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THESIS

AN ANALYSIS OF THE EFFECT OF RESERVE  
PARTICIPATION AND TRAINING ON CIVILIAN  
EMPLOYMENT AND EARNINGS

by

John A. McGuire

March 1993

Principal Advisor:

Stephen L. Mehay

Associate Advisor:

Gregory G. Hildebrandt

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AN ANALYSIS OF THE EFFECT OF RESERVE  
PARTICIPATION AND TRAINING ON CIVILIAN  
EMPLOYMENT AND EARNINGS

by

John A. McGuire  
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Submitted in partial fulfillment  
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the


NAVAL POSTGRADUATE SCHOOL  
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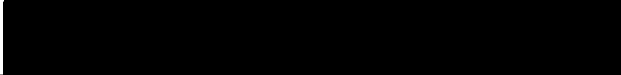
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**ABSTRACT**

Utilizing data from the 1986 Reserve Components Surveys, this thesis implements a test of the hypothesis that a positive relationship exists between occupational training received in the reserves and increased benefits and wages on reservists' civilian jobs. The null hypothesis was that no such relationship exists, or that it exists for relatively few reservists, so that reserve participation is mainly a form of moonlighting with few spillover benefits to the individual or society in the form of increased worker productivity. Log-earnings regression equations were specified to test the basic hypothesis. The two-stage least squares (2SLS) estimating technique was utilized to estimate the models due to the existence of simultaneity bias in the regression equations. It was determined that affiliating with the reserves to receive training results in an increase in civilian benefits and wages. Therefore the null hypothesis was rejected, leading to the conclusion that reserve training does appear to provide important benefits to some enlistees, namely those who are motivated to seek skill training that can be used on their civilian job or used to find a better civilian job.

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## I. INTRODUCTION

### A. RESERVE HISTORY

The United States military reserve system is deeply rooted in American history. From early colonial days, up to and including the Spanish American War of 1898, the reserves coexisted with their professional counterparts, the continental or standing army. There were relatively few changes made to the reserve system during this period primarily due to the success of the militia. Those changes that were made were done so with no regard for the resultant efficiency of the militia. Military reformers at the time of the Spanish American War were well aware of the conscription systems in use by European powers. These systems drafted men into the active army and then involuntarily assigned them to reserve mobilization billets. This provided a readily available pool of trained soldiers for periods of mobilization. [Sullivan, 1985]

The success of the reserves in the Spanish American War made changing the reserve system a difficult task. America was fast becoming a world superpower and took on a more internationally political role during the first few years of the nineteenth century. This active role in international politics required a larger, more effective military force. Subsequently, this also required a more centralized and

better trained reserve force than the pre-1898 reserve system could provide. Beginning in 1903 Congress enacted three acts that provided for a large, voluntary standing force, a reserve force to be used primarily for support missions, and a national guard for combat and civil disturbance missions. These three acts, the Dick Act of 1903, and the National Defense Acts of 1916 and 1920, while amended several times over the years, have provided the structural framework found in America's military system today.

#### **B. PRESENT DAY RESERVES**

There are basically two classifications of reservists: those who belong to the Selected Reserves (SELRES) and those who belong to the Individual Ready Reserves (IRR). The IRR is made up of individuals who have served less than six years in the active or selected reserve forces and have residual military service obligation (MSO). Most first term enlistments require the member to obligate him/herself for eight years from the date of enlistment. The IRR are not organized into units and members do not receive periodic training or pay.

The Selected Reserves are organized into specific units whose primary mission is to provide combat, combat support, and combat service support units that can be mobilized quickly in wartime. The same reserve units may be used for



civil disturbance missions during peacetime. These "weekend warriors" are divided into the Army and Air National Guard and the reserve components of the Army, Navy, Air Force, and Marines. The Selected Reserves are required to drill one weekend per month and one two-week period annually. Selected reservists are paid for both their monthly drills and the annual training concurrent with their paygrade.

Analysts have often referred to selected reservists as "moonlighters" since they normally hold a primary full- or part-time job in addition to their reserve duty. Moonlighters are characterized as individuals who participate in the secondary labor market in an effort to increase their earnings. The amount of moonlighting hours a worker provides is directly related to the worker's primary hours. If a worker is unable to work the amount of hours at his/her primary occupation that he/she desires, then the worker is "underemployed." Disregarding any additional costs of securing a second job, an underemployed worker will moonlight to enhance his/her total earnings. Since reserve pay is essentially a fixed wage per training day, reservists are not able to choose the amount of moonlighting hours they wish to work. This study will focus primarily on the Selected Reserves since there is no moonlighting benefit derived from being a member of the Individual Ready Reserves.

### **C. TRAINING**

Members of the Selected Reserves are afforded the same initial training opportunities as their active duty counterparts upon enlistment. A member is offered a choice of several military occupational specialties (MOS) depending on his/her scores on the Armed Services Vocational Aptitude Battery (ASVAB). The reservist first goes to boot camp or basic training and, if qualified for a technical occupation, moves on to advanced training in a formal service school to learn his/her military occupational specialty. There is no difference in the training provided the reservist and the active duty member at the time of enlistment.

### **D. PURPOSE**

Analysts have often argued that the reserves benefit from enlisting members whose primary motivation for participating in the reserves is to moonlight and to earn extra income. Some of these reservists are already trained in what eventually becomes their military occupational specialty. Both those with and those without prior training participate in the reserves as a way of supplementing their earnings.

On the other hand, there may be members, mostly non-prior service, who enlist in the reserves in order to receive training in an occupational skill to enhance their opportunities to obtain civilian employment and to boost

their long-run civilian earnings potential. Those who use the reserves in this way become better trained, more productive, and more employable civilian workers. As a result, there is a spillover benefit to society. If, however, the primary reason for enlistment in the reserves is to augment one's civilian income, reserve participation is simply a second job or a moonlighting activity with few indirect, or secondary, benefits to the individual and to society. Of course, the increase in earnings for those who moonlight in the reserves may initially exceed the increase in earnings for those who participate for training. But moonlighting tends to be a temporary phenomenon and ends when one's enlistment ends. For those who are trained in the reserves, benefits on their primary civilian job may continue throughout their worklife.

This thesis will attempt to test the alternative hypothesis that a positive relationship exists between undergoing reserve training and benefits and wages on one's primary civilian job for some reservists. The null hypothesis is that no such relationship exists, or that it exists for relatively few reservists so that reserve participation is mainly a form of moonlighting with few derivative benefits to the individual or to society. If a positive relationship is observed between reserve training and civilian occupations and compensation, this research will also measure the magnitude of the benefits of joining

the reserves to non-previous service high school graduates entering the labor force, which should provide valuable information to manpower planners and recruiters.

## II. LITERATURE REVIEW

### A. TRAINING TO OBTAIN A CIVILIAN JOB

Very few prior studies have treated reserve participation as a means of obtaining a civilian job or the training needed to obtain a civilian job. It is generally accepted that the reserves benefit by enlisting members from the civilian sector who are already trained in an occupational specialty. But, what about those reservists who had no prior skill training and were employed in an unskilled occupation or were unemployed when they enlisted?

In the 1986 Reserve Components Survey (RCS) over 18,000 (27 percent) of the more than 65,000 respondents stated that they joined the reserves to obtain skill training to help them get a civilian job. Presumably, respondents that either were not employed, or were employed only part-time, would be most likely to cite this reason for enlistment; they also would be the most likely to obtain a "spillover" benefit from reserve participation. However, others who were employed in an occupation in which they did not intend to remain would also stand to gain by receiving training that would allow them to switch to a better occupation. In the absence of previous studies in this area, this study examines the hypothesis that a positive relationship exists between training obtained in the reserves and increased

wages and benefits to reservists in their primary civilian occupation.

#### **B. REQUIREMENTS OF RESERVE PARTICIPATION**

There are virtually no other second jobs which come to mind that parallel the characteristics of reserve participation. Burrigh, Grissmer and Doering (1982) found three requirements of reserve participation that set it apart from other second jobs and voluntary activities. First, during annual training, reservists must spend 14 days of full-time work during the summer. This requires their absence from home and from their primary civilian full-time job. Non-prior service reservists must, upon entry, train full time for four months in their occupational specialty. Additionally, during periods of national crisis, such as Operation Desert Storm, or civil emergencies, reservists may be called-up to full-time duty.

