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Technical Report 999


# Army Reserve Force Structure Planning Model

Lenore A. Pienta, Gary L. Olin, Brian F. Shea, and Julie A. Hunt  
Fu Associates, Ltd

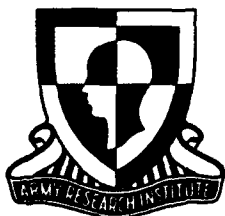
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## **Army Reserve Force Structure Planning Model**

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## **FOREWORD**

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The Leadership and Organizational Change Technical Area of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research in the areas of total Army retention, readiness, and family factors. Questions have recently arisen regarding the Army's ability to predict retention in Reserve/Guard units.

This Small Business Innovation Research contract report quantifies the economic and noneconomic predictors of reenlistment of Army Reserve/Guard personnel.

The results of this research will help to predict the reenlistment probabilities of Reserve/Guard personnel. The variables that can help increase the reenlistment include Reserve pay, job satisfaction, and family factors.

**EDGAR M. JOHNSON**  
Director

## **ACKNOWLEDGMENTS**

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The views, opinions, and/or findings contained in this paper are those of the authors and should not be construed as the official position of the U.S. Army Research Institute for the Behavioral and Social Sciences or as an official Department of the Army position, policy, or decision, unless so designated by other official documentation.

# **ARMY RESERVE FORCE STRUCTURE PLANNING MODEL**

## **EXECUTIVE SUMMARY**

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### **Requirements:**

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research on manpower, personnel, training, and family issues of significance to the U.S. Army and Reserve/National Guard units. Questions have been raised about the Army's ability to increase retention in Reserve/National Guard units.

The objective of this research is to empirically model the retention intention of Army Selected Reserve (Army Reserve and Army National Guard) enlisted personnel, hereafter called reservists. The study focuses on factors influencing reservists to reenlist because retention intention is an intervening variable related to retention behavior.

### **Procedure:**

Building on the labor economic theory of dual job holders or the "moonlighting" theory of second job labor supply, the model developed in this paper includes theoretical extensions that incorporate information on household production and the allocation of leisure time into the reenlistment decision. The model includes economic variables, demographic variables, and institutional factors related to the Army Selected Reserve. A key variable in the model is an estimate of the foregone wage available to reservists in the civilian second job market. Data from the Current Population Survey (CPS) are used to estimate the foregone civilian wage via Heckman's Two-Step Procedure. The intention decision is then modeled as a binomial logit equation. The study further examines the relationship between stated intention to reenlist and actual reenlistment behavior. The intention to stay in the Reserves until retirement is also examined. That behavior is similarly modeled as a binomial logit equation.

### **Findings:**

The results identify factors, subject to the control of policymakers, that affect a reservist's intention to reenlist. Therefore, it might be possible to affect policies that positively influence the decision of reservists who are undecided or leaning toward separation.

### **Utilization of Findings:**

This research shows that the U.S. Congress can help increase reenlistment of Selected Reserve personnel by increasing Reserve pay. The reenlistment can also be increased if Army policymakers assign reservists to primary Military Occupational Specialties in which they are trained.



# **ARMY RESERVE FORCE STRUCTURE PLANNING MODEL**

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# **ARMY RESERVE FORCE STRUCTURE PLANNING MODEL**

## **Introduction**

The objective of this research is to empirically model the retention intention decision of Army Selected Reserve (Army Reserve and Army National Guard) enlisted personnel, hereafter called reservists. The study focuses on factors influencing the intention of reservists to reenlist because retention intention is an intervening variable that is positively related to retention behavior. By identifying factors that affect the retention intention decision, policymakers can be provided with a method of influencing the decision of reservists to reenlist, thereby reducing attrition and related costs of maintaining a reserve force.

Building on the labor economic theory of dual job holders, or the "moonlighting" theory of second job labor supply, the model developed in this paper includes theoretical extensions that incorporate information on household production and the allocation of leisure time into the reenlistment decision. The model includes economic variables, demographic variables, and institutional factors related to the Army Selected Reserves. A key variable in the model is an estimate of the foregone wage available to reservists in the civilian second job market. Data from the Current Population Survey (CPS) is used to estimate the foregone civilian wage via Heckman's Two-Step Procedure. The intention decision is modeled as a binomial logit equation. The study then looks at the relationship between stated intention to reenlist and actual reenlistment behavior. The intention to stay in the reserves until retirement also is examined. The behavior is similarly modeled as a binomial logit equation.

