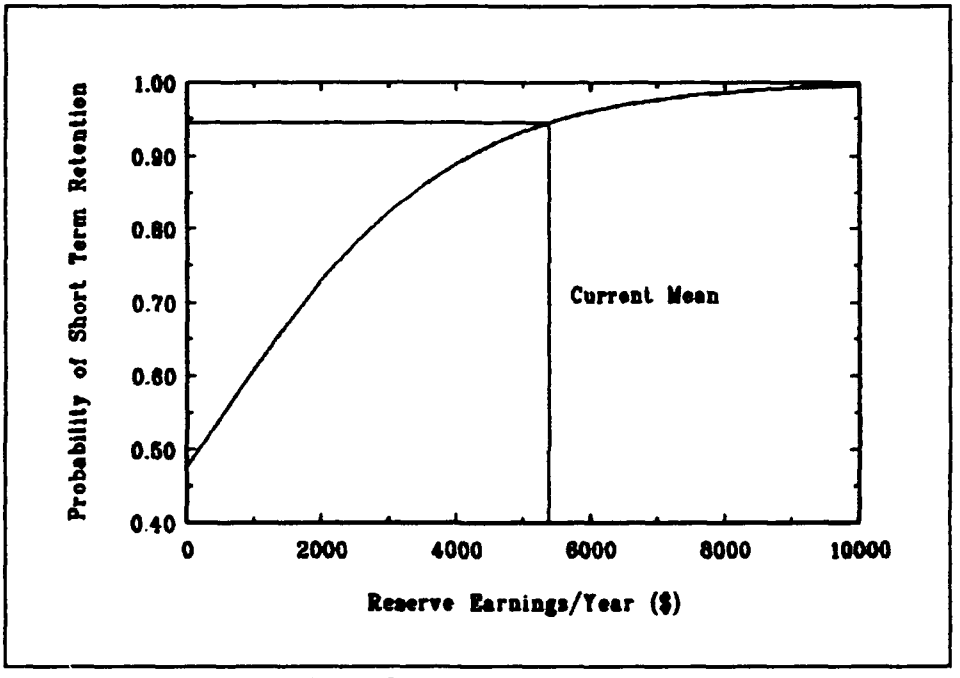

Figure 10. Probability of Short Term Retention for the Reserve Officer vs. Amount of Reserve Earnings

Dependents Under 18. Figure 11 graphs the number of dependents under 18 versus short term retention for enlisted members with 6 good years of service or less. The Y axis title "Probability of Short Term Retention" of Figure 11, is relative to the arbitrary definition of the short term

enlisted retention question. This question has 11 possible responses. In this instance, "short term retention" represents the enlisted member's indication of at least some possibility of reenlisting at the end of the current term of service. At the current mean of 2.23 dependents under 18,

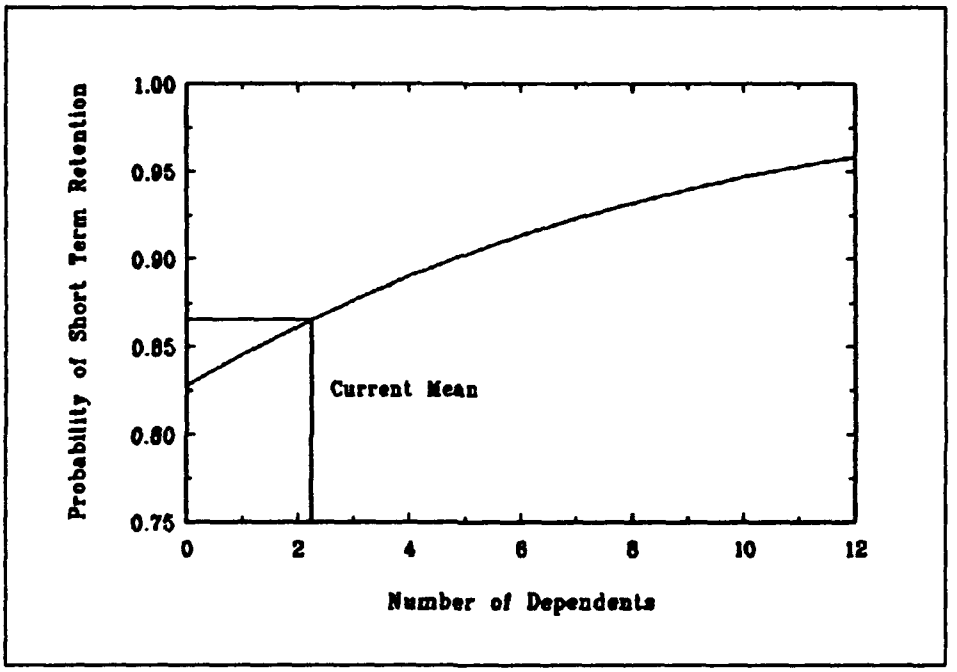

Figure 11. Probability of Short Term Retention for the Enlisted Reserve Member vs. Number of Dependents Under 18