The obligation to serve full time during summer ACDUTRA does not necessarily represent a cost to reservists, especially if their full-time military pay exceeds their civilian pay. David Grissmer, Richard Buddin, and Sheila Nataraj Kirby (1989) found that over 50 percent of the respondents in the RCS would face moderate or serious decreases in total income if mobilized for thirty days or more. If the training received in the reserves is transferable to a job opportunity in the civilian sector, then any costs associated with full-time duty are reduced.

Second, the reservist is legally obligated for up to eight years of service. Civilian second jobs do not normally require such an employment contract. This requirement provides job security to some reservists, while for others it represents an opportunity cost because it reduces the possibility of holding other secondary jobs.

Finally, Burright et al. determined the inflexible work schedule of reserve participation differs significantly from the work schedules of most moonlighting jobs. In 1982 reservists were paid for either 8 or 16 hours per month with no opportunity for increasing paid hours. Most mandatory drills are scheduled on weekends with no flexibility for alternative schedules to accommodate civilian employer concerns. Burright et al. found that civilian employer attitudes toward the reservist's participation were major factors in the reenlistment/enlistment decision.

### **C. SECONDARY LABOR MARKET PARTICIPATION THEORY**

Moonlighting has traditionally been treated as a decision to participate in the secondary labor market as a means of supplementing one's primary job income. Most of the prior studies on reserve participation have treated it as a labor force decision similar to civilian moonlighting [Mehay 1990]. Linda Gorman and George Thomas (1991) hypothesized that reserve membership is part-time employment that competes with leisure time and will usually have lower priority than the member's primary occupation. Stephen L.

Mehay (1990) hypothesized that, contrary to the assumptions of prior studies that reserve participation and moonlighting are influenced by similar economic factors, different criteria are used in the decisions of reservists and civilians. If the decision to participate in the reserves is distinctly different from the decision to moonlight, then previous studies that have treated them the same will be affected by specification bias [Mehay 1990]. Robert Shishko and Bernard Rostker (1976) simply defined anyone who holds two or more jobs as a moonlighter and thus participates in the secondary labor market. They estimated the moonlighting supply curve with data from the Panel Study of Income Dynamics using the Tobit technique for estimating relationships with limited dependent variables. Applying their definition of moonlighting to a person who holds two part-time jobs would seem to violate the principles of secondary labor market participation. Which job would be considered the primary occupation?

Grissmer et al. found that approximately three-quarters of Army reservists hold full-time civilian jobs in addition to participating in the reserves. They observed that reservists are drawn from the competitive labor market and, as such, the reserves compete with other employers who provide more flexible hours, perhaps a better wage, and occasional overtime. If an individual is able to obtain



overtime hours on his/her primary job, he/she will be less likely to either moonlight or participate in the reserves.

Grissmer et al. outlined four components every prospective reservist must consider in the decision to participate: the present and future monetary benefits from reserve service; the non-monetary benefits of reserve service; the monetary opportunity costs from reserve service; and the non-monetary opportunity costs of reserve service. An implicit assumption is that the prospective reservist is able to differentiate between monetary and non-monetary benefits as well as other available alternatives. This may not necessarily be true.

The decision to moonlight is based on several economic factors. Shishko and Rostker theorized that an individual's decision to moonlight is based on whether he/she can work enough hours at his/her primary wage rate to satisfy desired income goals. They identified hours worked on the primary job, the primary wage, the secondary wage, and non-labor income as the most important variables in the moonlighting decision. They proposed that "changes in the primary wage alter the minimum wage necessary to induce people to take a second job." An increase in the primary wage may result in an increase or a decrease in the minimum acceptable secondary wage rate (i.e., the second job reservation wage).

Due to substitution and income effects, an increase in the secondary wage could result in an increase or decrease

in moonlighting hours worked. This is especially true when the secondary wage is greater than the primary wage. If there are constraints on the number of hours a worker may work on the primary job, secondary jobs may be accepted even if the secondary wage is less than the primary wage.

Non-labor income only affects hours worked if the desired hours of employment fall below the actual hours. If an individual is working more hours than he desires, a small increase in non-labor income will result in an attempt to reduce the number of hours worked in either the primary or secondary job.

Gorman and Thomas proposed that along with economic factors such as extra income and additional training for future income, there are also psychic factors such as patriotism and camaraderie that are associated with reserve participation. Mehay also challenged the traditional "moonlighting hypothesis" stating that, along with extra income, reserve participation offers the member dynamic training and learning experiences, extensive fringe benefits, camaraderie and other unique features not normally found in civilian moonlighting jobs. Like Mehay, and Gorman and Thomas, Burrigh, et al. found reserve participation provides non-pecuniary rewards such as camaraderie and a sense of team accomplishment. Burrigh, et al. also found fringe benefits such as health care, life insurance, educational benefits, tax benefits, and a cost-of-living-

adjusted pension at the age of 60 after 20 years of service to be major attractions to reserve participation.

In an empirical moonlighting study conducted by Compton (1979), it was concluded that the supply of labor for second jobs will increase if:

1. Wages in the second job increase significantly.
2. The person is black.
3. The person is non-urban.
4. Wages in the primary job decrease significantly.
5. The person is not a high school graduate.
6. The number of hours required for the primary job decreases.
7. The person's spouse is not working or quits working.
8. The person's non-labor income (interest, dividends, etc.) decreases or is nonexistent.

SOURCE: *Motivation For First Term Reserve Reenlistment*, Naval Postgraduate School Master's Thesis by James S. Sullivan Jr., 1985.

In his empirical analysis, Mehay constructed a choice-based sample consisting of reservists and civilians who were already working full-time in a primary occupation and who chose to participate either in the reserves or the secondary labor market. He developed a trichotomous model whereby an individual could moonlight, participate in the reserves, or hold one primary job. He hypothesized that if the model collapsed to a dichotomous one then the decisions to

participate in the reserves or to moonlight would be assumed to be the same and the individual would be indifferent between reserve affiliation and moonlighting. Mehay concluded that the two decisions are not equivalent. His results did support previous research in that he found participation to be strongly influenced by members' economic status and job market factors such as unemployment rates and prevailing wage rates in the local geographic area. Mehay also concluded that individuals join the reserves to supplement their income, obtain skill training, receive fringe benefits and serve their country.

Gorman and Thomas observed many college students who join the U.S. Army Reserve (U.S.A.R.) to help finance their education. The U.S.A.R. is capable of accommodating people who pursue goals not fully compatible with service in the active Army [Gorman, *et al.* 1991].

Gorman and Thomas were surprised to find that almost 25 percent of their sample joined the Army Reserve intending to transfer to the active Army. It seemed that many high school graduates joined the reserves in order to obtain an "education" in Army life. Without obligating themselves to a full-time active Army job they could see what it would be like and decide if they wanted to transfer to the active Army or remain in the reserves until their commitment was up. This behavior provides an opportunity to increase the

pool of active Army members by increasing the pool of Army reservists.

Gorman and Thomas utilized log-linear models to estimate the probability that a person 18 years of age or younger will choose one of three (author-established) "motives" for enlisting in the reserves. These motives were "earn more money", "self-improvement", and "serve." The serve category included those members who responded they wanted to serve their country or that family tradition warranted serving.

Gorman and Thomas found that college-age recruits in mental categories 1 and 2 joined the reserves to earn more money. Almost 70 percent of those seeking more money did so to pay college expenses.

Gorman and Thomas concluded that the Army Reserve may be an invaluable source of high-quality recruits for the active Army. More than half of their respondents were in mental categories 1 and 2 and, of these, 25 percent stated that they planned to transfer to the active Army. Gorman and Thomas' findings suggest that reservists enlist for a variety of reasons including self-improvement, the opportunity to earn extra money, and patriotism. Of these, a large percentage enlist with the intent to transfer to the active Army.

Burright, et al. identified five variables that influence the reenlistment decision. For the purpose of this study these variables also could be applied to the

initial enlistment decision. The variables included net reserve pay, net required days of reserve service, civilian wage rate, number of hours worked on the civilian job, and frequency of overtime opportunities on the civilian job.