The results identify factors affecting the intention to reenlist that are subject to policymaker control. Thus it might be possible to affect policies that positively influence the decision of reservists who are undecided or leaning towards separation.

## **Literature Review**

Since the 1970s, several empirical studies have examined reserve accessions, attrition, and retention intentions. These studies model reserve participation as a second job following the economic theory of moonlighting and primarily focus on determining the significant explanatory variables and associated policy implications. Early models included standard labor supply explanatory variables such as demographic characteristics and economic factors. Participation in the reserves was later treated as a different kind of moonlighting—one that has attributes other second

jobs do not. The effects of these attributes were captured by the introduction of additional explanatory variables such as prior military service. In the late 1980s, attitudinal variables were introduced into the model. Such variables capture individual attitudes and tastes that may predispose a potential reservist toward reserve duty or a reservist toward reenlistment. Most recently, the moonlighting theory was extended to incorporate the theory of household production by including variables reflecting spouse labor market participation and family size. None of the previous models explicitly include an estimate of alternative second job wages for reservists, however. The explanatory variables included in these studies and the major findings are reported in Appendix A.

Early studies used the moonlighting model of second job participation as the theoretical context to estimate the supply of reserve labor. Rostker and Shishko<sup>1</sup> used data from the Panel Study of Income Dynamics to estimate the civilian moonlighting labor supply curve. Using the tobit estimation technique to correct for sample selection bias, they found strong support for the moonlighting theory; in particular, the data exhibited a significant and negative relationship between moonlighting and primary hours worked. Rostker and Shishko concluded that it would be costly to increase reserve enlistment via wage increases, if their estimates of civilian moonlighting pay elasticities (between 0.9 and 1.0) could be carried over to the market for reserves (in this case, Air Force Reserves). They also found that several demographic factors significantly influence the decision to moonlight. Age had a negative effect on participation while family size and cost of housing had positive effects. With these results, Rostker and Shishko established the moonlighting model as a suitable context in which to frame labor supply in secondary markets. However, they did not actually test the theory using reserve data.

The studies that followed used reserve data and began to incorporate institutional characteristics of the reserves into the analysis. In a companion piece to Rostker and Shishko (1973), Rostker<sup>2</sup> used enlistment data for Air Force Reserve enlistees from fiscal years 1968 and 1970 to ascertain how reserve participation might change in the wake of the termination of the draft. The draft reduced the probability that a reservist would be mobilized relative to a civilian registered for the draft. Rostker formalized the effect of this reduced probability by estimating reserve labor

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<sup>1</sup> Rostker, B. & Shishko, R. (1973, August). *Air Reserve Personnel Study: Volume II. The Air Reserve Forces and the Economics of Secondary Labor Market Participation* (Report No. R-1254-PR). Santa Monica, CA: The Rand Corporation

Rostker, B. & Shishko, R. (1976, June). *The Economics of Multiple Job Holding*. *American Economic Review*, 66, 298-303.

<sup>2</sup> Rostker, B. (1974, October). *Air Reserve Personnel Study: Volume III; Total Force Planning, Personnel Costs, and the Supply of New Reservists* (Report No. R-1430-PR). Santa Monica, CA: The Rand Corporation.

supply as a function of expected reserve wages, expected civilian wages, and expected active duty wages. Through this mechanism, Rostker illustrated that the draft in effect discounted the impact of civilian earnings on reserve participation relative to reserve pay. As modeled, the short run effect of ending the draft was to reduce reserve enlistments. The long run effect, as evidenced by the estimated wage elasticities, was to shift the sign (from positive to negative) of the effect of civilian wages on enlistment. The policy conclusions drawn from the study, e.g., that pay increases are too costly a way to induce enough enlistees to compensate for the termination of the draft, were more relevant in the early 1970s before the advent of the all volunteer force. The inclusion of the probability of mobilization as a determinant of labor supply, however, will always be relevant by virtue of the function of the reserves.