holding all other variables constant, 86.5% of the enlisted reserve members will reenlist at the end of their current term of duty. If the number of dependent under 18 is increases by 1, the probability of reenlistment increases from 86.5% to 88.0%. This is a 1.5% increase in short term

retention. This shows that the probability of short term retention is less sensitive to the number of dependents under 18 than the probability of a long term retention in the reserves. Recall that the long term retention probability increased 2.2% with one additional dependent under 18. For married enlisted members with no dependents under 18, the probability of reenlistment is 82.7%.

V. Summary and Conclusions

Summary

Table 18 summarizes the results of the logit analysis performed in this study. Of the family income streams, only two have a large and important impact on retention. The amount of retirement pay has a large impact on long term reserve officer and enlisted retention. The amount of reserve earnings has a large impact on short term officer retention. These two income sources are important because retirement pay and reserve earnings are controlled by government policy. The coefficient for retirement pay is significant and positive at the 1% level for reserve officers and significant and positive at the 5% level for the reserve enlisted member. The coefficient of reserve earnings is significant and positive at the 10% level for the reserve officer. The fact that reserve earnings have no significant effect on long term retention or short term enlisted retention is of some surprise. Perhaps there are specification problems in the definition of the dependent variable or perhaps reserve earnings are significant for year groups other than the 6 year group.

Table 18

Summary of the Significant Income Streams
Upon Retention in the Reserves

Reserve Officer	Long Term Retention	Short Term Retention
Civilian Earnings		
Reserve Earnings		+
Other Earnings		
Retirement Pay	+++	
Wife's Earnings		
Net Assets		
Dependents Under 18	++	
Wife Works		
Received Bonus		
Eligible Receive Bonus		
Prior Service		
Reserve Enlisted Member		
Civilian Earnings		
Reserve Earnings		
Other Earnings		-
Retirement Pay	++	
Wife's Earnings		
Net Assets	+	++
Dependents Under 18	+++	+++
Wife Works		
Received Bonus		
Eligible Receive Bonus		
Prior Service	+++	+++

+++ Significant and positive at the 1% level
++ Significant and positive at the 5% level
+ Significant and positive at the 10% level

--- Significant and negative at the 1% level
-- Significant and negative at the 5% level
- Significant and negative at the 10% level

Figure 12 shows the impact of various hypothetical levels of retired pay on officer and enlisted long term retention. From Figure 12 it can be seen that to achieve a 90% retention