Utilizing a logistic regression model, Burrigh, et al. defined the reenlistment decision by a dichotomous variable assuming the value of one for reenlistment and zero for separation. As expected, higher net reserve wages and fewer net reserve days would increase reenlistment rates. Presumably, these same factors would increase initial enlistment rates. Likewise, higher civilian wages, longer civilian hours, and increased civilian overtime opportunities decreased the probability of reenlistment. Presumably, these factors would also decrease initial enlistment rates.

Finally, Regets (1990) argues that reserve participation may be simply a form of "compensated leisure." He theorized that "moonlighting and compensated leisure models of reserve service generate very different predictions of labor supply behavior". Utilizing two sets of data, a Naval Reserve data set created from personnel records, and an all-service extract of reservists from the Survey of Income and Program Participation, Regets empirically tested both models. He found the compensated leisure model predicted a positive income effect (i.e., increases in non-labor income increase the quantity of labor supplied to Reserve service). The

moonlighting model however, predicts a negative income effect. With the exception of low-income reservists, Regets' empirical results supported the compensated leisure model.

In summary, most prior studies have utilized the economic labor market theory of moonlighting to explain reserve participation and reenlistment decisions. However, based on significant differences in the characteristics of reserve jobs and civilian moonlighting jobs, other analysts have questioned whether the formal economic model of moonlighting applies to reserve decisions, or whether reserve participation is a labor market activity at all. One purpose of this study is to turn the question around and to inquire whether reserve participation is motivated by a desire to upgrade earnings capacity on one's primary job. If so, economic factors, such as the level of reserve pay, would not have a strong impact on participations decisions. Rather, the opportunity for skill training, and the prospect that such training would augment future long-run earnings on the primary job, would be the principal motivating factor. The next section of the thesis proposes an empirical test of this hypothesis.

### III. METHODOLOGY

In January, 1983, the Deputy Secretary of Defense mandated a survey of military families, active and reserve, who were increasingly recognized as important to the retention and preparedness of the United States' armed forces. Each of the services had previously conducted small-scale studies of its own member families. However, no single consistent cross-service data set was available to permit the study of emerging DoD family issues. The DoD also needed to assess the various impacts of numerous personnel policies that had been implemented in the early 1980's.

The Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics established a DoD-wide committee, the Family Survey Coordinating Committee, to assess the information requirements and data sources needed to survey both the active and reserve components of the military [Hunt, et al. 1986]. Due to the complexity of surveying both components, the Committee initiated active force surveys in 1985 but temporarily postponed the reserve surveys. The Reserve Components Surveys (RCS) were not completed until 1986. The Defense Manpower Data Center (DMDC) was contracted to conduct both surveys.



The data provided by the 1986 Reserve Components Surveys made possible research on patterns of previous active and reserve service, financial issues that would face Guard and Reserve families during periods of mobilization, reserve compensation and career intentions, the relationships between civilian and military occupations for reserve members, and numerous other topics. The RCS is also the primary data source for this thesis.

#### **A. SAMPLE POPULATION**

The Reserve Components Common Personnel Data System (RCCPDS) as of 30 October 1985 was used to initially define the population on which the samples were based. This data system contained administrative information on all members of the reserves. The 1986 RCS consisted of Selected Reserve trained officers and enlisted personnel who had already completed training. Members in the training pipeline were not included. As a result, the target population was 9 percent smaller than the total population of the Selected Reserve. [Hunt, et al. 1986]

Survey packages containing questionnaires and related materials were mailed directly to approximately 15,000 reserve units in the United States and Puerto Rico. Each unit had, on average, 7-10 survey participants. The number of survey participants per unit ranged from one or two to 50 or more.

The basic sample selected for the RCS consisted of a total of 109,067 officer and enlisted personnel. Individuals who participated in the 1979 Reserve Force (RF) Follow-up Survey were included which brought the total number of participants to 120,787.

Data collection began in February, 1986 with the mailing of the initial notification letters to units containing sampled individuals. The last questionnaires were not received for processing until June 1986. Most of the questionnaires were received in March and April 1986.

#### **B. SURVEY DEVELOPMENT**

The Family Survey Coordinating Committee consisted of representatives from each of the reserve components, the office of the Deputy Assistant Secretary of Defense (Guard/Reserve Manpower and Personnel) and technical experts from DMDC. The Committee identified various subject areas from previous studies which would be important to reevaluate as well as new areas for which survey data would be helpful.

After the Committee reached agreement on the content of the survey questionnaires, DMDC prepared draft questionnaires. Numerous pretests were conducted in iterative fashion. These tests were administered to selected officers, enlisted personnel and spouses. Any problems or deficiencies found in previous tests were corrected or modified prior to the next test.

As a result of numerous pretests, the questionnaire underwent considerable refinements. In final form it contained questions pertaining to military background, (i.e., reserve component, paygrade, number of active duty years, etc.), "future" military plans, military training, benefits and programs, individual and family characteristics, civilian work, and military life. All of the survey respondents were provided with the opportunity to make additional comments or recommendations on all topics, whether or not the topic was included in the survey questionnaires. [Hunt, et al. 1986]

#### **C. RESPONSE RATES**

The most logical approach to assess response rates would be to compare the number of questionnaires mailed out with the final numbers received. Table 3.1 provides a breakdown of response rates by reserve component. This table is adapted from the 1986 RCS User's Manual and Codebook. In the table, the column labeled "Frame Count" refers to the number of reservists in the population, the column labeled "Selected" is the number chosen to participate using the RCCPDS, "Eligible" is the number of reservists still assigned to the same unit they were assigned in 1985, and "Responding" is the actual number of reservists who responded to the survey. The unadjusted rates do not account for the fact that some individuals who had been selected for participation from the 30 October 1985

**TABLE 3.1**  
**1986 RESERVE COMPONENTS SURVEYS RESPONSE RATES**  
**FOR MILITARY MEMBERS, BY RESERVE COMPONENTS**

Reserve Component	Frame Count	Selected	Eligible	Responding	Unadjusted Response Rate	Adjusted Response Rate
<b>Rank Group - Officer</b>						
USAR	53567	6006	5056	3608	60.1	71.4
USAFR	15710	1809	1611	1331	73.6	82.6
ARNG	42139	4421	3922	2810	63.6	71.6
ANG	13027	1393	1333	1124	80.7	84.3
USMCR	3279	1363	1225	965	70.8	78.8
USNR	22838	2456	2126	1685	68.6	79.3
-----	-----	-----	-----	-----	-----	-----
Subtotal	150560	17448	15273	11523	66.0	75.4
<b>Rank Group - Enlisted</b>						
USAR	204321	25391	19704	9640	38.0	48.9
USAFR	57955	5783	4960	3565	61.6	71.9
ARNG	356982	42300	36636	21034	49.7	57.4
ANG	92574	9251	8593	6991	75.6	81.4
USMCR	32853	6562	5414	3333	50.8	61.6
USNR	100653	9898	8132	4893	49.4	60.2
-----	-----	-----	-----	-----	-----	-----
Subtotal	845338	99185	83439	49456	49.9	59.3
<b>Reserve Components</b>						
USAR	257888	31397	24760	13248	42.2	53.5
USAFR	73665	7592	6571	4896	64.5	74.5
ARNG	399121	46721	40558	23844	51.0	58.8
ANG	105601	10644	9926	8115	76.2	81.8
USMCR	36132	7925	6639	4298	54.2	64.7
USNR	123491	12354	10258	6578	53.2	64.1
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Subtotal	995898	116633	98712	60979	52.3	61.8

Source: Description of Officers and Enlisted Personnel in the U.S. Selected Reserve: 1986, Defense Manpower Data Center, Washington, D.C.

RCCPDS were no longer members of the unit to which the questionnaires were sent at the time of actual data collection. Individuals may have separated, transferred to an active component, or transferred to another reserve unit.

Upon examination of Table 3.1 it can be seen that the unadjusted response rates for all components except the Army are over 50 percent. Since the Army comprises 65 percent of the total DoD sample selected, its response rate lowers the overall unadjusted DoD response rate to approximately 52 percent.