Most of the early studies focused only on nonprior service (NPS) personnel, or on reservists who had never served as full time active duty personnel.<sup>3</sup> McNaught<sup>4</sup> estimated the labor supply of both prior service (PS) and NPS personnel and tested the sensitivity of each group to unemployment rates. The study found that the labor supply of NPS personnel was significantly and positively affected by unemployment, whereas the labor supply of PS personnel was not significantly affected. Clay-Mendez<sup>5</sup> found similar results for Navy veterans: all of the explanatory variables included in her probit analysis, except for unemployment, significantly and positively affected participation. These two studies suggest that PS reservists' decision to participate is not motivated by the general economic environment. McNaught's study, on the other hand, suggests that NPS personnel enlist at least in part because of poor economic conditions as measured by the unemployment rate. Based on these results, the underlying reasons for participation appear to differ for these two groups.

Several other reserve-specific explanatory variables were considered by Burright, Grissmer, and Doering.<sup>6</sup> The authors applied ordinary least squares (OLS) to Army National Guard survey data from the 1978 Selected Reserve Reenlistment Bonus Test Program Study to estimate the impact of various economic, demographic, and institutional factors on the reenlistment decision. In addition to prior military service, they found that pay grade (which reflects rank), primary employer's attitude

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<sup>3</sup> For example, see Kelly, R. (1979, May). *The Supply of Volunteers to the Selected Reserve* Unpublished Manuscript, United States Military Academy, Department of Social Sciences.

<sup>4</sup> McNaught, W. (1981, June). *Projecting Future Accessions to the Selected Reserve Components* (Report No. N-1563-MRAL). Santa Monica, CA: The Rand Corporation.

<sup>5</sup> Clay-Mendez, D. (1983, September). *Alternative Accession Policies for Junior Enlisted Personnel in the Naval Selected Reserve: A Total Force Perspective* (Report No. CRC 500). Alexandria, VA: The Center for Naval Analyses.

<sup>6</sup> Burright, B., Grissmer D. W., & Doering, Z. D. (1982, October). *A Model of Reenlistment Decisions of Army National Guardsman* (Report No. R-2866-MRAL). Santa Monica, CA: The Rand Corporation.

toward the reserves, and prior reenlistment had a significant and positive effect on reenlistment. Years of service, enlistment motivated by the draft, and assignment to a combat position were factors that negatively affected reenlistment.

Using the same data, Grissmer and Kirby<sup>7</sup> estimated a two stage logit model to assess the impact of the reenlistment bonus on reenlistment behavior. The first stage estimated the probability of reenlistment and the second, the expected term of reenlistment. While the reenlistment bonus was found to have a small effect on the decision to reenlist, reservists opted for a longer term of service than they otherwise would have without the bonus. The positive effects of bonuses also are evident in a 1988 study of the effect of pay and bonuses on U.S. Army reenlistment. Lakhani<sup>8</sup> showed that quit rates and the size of reenlistment bonuses are negatively related, even more so than quit rates and pay level.

A 1991 GAO study<sup>9</sup> used logit on the 1986 Reserve Components Survey (RCS) and the Reserve Components Common Personnel Data System (RCCPDS) to estimate attrition rates for all reserve components. Attrition rates were found to increase when a reservist lost overtime pay opportunities because of reserve duty or a mismatch existed between a reservist's primary occupational specialty and his or her duty specialty. Holding other factors constant, PS personnel tended to have higher attrition rates than NPS personnel. GAO commented that PS personnel—by virtue of their experience in the active military—have different expectations than NPS personnel, and it is likely these differences are manifested in the attrition behavior of the two groups. Other human capital and demographic variables such as education and gender had negative and significant effects as well. As a result of their study, the GAO recommended more flexible training requirements and further study of matching military and duty specialty.

Hogan and Villa<sup>10</sup> used the 1986 RCS and the RCCPDS to analyze reenlistment behavior. Using information from the RCCPDS, they matched survey responses with actual retention outcomes in order to estimate the probability of reenlisting. Their analysis is based on an extended version of the moonlighting model

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<sup>7</sup> Grissmer, D. & Kirby, S. N. (1985, October). *Attrition of Nonprior-Service Reservists in the Army National Guard and Army Reserve* (Report No. R-3267-RA). Santa Monica, CA: The Rand Corporation.

<sup>8</sup> Lakhani, H. (1988, April). The Effect of Pay and Retention Bonuses on Quit Rates in the U.S. Army. *Industrial and Labor Relations Review*, 41(3), 430-438.