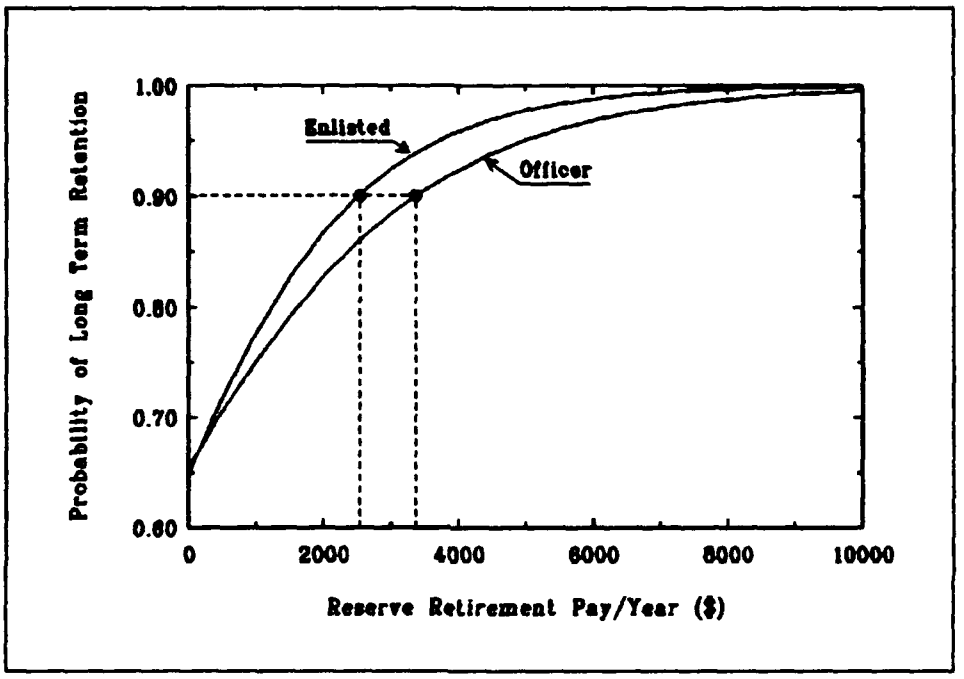

Figure 12. Officer/Enlisted Comparison Plot of Long Term Retention Probability vs. Retirement Pay

rate of reserve personnel, retirement pay should be $2,556.00/year (in 1985 dollars) for enlisted and $3,357.00/year (in 1985 dollars) for officers. This shows that less retirement pay is required for the enlisted to achieve the same retention rate as for officers. It can also be seen from figure 12 that the elimination of retirement pay would have substantial and an adverse impact on retention.

Eliminating retirement pay would reduce long term retention from 96.3% for officers and 88.5% for enlisted members to 65.4% and 65.0% respectively.

The number of dependents under 18 also has an effect (although not as large as retirement pay and reserve earnings) on long term and short term retention in the reserves. The number of dependents is important and perhaps reflects perceived need for extra income. Figure 13 shows the impact of various hypothetical levels of the number of dependents under 18 on officer and enlisted long term

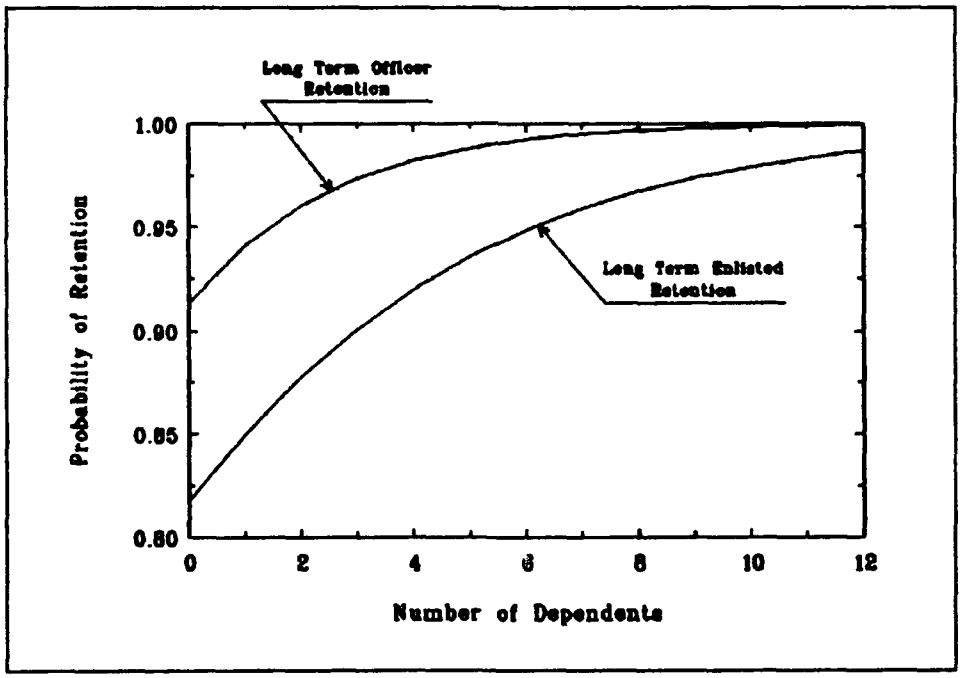

Figure 13. Long Term, Short Term Comparison Plot of Reserve Retention Probability vs. Number of Dependents Under 18

retention. From the figure it can be seen that for the lower numbers of dependents under 18, reserve officers maintain higher retention rates than enlisted members. For reserve families without dependents under 18, the long term retention is 91.3% for officers and 81.7% for enlisted members.

Conclusions

This study found that the annuitized value of potential retirement pay has a significant and positive impact on long term reserve retention. This is in contrast to some who suggest that retirement pay is not needed in the reserves because civilian companies do not offer retirement benefits for part time work. This research indicates that eliminating retirement pay would adversely affect long term reserve retention.