Of the 120,787 individuals originally selected, only 102,267 were still in an active drilling status in the reserves. After adjusting for the "missing" members, the adjusted response rates, shown in Table 3.1, were substantially higher than the unadjusted response rates. The unadjusted response rate is calculated by dividing the responding members by the number of members selected for the survey. The adjusted response rate is calculated by dividing the responding members by the number of eligible members (i.e., those still in a drilling status). The overall DoD response rate increased to 62 percent. For this reason, the dataset available for analysis consisted of 60,120 observations from the officer and enlisted communities of guard and reserve units from the Army, Air Force, Navy, Marine Corps and Coast Guard. For the purposes of this study all members of the Coast Guard were dropped

from the analysis. The Army Reserve response rates were considerably lower than the other components perhaps due to the greater mobility of Army reservists.

#### **D. MODEL SPECIFICATION**

In order to eliminate those members who may have been motivated to enlist in the reserves to avoid the draft, only members who joined after the end of conscription in 1972 were included in this study. In addition, two other limitations were placed on the sample. To study the effects of reserve training on civilian earnings, only non-prior service members holding full-time civilian jobs were included. Prior service members were omitted because it is less likely that they will view the reserves as a source of valuable training because they will have already been trained in an occupation through their active duty service. After imposing these limitations on the models, and allowing for observations with missing variables, the sample size decreased to 7,377 observations of enlisted members only. Finally, officers were deleted from this study because most, if not all, are college graduates and have far different earnings capacities than enlisted personnel.

A standard human capital earnings equation was specified and estimated using Two-Stage Least Squares (2SLS) techniques. The natural log of the individual's annual income was used as the dependent variable. The coefficients of the independent variables could then be interpreted as

the percentage change in the income of the individual for a unit change in the independent variable. The models were specified as:

$$LNENGS = \alpha + \sum \beta_i X_i + \beta_R + \epsilon \quad (1)$$

$$LNENGS = \alpha + \sum \beta_i X_i + \beta_S + \epsilon \quad (2)$$

where,

LNENGS = log of annual earnings

$X_i$  = vector of explanatory variables summarized in Table 3.2

R = dummy variable representing those who cite reserve training as reason for reserve participation

S = dummy variable representing those who cite supplementing their income as reason for reserve participation

e = a random error term that is normally distributed with mean zero and a constant variance

Because members who enlist in the reserves do so voluntarily, and for various reasons, regression models estimated by Ordinary Least Squares (OLS) may be affected by selectivity bias. Members may "self select" themselves to obtain reserve training to increase their civilian earnings. Previous studies have shown that the probability of reserve participation decreases as civilian earnings increase. People with lower civilian earnings may be more likely to join the reserves to receive training in order to increase their potential to obtain better jobs and to increase their civilian earnings. On the other hand, others may join the reserves with the intent of supplementing their income. OLS

models assume one-way causality in which acquisition of reserve training causes an increase in civilian earnings. If two-way causality exists, using OLS to estimate an earnings model would violate the classical assumption of the regression model which states that all explanatory variables are uncorrelated with the error term. However, the models, as specified, may involve correlation of "reserve training" (RECTNG) or "supplement income" (SUPPINC) with the error term because of the two-way causality between LNENGS and RECTNG or SUPPINC. This interaction between earnings and the reason for reserve participation creates a simultaneity bias. If LNENGS and RECTNG or SUPPINC are simultaneously determined, the expected values of the OLS-estimated structural coefficients are not equal to the true coefficients (b's). Two-way causality may occur because RECTNG is a function of all the other explanatory variables including LNENGS. It is likely the lower one's annual income, the higher the probability that one will choose to receive training in order to increase human capital and subsequently annual income. This relationship is shown in equation (3). On the other hand one's annual income is a function of many other explanatory variables including the extent of one's training. Those who have had formal training are more likely to have a higher annual income than those who have not. This relationship is shown in equation (4).



In the empirical section, a test for simultaneity is performed.

When simultaneity bias is present, the Two-Stage Least Squares (2SLS) technique can be used to generate efficient estimates of the parameters in the models. The 2SLS method eliminates simultaneity bias by substituting an instrumental variable for the endogenous variable that is correlated with the error term, in this case, RECTNG or SUPPINC. An endogenous variable is any variable that is simultaneously determined with any other variable. The instrumental variable must be a good proxy for the endogenous variable and be independent of the error term.

One's earnings on the civilian job are hypothesized to be affected by the desire to receive training in the reserves, or one's desire to supplement his or her income, as displayed in equations (1) and (2). However, it may also be true that the desire to obtain training or supplement one's income will be greater the lower one's annual income. This simultaneity suggests the following two-equation system (written for RECTNG):

$$RECTNG = \alpha_0 + C_1 LNENGS + \sum D_i Z_i + \epsilon_e \quad (3)$$

$$LNENGS = \beta_0 + \sum \beta_i X_i + GRECTNG + \epsilon_e \quad (4)$$

The instrumental variables approach involves estimating each endogenous variable, RECTNG and LNENGS, as a function of the

exogenous variables in the system,  $Z_i$  and  $X_i$ , and substituting the fitted values of RECTNG and LNENGS back into equations (3) and (4). In order to test the hypothesis that reservists join to supplement their income, the same approach is taken and the variable SUPPINC is substituted in place of RECTNG in equations (3) and (4).

#### **E. VARIABLE DEFINITION**

Table 3.2 contains the definitions of all of the variables used in the model as well as the occupational variables utilized. Two dummy variables were created for the purpose of this study to test the hypothesized effect of reserve training. These variables were "participate to receive training" (RECTNG) and "participate to supplement income" (SUPPINC). Question 26 of the RCS specifically asks:

People participate in the Guard/Reserve for many reasons. How much have each of the following contributed to your most recent decision to stay in the Guard/Reserve?

The survey participants were then given 14 choices of reasons for staying in the Guard/Reserve including "obtaining training in a skill that would help get a civilian job" (26C), "needed the money for basic family expenses" (26I), and "wanted extra money to use now" (26J). The respondents evaluated each reason on a scale from major contribution to no contribution. Table 3.3 lists the various responses to question 26 and the percentages of

**TABLE 3.2**  
**VARIABLE DEFINITIONS**

**INDIVIDUAL CHARACTERISTICS**

AGE	Range 17 to 57 years
CHILD	0 if no dependents 1-10 or more if dependents
EDUC	years of education completed range sixth grade through 8+ years of college
MARRIED	1 if married 0 otherwise
NONWHITE	1 if Black or Hispanic 0 if Caucasian

**WORK CHARACTERISTICS**

WORKFTC	1 if working full-time in civilian job 0 otherwise
SELFEMPL	1 if self employed 0 otherwise

**DEPENDENT VARIABLE**

LNENGS	Natural logarithm of respondent's annual income
--------	---

**CENSUS OCCUPATION CATEGORIES**

<b><u>VARIABLE</u></b>	<b><u>OCCUPATIONS INCLUDED *</u></b>
ADMIN	Administrative Support, Clerical excluding Postal
CRAFT MANAGEP	Construction Workers, Mechanics and Engineers Administrative, Managerial and Management related
MINEFM	Mine and Farm Workers
OPLABOR	Other Handlers, Helpers and Laborers
OPMACHIN	Precision Production Workers, Machine Operators, Assemblers and Inspectors
OPMOVG	Motor Vehicle Operators, Other Transportation and Material Moving Occupations
PROFESS	Professional, Scientific, Specialty, Teachers Education Administration, Technicians
SERVICE	Protective Services, Postal and Food Services

TABLE 3.2 (cont)

CENSUS INDUSTRY CATEGORIES

<u>VARIABLE</u>	<u>INDUSTRIES INCLUDED *</u>
AGRIMIN	Agriculture, Forestry, Fisheries, Mining and Construction
MANUFAC	Manufacturing
TRANSP	Transportation, Communication and other Public Utilities
WSALE	Wholesale trade
RETAIL	Retail trade
FINANCE	Finance, Insurance, Real Estate, Business
REPSERV	Repair services
PERSERV	Personal services
PROSERV	Professional services
ENTREC	Entertainment and Recreation
PUBADM	Public Administration

\*Each is coded 1 if the respondent is employed full-time in that category, 0 otherwise.