<sup>9</sup> General Accounting Office. (1991, April). *Reserve Components: Factors Related to Personnel Attrition in the Selected Reserve*. Washington, DC: Author.

<sup>10</sup> Hogan, P. & Villa, C. (1991). Factors Affecting Reenlistment in the Army Reserve: Evidence from the 1986 DoD Survey. In C.L. Gilroy (Ed.), *Military Compensation and Personnel Retention* (pp. 355-395). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

that incorporates the theory of household production. The analysis concentrated on three different categories of reserve experience: 0 through 6, 7 through 9, and 10 through 11 years. Institutional variables included in the study were whether or not the reservist was a student or a PS enlistee and his or her Department of Defense occupational category. Only the PS variable and one occupational category were significant and then only for the group with 0 through 6 years of service. The authors suggested that most variables were not significant as a result of poor data rather than the model specification.

Recently, studies focussed more heavily on the noneconomic determinants of enlistment, reenlistment, and attrition. A descriptive study linking enlistment motivations to reenlistment behavior by Gorman and Thomas,<sup>11</sup> for example, examined the behavior of Army Reserve enlistees. The study used generalized logit to estimate the probability that patriotism, self-improvement, or student benefits is the primary motive for Army Reserve enlistment. The authors concluded that "a narrow view of Army Reserve loss rates could result in suboptimal management practices." That is, raising reserve compensation to keep individuals who enlisted for reasons other than those associated with typical moonlighting jobs, e.g., for student benefits, may be very costly—so much so that it may be optimal to plan for high turnover in the college cohort.

Regets<sup>12</sup> modeled enlistment by assuming that utility is derived from intangible benefits as well as wages. These benefits include patriotism, camaraderie, and "taste" for military life. Regets posited a model of compensated leisure in which reserve activity is a consumption good from which individuals derive utility in addition to providing additional income. He found that the probability of reserve participation increased with nonlabor income, which is consistent with the hypothesis that reserve activity yields positive utility for participants.

Lakhani and Fugita<sup>13</sup> utilized Wilensky's social psychological theory to explain how spouse attitudes toward the reserve affect the retention intention decision. Using the 1986 RCS in conjunction with personnel data, they found that, in addition to family earnings, spouse attitude positively affected plans to remain in the reserves. The more favorable a spouse's attitude was toward participation in the reserve, the more likely the reservist was to remain in the reserves.

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<sup>11</sup> Gorman, L. & Thomas, G. (1991, Summer). Enlistment Motivations of Army Reservists: Money, Self-Improvement, or Patriotism? *Armed Forces and Society*, pp. 589-600.

<sup>12</sup> Regets, M.C. (1990, July). *Military Reserves as Compensated Leisure: A Peculiar Case of Labor Supply*. Presented at the 65th Western Economic International Conference Meetings, San Diego, CA.

<sup>13</sup> Lakhani, H. & Fugita, S. (1993). Reserve/Guard Retention: Moonlighting or Compensated Leisure? *Military Psychology*, 5(2), 113-125.

## The Retention Intention

Previous studies indicate the behavior of reservists is influenced by more than economic considerations. This section develops a model that explains the revealed reenlistment intentions of reservists in terms of demographic variables and the characteristics of the Reserves as well as economic factors. While some researchers would include attitudinal variables in the analysis, this study views attitude toward Reserve life as an endogenous variable, jointly determined with the retention intention decision. Modeling this system of equations is beyond the scope of the current work.

However, the retention intention decision can be analyzed within an expanded framework of the moonlighting model developed by Rostker and Shishko.<sup>14</sup> Rostker and Shishko hypothesize that a utility maximizing individual may wish to work more hours than his primary job permits. Constrained in the number of hours that he or she can work for pay, the individual may seek a second job in order to increase his or her well-being, i.e., equate the marginal value of time spent in work and leisure. Moreover, so long as the secondary job wage is higher than the reservation wage<sup>15</sup> of the individual, he or she will choose to moonlight even at a wage below his or her primary job wage.

In the moonlighting model, hours of labor supplied to a second job depend on primary and secondary wage rates, nonlabor income, and hours worked on the primary job. If leisure is a normal good,<sup>16</sup> hours of labor supplied to the second job will fall as primary wages or nonlabor income increase, while an increase in secondary wages will have an ambiguous effect on hours supplied to the second job. An increase in hours worked on the primary job will reduce labor supplied to the second job so long as the primary wage is greater than the secondary wage.