Reserve earnings also have a significant and substantial impact on short term officer retention. This finding is strengthened by the fact that O'Donohue also found that reserve earnings have a significant and positive impact on first term retention in the Selected Marine Corp Reserves (15:74).

In doing this study some limitations were encountered. It would be useful to know the number of points the reserve member has accumulated to date. Total points accumulated at retirement determines the retirement pay amount for each pay

grade. For this study the number of points at retirement was estimated by assuming that an average of 77 points per year was earned by all respondents and that all respondents would stay in the reserves for the maximum number of years allowed. This last assumption could be avoided if the actual number of years the member planned to serve were known.

The findings of this thesis suggest this type of research can be used by government officials that wish to know how changes in retirement pay and reserve earning would impact overall reserve retention. Such information is important to high level government officials who establish DoD policy.

Appendix A: Variable Definition List

Variables in Alphabetical Order

ACADEMY	Zero/one dummy variable denoting a military academy graduate
AGE	Age on last birthday
AGE2	Age squared
AIRNG	Zero/One dummy variable denoting Air National Guard Status
ANG	Zero/one dummy variable denoting Army National Guard Status
AR	Zero/one dummy variable denoting Army Reserve Status
BA	Zero/one dummy variable denoting a Bachelor's degree
BLACK	Zero/one dummy variable denoting race
CAREER	Zero/one dummy variable denoting likelihood of staying in until retirement
CGR	Zero/one dummy variable denoting Coast Guard Reserve Status
CIV_EARN	Reserve members annuitized lifetime civilian earnings
CIV_INCOME	Actual 1985 reserve member's weekly civilian income
DEPEND18	Number of dependents under 18
DTYDAYS	Day of annual training attended
ENGLISH	Zero/one dummy variable denoting english as main language at home
FSCHOOL	Fathers education level
GOODYRS	Good years of service for retirement

MA	Zero/one dummy variable denoting a masters degree
MCR	Zero/one dummy variable denoting Marine Corp Reserve Status
NET_ASSETS	Reserve family's annuitized lifetime net assets
NOANNTRG	Zero/one dummy variable denoting non-attendance of annual reserve training in 1985
OTHER_EARN	Reserve family's annuitized lifetime other earnings from stocks and interest
OTHER_INCOME	Reserve family's actual 1985 income from stocks and interest
PHD	Zero/one dummy variable denoting a doctoral degree
PRIOR	Zero/one dummy variable denoting prior active duty service
RANK	Present pay grade
REC_BONUS	Zero/one dummy variable denoting receipt of a reenlistment bonus
RES_EARN	Reserve members annuitized lifetime reserve earnings
RES_INCOME	Actual 1985 annual income from reserve participation
RET_PAY	Reserve members annuitized lifetime reserve retirement pay
REUP	Zero/one dummy variable denoting likelihood of member reenlisting at end of current term
REUP_BONUS	Zero/one dummy variable denoting eligibility to receive a reenlistment bonus
SAGE	Age of wife on last birthday
SAGE2	The SAGE variable squared
SCHOOL	Highest grade/year completed for credit
SCHOOL2	The SCHOOL variable squared

SSCHOOL	Wife's highest grade/year of schooling completed
SSCHOOL2	The SSCHOOL variable squared
STAY	Zero/one dummy variable denoting reserve officer's intentions of staying in after current obligation is served
TENURE	Amount of tenure in the current job
TENURE2	The TENURE variable squared
WIFE_EARN	Wife's annuitized lifetime civilian earnings
WIFE_INCOME	Actual 1985 weekly income from the wife's civilian job
WIFE_WORK	Zero/one dummy variable denoting wife's working status

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VITA

Captain Dale C. Figart [redacted] He graduated from State College High School in 1976, and enlisted into the United States Air Force on 15 November 1977. In 1981 he was accepted into the Airman Education and Commission Program. Under this program Captain Figart attended the University of Florida and received a Bachelor of Science degree in Aerospace Engineering. After his commissioning in 1984 he was assigned to the Optical Components Branch, Air Force Weapons Laboratory, Kirtland AFB NM. There he served as a project officer procuring and developing high energy laser optics. He entered the School of Systems and Logistics, Air Force Institute of Technology, in June 1989.

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13. ABSTRACT *(Maximum 200 words)*

The purpose of this study is to examine the impact of family income on retention in the military reserves. There are five types of family income examined. They are income from the reserves, income from civilian employment, income from other sources, income from the wife's employment, and potential income from reserve retirement. The study is limited to married male reserve members with 6 years or less in the reserves.

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