**TABLE 3.3**  
**PERCENT YES RESPONSES**  
**TO QUESTION 26 ON RCS**

<u>QUESTION</u>	<u>RESPONSE</u>	<u>% MENTIONING REASON FOR STAYING IN RESERVES</u>
26A	Serving the country	88.7
26B	Using educational benefits	38.4
26C	Obtaining training in a skill that would help get a civilian job	41.9
26D	Serving with people in the unit	68.8
26E	Getting credit towards Guard/ Reserve retirement	55.5
26F	Promotion opportunities	63.4
26G	Opportunity to use military equipment	53.3
26H	Challenge of military training	70.7
26I*	Needed the money for basic family expenses	57.0
26J*	Wanted extra money to use now	60.4
26K	Saving income for the future	43.7
26L	Travel/"get away" opportunities	53.9
26M	Just enjoyed the Guard/Reserve	59.6
26N	Pride in my accomplishments in the Guard/Reserve	77.5

\*These were combined to form the variable SUPPINC.

NOTE: Responses were coded as "yes" if the respondent marked the reason as a major or moderate contribution to his/her decision to stay in the Guard/Reserve.

Sample = 7,377

respondents who stated whether each was a major or moderate contribution to their decision to stay and those who stated these were a minor or no contribution to their decision to stay. For example, if respondents stated answer (26C) was a major or moderate contribution then the RECTNG variable was coded 1, otherwise it was coded 0. If the respondent stated that either answers 26I or 26J were a major or moderate contribution to their decision to stay then the SUPPINC variable was coded 1, otherwise it was coded 0. In this way respondents could be sorted according to whether they desired skill training or simply wanted to supplement their income.

A major problem with this type of questionnaire is that there was no "either/or" answer. A respondent was free to mark all answers that applied. Many reservists who stated they desired training to obtain a civilian job also stated that they wished to supplement their income. For this reason, another dummy variable "Receive training only" (RECONLY), was created. RECONLY was coded 1 when RECTNG equalled 1 and SUPPINC equalled 0; otherwise RECONLY was coded 0. Alternatively, there may be members who wish to supplement their income but not receive training to obtain a civilian job. Another dummy variable, "Supplement income only" (SUPONLY), was created. SUPONLY was coded 1 when SUPPINC equalled 1 and RECTNG equalled 0; otherwise SUPONLY was coded 0. RECONLY and SUPONLY were then substituted in

place of RECTNG in equations (3) and (4) to test these two hypotheses. It was anticipated that this would provide a clearer classification of those members who affiliated to receive training but not to supplement their income and those who affiliated to supplement their income but not to receive training.

The major focus of this thesis is to specify and estimate equation (4). The specification followed the conventional human capital earnings model in the literature [Berndt, 1991]. Thus, the log of annual earnings (LNENGS) was specified as a function of age (AGE), the square of age (AGESQ), number of children (CHILD), marital status (MARRIED), race (NONWHITE), education (EDUCATION), and several occupational dummy variables as shown in equation (5).

$$LNENGS = \alpha_0 + \beta_1 AGE + \beta_2 AGESQ + \beta_3 CHILD + \beta_4 MARRIED + \beta_5 NONWHITE + \beta_6 SELFEMPL + \beta_7 ADMIN + \beta_8 CRAFT + \beta_9 MANAGER + \beta_{10} MINEFM + \beta_{11} OPLABOR + \beta_{12} OPMACHIN + \beta_{13} OPMOVG + \beta_{14} PROFESS + \beta_{15} SERVICE + \epsilon \quad (5)$$

The next chapter presents 2SLS estimates of the specified model.

#### IV. EMPIRICAL RESULTS

##### A. DESCRIPTIVE STATISTICS

Table 4.1 presents the descriptive statistics for the entire sample of enlisted respondents who reported positive annual income (N=32,482) as well as the descriptive statistics for the restricted sample used to estimate the basic model (N=7,377). The average annual income for the full sample is \$23,284, while the average annual income for the restricted sample is \$16,807. This large disparity in annual income can be attributed to the large difference in the mean ages of the two samples: The mean age of those in the restricted sample is approximately ten years younger than those in the full sample. This age difference results from limiting the sample to reservists who affiliated after 1972 and who have no prior active duty. Human capital theory hypothesizes that the older one is, the higher his or her position on the earnings curve. The longer one has been in the labor market, the more experience he or she will have and the higher his or her income will be, provided there are few prolonged periods of unemployment or numerous occupational shifts.

Members in the full sample have approximately six months more education than those in the basic model, a difference which also is attributable to their disparity in ages. Of



**TABLE 4.1**  
**DESCRIPTIVE STATISTICS FOR**  
**THE FULL SAMPLE AND THE RESTRICTED SAMPLE**

VARIABLE	FULL SAMPLE N = 32,482		RESTRICTED SAMPLE* N = 7,377	
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION
AGE	34.38	9.42	24.84	4.48
CHILD	1.49	1.42	0.84	1.20
EDUC	12.98	1.88	12.42	1.52
MARRIED	0.70	0.46	0.48	0.50
NONWHITE	0.24	0.43	0.26	0.44
SELFEMPL	0.07	0.25	0.04	0.19
ADMIN	0.06	0.23	0.05	0.22
CRAFT	0.20	0.40	0.19	0.40
MANAGER	0.10	0.30	0.06	0.23
MINEFM	0.02	0.14	0.03	0.17
OPLABOR	0.06	0.24	0.09	0.29
OPMACHIN	0.14	0.34	0.18	0.38
OPMOVG	0.06	0.24	0.08	0.28
PROFESS	0.14	0.34	0.08	0.27
SERVICE	0.14	0.34	0.15	0.35
INCANN	23283.95	15092.25	16807.05	13277.60

\*This sample restricted to non-prior service (NPS), full-time civilian (FTC) job, and affiliation with reserves during AVF period (after 1972).

the respondents in the full sample, 24 percent were either black or hispanic compared to 26 percent in the basic model. There were fewer self employed workers in the restricted sample, as one would expect given their relative youth. Also, fewer of the restricted sample members were managers, or worked in the more skilled occupations such as administration, craft, manager, or professional. Conversely, workers in the restricted sample were more likely to work in semi-skilled or non-skilled occupations such as mine or farm worker, basic laborer, machine operator, transportation, or service. These differences support the theory that younger workers tend to be employed in less skilled occupations and earn lower wages than older, more experienced workers who tend to be employed in skilled occupations.

The three restrictions placed on the basic model--non-prior service, full-time civilian job, and affiliation with the reserves during the AVF period--all contributed to the lower mean age as well as the lower mean annual income of reservists in the restricted sample. In the full sample, 54 percent of respondents had prior military service before affiliating with the reserves. Studies have shown that civilians who were trained in the military will have a steeper earnings curve than their civilian counterparts following an initial period of lower earnings immediately

following separation from the military (Mehay, 1992). The disparities mentioned in the mean ages, educational levels, and occupations are significant enough to cause the \$6,477 difference in the mean annual income of the two samples.