### *Extensions of the Moonlighting Model*

In an analysis of reenlistment behavior in the Army Reserves, Hogan and Villa<sup>17</sup> used the theory of the allocation of leisure time and the concept of household production to expand the moonlighting model. By extending the moonlighting model to include household behavior, the authors were able to consider

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<sup>14</sup> Rostker and Shisko, 1976, op. cit.

<sup>15</sup> The minimum wage an individual requires to work.

<sup>16</sup> A good whose demand is reduced as income falls.

<sup>17</sup> Hogan and Villa, op. cit.



the effects of variables such as family size and spouse labor market participation on reenlistment of enlisted personnel in the reserves. The authors also included institutional characteristics of the reserves in their model, because participation in the reserves is not a typical form of moonlighting.

The economic variables, except for nonlabor family income and the unemployment rate, reflect choices made by individuals. In this sense, they capture the relative value of reserve duty, primary civilian work, and leisure time. Building on this framework, the potential economic variables to be used in the model developed below include:

- *Primary job wage rate.* The moonlighting model predicts primary job wage rates to be negatively related to the intention to reenlist.
- *Net reserve wage rate.* The moonlighting model predicts net reserve pay to have an ambiguous effect on the intention to reenlist, depending on the relative strength of income and substitution effects. Net reserve pay differs according to the policy of the reservist's employer with respect to payment for the two weeks active duty training. For example, some employers provide full civilian pay for the time the reservist is on active duty, others provide the difference between reserve pay and regular pay, and still others provide no pay.
- *Alternative civilian moonlighting wage.* Alternative civilian moonlighting wage rates are expected to negatively affect the intention to reenlist, as long as civilian wage rates are greater than net reserve wage rate.
- *Nonlabor family income.* If leisure is a normal good, the moonlighting theory predicts that nonlabor income will have a negative effect on reenlistment.
- *Expected value of military retirement.* The value of military retirement is determined by an individual's expected pay grade and points earned at the time of retirement, interest rates, and life expectancy. Military retirement is expected to have a positive effect on reenlistment.
- *Hours of work on primary civilian job.* The moonlighting theory predicts that hours of work on the primary job will negatively affect the intention to reenlist.
- *Unemployment rate.* The civilian unemployment rate, as a measure of alternative second jobs available in local labor markets, is expected to have a positive effect on reenlistment.

Demographic variables and household characteristics are included in the model to capture their effects on the retention intention decision. These variables include:

- *Work experience.* Work experience is the number of years an individual has been in the full time civilian or military labor force. Experience is expected to increase primary civilian wage, reserve wage, and alternative second job wage. Thus, the expected sign on intention to reenlist is ambiguous.
- *Education.* Education is the number of years of formal education that an individual has completed as reported in the survey. Education is expected to increase primary civilian wage, reserve wage, and alternative second job wage. As a result, the expected sign on intentions is ambiguous.
- *Marital status.* Marriage is expected to have a positive effect on reenlistment intention, as the presence of a spouse facilitates specialization in market work.
- *Number of dependents.* Dependents under six years of age are expected to decrease the intention to reenlist, since young children are likely to require time devoted to their care.
- *Working spouse.* A working spouse eliminates the possibility of spouse specialization in home production and therefore is more likely to require the reservist to devote time to household activities, reducing the time available for leisure or market work. Consequently, the presence of a working spouse is likely to have a negative effect on the intention to reenlist.

Although the theory of moonlighting offers a sound frame of reference for analyzing the intention decision, moonlighting as a reservist can differ from moonlighting as a civilian. For example, reserve obligations are less flexible than most civilian second jobs, and benefits can be better, e.g., the provision of retirement benefits. To measure such effects, variables that are specific to the reserves, or variables that capture reserve institutional characteristics, are included in the estimation. The kinds of variables that capture the difference between moonlighting as reservist and moonlighting as a civilian include:

- *Reenlistment bonus.* A reenlistment bonus is expected to have a positive effect on the intention to reenlist.
- *Prior military service.* Prior military service is expected to have a positive influence on the intention to reenlist. Individuals with prior

active duty service are more likely to have a "taste" for military life, military camaraderie, or patriotism. In addition, since 360 points are credited towards retirement for each year of active duty service, reservists with prior active duty service may also have a large number of points or more years credited towards retirement that would increase the value of their potential retirement benefits.