Tables 4.2 through 4.5 calculate t-tests of differences in the means of the characteristics of members who were categorized by the four dummy variables that represent reasons for reserve participation. These four variables were "receive training" (RECTNG), "supplement income" (SUPPINC), "receive training only" (RECONLY), and "supplement income only" (SUPONLY). The coding of these variables was described in the previous chapter. The results in Table 4.2 reveal that members who affiliated to receive training (41% of the restricted sample) were younger, less educated and earned \$996 less than members who were classified as affiliating for other reasons. All of these differences are statistically significant at the one percent level. Of those who affiliated to receive training, 32 percent were black or hispanic, versus 22 percent of those who joined for other reasons. This is statistically significant at the one percent level. Recall that the entire sample is 24 percent black or hispanic. Of the sample of 7,377 reservists, 32 percent of those in the restricted sample who affiliated to receive training were black. This suggests that the rate at which minorities join the reserves to receive training is disproportionate to the

**TABLE 4.2**  
**T-TEST OF DIFFERENCES IN MEANS**

VARIABLE	RECTNG = 1		RECTNG = 0		TEST STAT
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
AGE	24.55	4.293	25.04	4.601	4.663*
CHILD	0.85	1.211	0.84	1.194	0.343
EDUC	12.23	1.355	12.53	1.613	6.899*
MARRIED	0.45	0.497	0.49	0.500	3.355*
NONWHITE	0.32	0.466	0.22	0.413	-9.750*
SELFEMPL	0.03	0.179	0.04	0.202	2.108**
ADMIN	0.06	0.229	0.05	0.216	-1.242
CRAFT	0.19	0.391	0.20	0.399	1.100
MANAGER	0.04	0.198	0.06	0.247	4.477*
MINEFM	0.03	0.168	0.03	0.173	0.384
OPLABOR	0.09	0.293	0.09	0.290	-0.199
OPMACHIN	0.17	0.374	0.19	0.390	2.005**
OPMOVG	0.10	0.294	0.08	0.265	-2.995*
PROFESS	0.08	0.267	0.08	0.264	-0.332
SERVICE	0.16	0.369	0.14	0.343	-3.104*
INCANN	16212.95	13308.82	17208.82	13234.29	3.173*
	N=3,026		N=4,359		

\* Significant at the 0.01 level

\*\* Significant at the 0.05 level

**TABLE 4.3**  
**T-TEST OF DIFFERENCES IN MEANS**

VARIABLE	SUPPINC = 1		SUPPINC = 0		
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	TEST STAT
AGE	25.09	4.605	23.91	3.866	-9.297*
CHILD	0.89	1.208	0.66	1.157	-6.959*
EDUC	12.35	1.489	12.69	1,595	7.741*
MARRIED	0.49	0.500	0.41	0.493	-5.792*
NONWHITE	0.27	0.442	0.23	0.424	-2.599*
SELFEMPL	0.04	0.192	0.04	0.198	0.469
ADMIN	0.05	0.220	0.06	0.230	0.802
CRAFT	0.20	0.399	0.18	0.381	-2.132**
MANAGER	0.05	0.224	0.06	0.245	1.761***
MINEFM	0.03	0.174	0.03	0.163	-0.776
OPLABOR	0.09	0.291	0.09	0.293	0.166
OPMACHIN	0.18	0.386	0.17	0.376	-1.099
OPMOVG	0.09	0.279	0.08	0.272	-0.655
PROFESS	0.07	0.255	0.10	0.298	3.795*
SERVICE	0.15	0.357	0.14	0.343	-1.362
INCANN	16907.70	13370.42	16405.30	12902.97	-1.332
	N=5,813		N=1,572		

\* Significant at the 0.01 level  
 \*\* Significant at the 0.05 level  
 \*\*\* Significant at the 0.10 level

**TABLE 4.4**  
**T-TEST OF DIFFERENCES IN MEANS**

VARIABLE	RECONLY = 1		RECONLY = 0		TEST STAT
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
AGE	23.43	3.316	24.92	4.531	6.560*
CHILD	0.62	1.055	0.86	1.208	3.906*
EDUC	12.54	1.304	12.42	1.529	-1.552
MARRIED	0.37	0.483	0.48	0.500	4.631*
NONWHITE	0.25	0.433	0.26	0.439	0.515
SELFEMPL	0.04	0.199	0.04	0.193	-0.254
ADMIN	0.07	0.260	0.05	0.220	-1.931**
CRAFT	0.17	0.377	0.20	0.397	1.214
MANAGER	0.04	0.199	0.06	0.230	1.300
MINEFM	0.02	0.146	0.03	0.173	1.049
OPLABOR	0.11	0.309	0.09	0.290	-0.904
OPMACHIN	0.16	0.367	0.18	0.384	1.084
OPMOVG	0.10	0.299	0.08	0.276	-1.117
PROFESS	0.12	0.326	0.07	0.261	-3.531*
SERVICE	0.12	0.326	0.15	0.356	1.547
INCANN	15363.16	9701.40	16886.14	13451.04	2.269**
	N=414		N=6971		

\* Significant at the 0.01 level

\*\* Significant at the 0.05 level

**TABLE 4.5**  
**T-TEST OF DIFFERENCES IN MEANS**

VARIABLE	SUPONLY = 1		SUPONLY = 0		TEST STAT
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
AGE	25.39	4.744	24.42	4.227	-9.275*
CHILD	0.90	1.189	0.80	1.209	-3.580*
EDUC	12.45	1.580	12.41	1.468	-1.176
MARRIED	0.52	0.500	0.45	0.497	-5.969*
NONWHITE	0.21	0.411	0.29	0.456	7.739*
SELFEMPL	0.04	0.204	0.03	0.184	-1.830***
ADMIN	0.05	0.216	0.05	0.226	0.999
CRAFT	0.21	0.405	0.19	0.388	-2.289**
MANAGER	0.06	0.242	0.05	0.217	-2.380**
MINEFM	0.03	0.175	0.03	0.169	-0.535
OPLABOR	0.09	0.292	0.09	0.291	-0.085
OPMACHIN	0.19	0.393	0.17	0.376	-2.395**
OPMOVG	0.08	0.267	0.09	0.286	1.911***
PROFESS	0.07	0.255	0.08	0.273	1.824***
SERVICE	0.13	0.341	0.16	0.363	2.673*
INCANN	17364.72	13001.51	16369.30	13462.65	-3.196*
	N=3201		N=4184		

\* Significant at the 0.01 level  
 \*\* Significant at the 0.05 level  
 \*\*\* Significant at the 0.10 level

rate for the overall population of minorities in the reserves.

Table 4.3 illustrates the differences in the mean characteristics of those members who affiliated to supplement their income (79 percent of the restricted sample) versus those who did not. Average annual income is \$502 greater than for those who did not join to supplement their income. While this difference is not statistically significant, the higher earnings of those who joined to supplement their income was expected. Those who affiliated to supplement their income were generally older and had more children; on the other hand they were less educated than those members who did not affiliate to supplement their income and 27 percent were non-white. Only three of the differences in means of the occupation variables were statistically significant at conventional levels. These occupations were CRAFT, MANAGER, and PROFESS. Of these, PROFESS had the largest disparity, with 7 percent of those who joined to supplement their income coming from a professional occupation compared with 10 percent who did not join to supplement their income. It was expected that fewer professionals would require a supplement to their income.

As stated in Chapter III, an attempt was made to provide a better breakdown of those reservists who affiliated to receive training but not to supplement their income (RECONLY) and those who affiliated to supplement their



income but not to receive training (SUPONLY). Table 4.4 presents the results of the t-test of the differences in means of the characteristics of those members in the RECONLY category. Only 5.6 percent of the restricted sample affiliated to receive training only. Those who joined to receive training only were younger and had much lower annual income than those who did not join to receive training only. These differences are significant at the 1 and 5 percent levels, respectively. Note, however, that members who affiliated to receive training only were slightly more educated than those who did not. This was not expected but it is statistically significant at only the 12 percent level. A smaller percentage of those who affiliated to receive training only were non-white or married compared to those who did not join to receive training. The mean of the occupational variable PROFESS was unexpected when compared to its mean in the RECTNG model: 12 percent of those members who affiliated to receive training only were professionals compared with only 8 percent in the RECTNG model (Table 4.2). While this difference is statistically significant at the 1 percent level, this only applies to 50 of the respondents.

Table 4.5 presents a t-test of the differences of the means of the variables in the SUPONLY model. Over 41 percent of the respondents in the sample population stated they joined the reserves to supplement their income instead

of to receive training. Their mean annual income was almost \$1,000 more than those who did not join to supplement their income. Those who affiliated to supplement their income only were older, had more children, and had slightly more education than those who did not join to supplement their income. More of them were married (52%) while less came from a minority (21%). In this classification, most of the occupational variables were statistically significant. There was no standard breakdown between skilled and non- or semi-skilled occupations. Those members who wished to supplement their income were represented in all occupational categories.

#### **B. REGRESSION RESULTS**

Tables 4.6 and 4.7 present the results for four different OLS regression models, each model using one of the four constructed dummy variables representing the reason for reserve participation--RECTNG, SUPPINC, REONLY, and SUPONLY. It is apparent that most of the coefficients of the independent variables in each model are statistically significant at conventional (1, 5, or 10 percent) levels. In all four models the coefficient of the NONWHITE variable is negative. This would suggest that being a minority is associated with lower annual earnings. This effect was statistically significant at the 1 percent level. The coefficients of AGE and AGESQ indicate that the age-earnings profile for reservists is fairly steep. Married persons and

**TABLE 4.6**  
**REGRESSION RESULTS USING**  
**ORDINARY LEAST SQUARES**

VARIABLE	RECEIVE TRAINING MODEL		SUPPLEMENT INCOME MODEL	
	COEFFICIENT	T-RATIO	COEFFICIENT	T-RATIO
INTERCEPT	6.850	36.474*	6.818	36.296*
AGE	0.137	10.675*	0.137	10.717*
AGESQ	-0.002	-7.813*	-0.002	-7.828*
CHILD	0.005	0.641	0.004	0.596
EDUC	0.024	4.223*	0.025	4.359*
MARRIED	0.120	6.589*	0.122	6.673*
NONWHITE	-0.098	-5.291*	-0.104	-5.610*
SELFEMPL	0.116	2.856*	0.118	2.886*
ADMIN	0.013	0.290	0.011	0.255
CRAFT	0.063	1.955**	0.063	1.977**
MANAGER	0.192	4.479*	0.195	4.564*
MINEFM	-0.193	-3.680*	-0.192	-3.662*
OPLABOR	-0.026	-0.714	-0.026	-0.694
OPMACHIN	0.086	2.652*	0.087	2.699*
OPMOVG	0.061	1.602	0.058	1.541
PROFESS	0.149	3.741*	0.145	3.650*
SERVICE	-0.004	-0.121	-0.005	-0.156
RECTNG	-0.047	-2.395*	--	--
SUPPINC	--	--	-0.014	-0.728
	N=7,377		N=7,377	
	F STATISTIC	61.721	F STATISTIC	61.178
	R-SQUARE	0.1248	R-SQUARE	0.1238
	ADJ R-SQUARE	0.1228	ADJ R-SQUARE	0.1217

\* Significant at the 0.01 level

\*\* Significant at the 0.05 level

**TABLE 4.7**  
**REGRESSION RESULTS USING**  
**ORDINARY LEAST SQUARES**

VARIABLE	RECEIVE TRAINING ONLY MODEL		SUPPLEMENT INCOME ONLY MODEL	
	COEFFICIENT	T-RATIO	COEFFICIENT	T-RATIO
INTERCEPT	6.81	36.319*	6.81	36.357*
AGE	0.14	10.698*	0.14	10.628*
AGESQ	-0.00	-7.817*	-0.00	-7.786*
CHILD	0.00	0.589	0.00	0.610
EDUC	0.03	4.445*	0.03	4.441*
MARRIED	0.12	6.661	0.12	6.596*
NONWHITE	-0.10	-5.655*	-0.10	-5.406*
SELFEMPL	0.12	2.891*	0.12	2.869*
ADMIN	0.01	0.253	0.01	0.260
CRAFT	0.06	1.966**	0.06	1.929***
MANAGER	0.20	4.571*	0.20	4.521*
MINEFM	-0.19	-3.671*	-0.19	-3.692*
OPLAOR	-0.03	-0.698	-0.03	-0.727
OPMACHIN	0.09	2.695*	0.09	2.651*
OPMOVG	0.06	1.540	0.06	1.574
PROFESS	0.15	3.657*	0.15	3.717*
SERVICE	-0.00	-0.165	-0.00	-0.150
REONLY	0.00	0.086	---	---
SUPONLY	---	---	0.04	2.349**
	N=7,377		N=7,377	
	F STATISTIC	61.143	F STATISTIC	61.513
	R-SQUARE	0.1238	R-SQUARE	0.1244
	ADJ R-SQUARE	0.1217	ADJ R-SQUARE	0.1224

\* Significant at the 0.01 level  
\*\* Significant at the 0.05 level  
\*\*\* Significant at the 0.10 level

the self employed tend to earn more than their peers. The coefficient on EDUC indicates that over a 2 percent annual return on each additional year of education is obtained. Over half of the occupational dummy variables are statistically significant.

The negative coefficient on RECTNG would suggest that receiving training in the reserves would have a negative impact on annual income. This is a surprising result. Most training, no matter the source, would be an investment in human capital, resulting in some improvement in earnings.

In the "supplement income model" age, age squared, education, marital status, and race/ethnicity were all significant at the 1 percent level. The negative sign on the coefficient of SUPPINC again, however, was unexpected. Taken at face value this suggests that reservists who affiliate to supplement their income end up earning less than those who join for other reasons.

The results of the RECONLY and SUPONLY models are presented in Table 4.7. The coefficients of the variables are similar to the coefficients of the variables in the RECTNG and SUPPINC models, with minor differences. This is probably due to the fact that many of the observations in the RECTNG model are also found in the RECONLY model. The same is true of the SUPPINC and SUPONLY models. Of all the personal characteristics in the four models, NONWHITE is the only one to have a negative impact on annual income.

Using OLS for all four models resulted in estimates of the coefficients that were not supportive of the initial hypothesis, namely, that those who initially join the reserves to receive training would experience an increase in annual income. The negative coefficient on the RECTNG variable and the extremely small coefficients on SUPPINC, RECONLY, and SUPONLY made it obvious that either these variables are poor measures of actual intent or training received or the hypothesis is rejected. The methodology employed in this thesis was to specify and estimate the models and not to re-estimate them after eliminating variables whose t-ratios were statistically insignificant. The model was determined to be appropriate as specified and no attempt was made to alter it by eliminating what were important variables. However, as mentioned in Chapter III, the OLS coefficients may be biased. Simultaneity bias may affect the estimates of the models which would result in estimated structural coefficients not equal to the true coefficients (b's).

In testing the model for simultaneity two procedures were used, the first procedure involved estimating log-earnings (LNENGS) as a function of all of the exogenous variables in the system. A predicted value of LNENGS was generated from this OLS equation. This predicted value (YHAT) was then used as an explanatory variable in a logit model of RECTNG. The test consists of examining the

significance of the coefficients of YHAT in the logit model of RECTNG. Table 4.8 presents the results from the logit estimation of RECTNG. The negative coefficient on YHAT, coupled with its significance at the 2 percent level, reveals that LNENGS is simultaneously determined with the probability of affiliating with the reserves to receive training. In other words, the lower one's annual income, the more likely one is to join the reserves to receive training in order to increase their potential to obtain better jobs and to increase their civilian earnings.

To rid the models of simultaneity bias, 2SLS estimating techniques were undertaken. Tables 4.9 and 4.10 present the 2SLS estimates for the four models. Age, Education, marital status, and racial group were still significant at the 1 or 5 percent level in all of the models except SUPPINC. In both the RECTNG (Table 4.9) and RECONLY (Table 4.10) models the coefficients on these variables have now become positive, which indicates that those who joined the reserves for the training benefits have higher income on their civilian job. Of major importance is the fact that the RECTNG variable in the "receive training" model became positive and significant at the 1 percent level. The RECONLY variable was significant at only the 17 percent level.