- *Years credited towards retirement.* The number of good years credited towards retirement is expected to have a positive effect on the intention to reenlist (since 20 years are required for vesting.)
- *Percentage of time spent in primary Military Occupational Specialty (MOS).* Percentage of time spent in primary MOS, or in other words, the occupational specialty in which the reservist was trained, is expected to have a positive effect on reenlistment intentions.

### ***Modeling the Retention Intention Decision***

Our analysis of the retention intention decision uses the framework developed by Hogan and Villa.<sup>18</sup> The model is based on the assumption that each individual maximizes household utility subject to a budget constraint and has the resulting indirect utility function:

$$(1) \quad U_{ij}(\mathbf{w}_{ij}, \delta_i, \lambda_{ij})$$

where  $j = 0$  if individual  $i$  does not intend to reenlist and  $j = 1$  if  $i$  does intend to reenlist and  $\mathbf{w}_{ij}$ ,  $\delta_i$ , and  $\lambda_{ij}$  are vectors of economic, demographic, and institutional variables affecting the retention intention decision. This function describes the maximum utility that can be achieved given prices, outlays on consumption, and other factors affecting the well-being of households.

The model can be estimated by expressing the  $i$ th individual's indirect utility as

$$(2) \quad U_{ij} = \mathbf{X}_{ij}'\mathbf{B} + e_{ij}$$

where  $j = 0$  if  $i$  does not intend to reenlist and  $j = 1$  if  $i$  does intend to reenlist,  $\mathbf{X}_{ij}$  is a vector of economic, demographic, and institutional variables affecting utility,  $\mathbf{B}$  is a vector of coefficients, and  $e_{ij}$  is the unobservable component of the utility function. The individual is assumed to have a positive retention intention decision ( $RI_i = 1$ ) if the utility associated with a positive retention intention decision is greater than the

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<sup>18</sup> Hogan and Villa, *op. cit.*

utility associated with negative retention intentions. This probability can be expressed as follows:

$$\begin{aligned} (3) \quad \text{Prob}[RI_i = 1] &= \text{Prob}[U_{i1} > U_{i0}] \\ &= \text{Prob}[e_{i0} - e_{i1} < X_{i1}'B - X_{i0}'B] \\ &= F[X_{i1}'B - X_{i0}'B] \end{aligned}$$

where  $F$  is the cumulative distribution function of  $e_{i0} - e_{i1}$ . Assuming that  $e_{i0} - e_{i1}$  has a logistic distribution, the probability of a positive retention intention decision can be written as:

$$(4) \quad \text{Prob}[RI_i=1] = 1/(1 + \exp(X_{i0}'B - X_{i1}'B))$$

which can be estimated by using a binomial logit procedure.

### *Data*

Data for respondents to the DMDC 1986 RCS were obtained from the survey and supplemented with information from the RCCPDS. Our final sample was limited to male Army Selected Reserve enlisted personnel 18 through 55 years of age who worked full time in the private or government sectors and had an expiration of term of service (ETS) falling between the time they took the survey and December 1987. Individuals with outlying values on civilian wage rate, reserve earnings, and civilian earnings were screened from the data set, along with individuals who had inconsistent responses to the survey questions regarding intention to reenlist and intention to stay until retirement. A complete discussion of the data and the variables used to model the retention intention decision is contained in Appendix B.

Table 1 presents descriptive statistics on individuals in the final sample of 1,747 reservists according to their stated intention to reenlist. These statistics may indicate important differences between reservists who intend to reenlist and those who do not. Reservists who intend to reenlist have higher average reserve wages but lower nonlabor income than those who do not intend to reenlist. In addition, reservists who intend to reenlist spend more time in their primary MOS and have more active duty experience than the other reservists in the sample.