The coefficients on the SUPPINC and SUPONLY variables in their respective models are both negative with the SUPONLY variable being significant at the 1 percent level. This

**TABLE 4.8**  
**LOGIT ESTIMATES ON**  
**RECEIVE TRAINING (RECTNG)**

VARIABLE	COEFFICIENT	STANDARD ERROR	WALD CHI-SQUARE
INTERCEPT	3.720	1.105	11.33*
EDUC	-0.114	0.018	38.52*
MARRIED	-0.081	0.058	1.93
NONWHITE	0.505	0.055	84.26*
SELFEMPL	-0.120	0.130	0.85
ADMIN	0.129	0.133	0.94
CRAFT	-0.019	0.099	0.04
MANAGER	-0.336	0.140	5.81**
MINEFM	-0.085	0.162	0.28
OPLABOR	-0.057	0.113	0.25
OPMACHIN	-0.110	0.101	1.18
OPMOVG	0.205	0.116	3.10***
PROFESS	0.302	0.125	5.86**
SERVICE	0.123	0.102	1.44
YHAT	-0.292	0.123	5.61**

N=7,377

- 
- \* Significant at the 0.01 level
  - \*\* Significant at the 0.05 level
  - \*\*\* Significant at the 0.10 level



**TABLE 4.9**  
**REGRESSION RESULTS FOR RECEIVE TRAINING AND SUPPLEMENT**  
**INCOME MODELS USING TWO-STAGE LEAST SQUARES**

VARIABLE	RECEIVE TRAINING MODEL		SUPPLEMENT INCOME MODEL	
	COEFFICIENT	T RATIO	COEFFICIENT	T RATIO
INTERCEPT	5.774	12.937*	7.465	14.770*
AGE	0.146	8.408*	0.158	7.612*
AGESQ	-0.001	-5.996*	-0.002	-6.710*
CHLID	-0.005	-0.497	0.008	0.009
EDUC	0.056	4.202*	-0.001	-0.065
MARRIED	0.155	5.716*	0.137	5.801*
NONWHITE	-0.256	-4.295*	-0.087	-3.567*
SELFEMPL	0.157	2.783*	0.103	2.148**
ADMIN	-0.027	-0.448	0.011	0.227
CRAFT	0.073	1.695***	0.088	2.158**
MANAGER	0.293	4.382*	0.178	3.524*
MINEFM	-0.184	-2.633*	-0.159	-2.462**
OPLABOR	-0.010	-0.206	-0.018	-0.432
OPMACHIN	0.124	2.731*	0.096	2.540**
OPMOVG	0.002	0.039	0.057	1.296
PROFESS	0.069	1.147	0.115	2.261**
SERVICE	-0.043	-0.915	0.017	0.413
RECTNG	1.179	2.798*	-	-
SUPPINC	-	-	-0.956	-1.437
N = 7,377		N = 7,377		
F STATISTIC 34.826		F STATISTIC 46.482		
R-SQUARE 0.0745		R-SQUARE 0.0970		
ADJ R-SQUARE 0.0723		ADJ R-SQUARE 0.0949		

\* Significant at the 0.01 level  
 \*\* Significant at the 0.05 level  
 \*\*\* Significant at the 0.10 level

**TABLE 4.10**  
**REGRESSION RESULTS FOR RECEIVE TRAINING ONLY AND SUPPLEMENT**  
**INCOME ONLY MODELS USING TWO-STAGE LEAST SQUARES**

VARIABLE	RECEIVE TRAINING ONLY MODEL		SUPPLEMENT INCOME ONLY MODEL	
	COEFFICIENT	T RATIO	COEFFICIENT	T RATIO
INTERCEPT	6.592	24.966*	6.686	15.449*
AGE	0.147	9.209*	0.204	5.258*
AGESQ	-0.002	-7.113*	-0.002	-4.146*
CHILD	0.004	0.472	-0.008	-0.412
EDUC	0.020	2.794*	0.029	2.209**
MARRIED	0.141	5.626*	0.210	3.917*
NONWHITE	-0.105	-5.087*	-0.414	-3.322*
SELFEMPL	0.105	2.229**	0.192	1.957***
ADMIN	-0.027	-0.477	-0.006	-0.064
CRAFT	0.067	1.848***	0.152	1.875***
MANAGER	0.208	4.263*	0.354	3.074*
MINEFM	-0.170	-2.777*	-0.118	-0.954
OPLABOR	-0.038	-0.892	0.056	0.614
OPMACHIN	0.088	2.418**	0.197	2.308**
OPMOVG	0.032	0.670	-0.031	-0.325
PROFESS	0.086	1.356	-0.016	-0.143
SERVICE	0.004	0.116	-0.046	-0.587
REONLY	1.482	1.351	---	---
SUPONLY	---	---	-2.809	-2.643*
	N = 7,377		N = 7,377	
	F STATISTIC	48.926	F STATISTIC	12.006
	R-SQUARE	0.1015	R-SQUARE	0.0270
	ADJ R-SQUARE	0.0995	ADJ R-SQUARE	0.0247

\* Significant at the 0.01 level  
 \*\* Significant at the 0.05 level  
 \*\*\* Significant at the 0.10 level

reinforces the earlier result that joining the reserves to supplement income does not benefit one in terms of annual income. Most of the same variables were statistically significant at conventional levels in all of the models specified whether using OLS or 2SLS.

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

This thesis tests the alternative hypothesis that a positive relationship exists between participation in the reserves to receive training and increased benefits and wages on one's civilian job for some reservists. The null hypothesis is that no such relationship exists, or, that it exists for relatively few reservists. If so, then reserve participation is mainly a form of moonlighting with few derivative benefits to the individual or to society.

The mean statistics of this thesis showed that only 5 percent of the sample population of 7,377 reservists affiliated solely to receive training while over 41 percent affiliated solely to supplement their income. Those who affiliated to receive training had a higher annual income than those who affiliated for other reasons except those members who affiliated only to supplement their income. In the multivariate model estimated by OLS the negative coefficients on the RECTNG and SUPPINC variables would suggest that affiliating with the reserves to receive training or to supplement annual income would reduce annual income. It was hypothesized however, that a single equation model of the training-earnings relationship was inappropriate and that the true relationship was

simultaneous in nature. Therefore, a test for simultaneity was conducted with the results shown in Table 4.8. The results showed that there was simultaneity in the OLS models and the 2SLS estimating technique was consequently applied to the regression equations.

The 2SLS estimates support the hypothesis that receiving training in the reserves results in an increase in civilian benefits and wages. The coefficient on the RECTNG variable became positive and highly significant while the SUPPINC coefficient remained negative. Therefore, the null hypothesis was rejected. We can conclude that reserve training does appear to provide important benefits to some enlistees, namely those who are motivated to seek skill training that can be used on their civilian job or used to find a better civilian job.

One major issue associated with attempting to estimate the effect of reserve training on civilian wages is the possibility that the system of equations defining the model is recursive rather than simultaneous. In Chapter III, equation (3) defines RECTNG as a function of several explanatory variables including the log of current annual income (LNENGS). In actuality, the probability of affiliating to receive training may be a function of one's annual income in the previous year. If so, Equations (3) and (4) in Chapter III should be rewritten as follows:

$$RECTNG_t = \alpha_0 + C_1 LNENGS_{t-1} + \sum D_i Z_i + \epsilon_t \quad (1)$$

$$LNENGS_t = \beta_0 + \sum \beta_i X_i + GRECTNG_t + \mu_t \quad (2)$$

Although this system of equations might seem simultaneous, it is actually recursive, and the variables  $RECTNG_t$  and  $LNENGS_t$  are sequentially determined. Values for annual income in the previous year ( $LNENGS_{t-1}$ ) would allow us to solve directly for the probability of affiliating to receive training ( $RECTNG_t$ ). Then, knowing  $RECTNG_t$  would allow us to solve for annual income in the current year.

In any recursive system of this sort, Ordinary Least Squares (OLS) is the appropriate estimation technique (Pindyck *et al.* 1991). OLS is appropriate for equation (1) because  $LNENGS_{t-1}$  is predetermined and therefore uncorrelated with the error term in equation (1). OLS is also appropriate for equation (2) because  $RECTNG_t$  is uncorrelated with the error term in equation (2). However, the 1986 Reserve Components Surveys did not contain data on members' annual incomes prior to affiliation with the reserves. This prevented specification of the system of equations as recursive and made it necessary to specify equations that were simultaneously determined. This required the application of Two-Stage Least Squares estimating techniques to estimate the model.

Another problem encountered in this thesis was the fact that reserve affiliation is voluntary and members self-select themselves to join. People who have a lower annual income than their cohorts are more likely to affiliate with the reserves to receive training to increase their human capital and subsequently their annual income. The effects of reserve training on annual income may be biased downward by a member's already depressed annual income below that of his cohorts.

#### **B. RECOMMENDATIONS**

Future Reserve Components Surveys should include questions pertaining to a members status prior to affiliation with the reserves. Annual income, type of occupation, marital status, number of children, and years of completed education, and unemployment and employment status prior to the member's enlistment in the reserves, would be valuable information in measuring the effects of reserve training on civilian annual income. The data available in the 1986 Reserve Components Surveys simply were not sufficient enough to support an empirical analysis of the economic motives for reserve participation.

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