**Table 1*****Descriptive Statistics for Reservists in Reenlistment Intention Model Sample***

	All reservists		Reservists with stated intention to reenlist		Reservists with stated intention not to reenlist	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Alternative civilian second job wage	7.34	1.85	7.35	1.73	7.31	2.11
Civilian primary job wage	11.17	4.54	11.15	4.27	11.22	5.13
Reserve wage	8.98	2.14	9.23	2.12	8.40	2.08
Nonlabor family income	789.51	1,592.60	767.51	1565.90	841.58	1654.50
Percentage working more than 45 hours per week on primary job	0.25	—	0.24	—	0.28	—
State unemployment rate	6.57	1.67	6.63	1.67	6.45	1.65
Percentage of time spent in primary MOS	64.90	34.51	68.59	33.26	56.17	35.84
Percentage with prior active duty service	0.58	—	0.61	—	0.53	—
Years of education completed	13.47	2.01	13.51	2.01	13.39	2.01
Age	37.26	8.02	37.84	7.63	35.88	8.73
Percentage currently married	0.81	—	0.83	—	0.77	—
Percentage with a working spouse	0.59	—	0.59	—	0.58	—
Good years credited towards reserve retirement	12.51	6.45	12.91	6.17	11.56	6.97

## Empirical Results

A model of the retention intention decision was estimated using a binomial logit procedure.<sup>19</sup> The dependent variable takes the value 1 if the individual indicates that he will reenlist in the reserves, zero otherwise.<sup>20</sup> The explanatory variables are drawn from variables discussed in the section on the extended moonlighting model. Not all of the previously discussed variables are included in the retention intention model. Some variables could not be created from our data on reservists. For example, retirement point information was incomplete for 1986, and therefore, the expected value of reserve retirement income could not be estimated.

Table 2 contains the estimated coefficients and standard errors of the explanatory variables. The coefficients generally have the expected sign, although not all of the coefficients are statistically significant.

**Table 2**  
***Estimated Retention Intention Equation***

Variable	Coefficient	Standard error	t-ratio
CONSTANT <sup>a</sup>	-2.398	0.453	-5.298
WAGE2 <sup>c</sup>	-0.075	0.040	-1.864
CIV_WAGE <sup>b</sup>	-0.034	0.014	-2.460
RES_WAGE <sup>a</sup>	0.339	0.046	7.41
RD2_I_RW	0.022	0.018	1.253
RD3_I_RW <sup>a</sup>	-0.124	0.022	-5.772
NLBRINC	-0.176E-04	0.349E-04	-0.504
WKHRS_D2 <sup>b</sup>	-0.306	0.128	-2.397
UNEMP85 <sup>a</sup>	0.089	0.034	2.607
PS_ACTIV	0.118	0.119	0.992
MOS_PER <sup>a</sup>	0.009	0.002	5.387
ED3	0.196	0.166	1.180

<sup>19</sup> For details see Green, W. (1992). *LIMDEP Version 6.0 Users Manual and Reference Guide*. Bellport, NY: Econometric Software.

<sup>20</sup> The values of the dependent variable were generated from the responses of the individuals to the question of whether or not they intended to reenlist in the Reserves/Guard. An individual who indicated that the probability of reenlisting was greater than 0.5 was counted as answering yes, otherwise, the answer was treated as a response of no.

**Table 2*****Estimated Retention Intention Equation (Continued)***

Variable	Coefficient	Standard error	t-ratio
CURRMARR <sup>a</sup>	0.513	0.180	2.856
SPOU_WK1 <sup>b</sup>	-0.322	0.143	-2.255

*Note:* Sample size = 1,747

<sup>a</sup> Significant at the 0.01 Level

<sup>b</sup> Significant at the 0.05 Level

<sup>c</sup> Significant at the 0.10 Level

WAGE2, a key variable in modeling the retention intention decision, is the estimated wage that reservists could earn by moonlighting in the civilian sector. The wage represents an opportunity cost to reservists that typically has not been included in studies of reserve participation.<sup>21</sup> It should be negatively correlated with the retention intention decision, and has the expected negative effect on reenlistment decisions in the empirical model.

CIV\_WAGE is the civilian primary job hourly wage rate. The coefficient is significant and has the expected negative sign. The model supports the moonlighting theory's prediction that the higher the civilian wage, other factors equal, the less likely an individual is to reenlist in the reserves.

In order to differentiate the impact of current reserve wage for reservists who are close to retirement, an interaction term using reserve wage and years credited towards retirement was introduced. RD2\_I\_RW is the interaction between RES\_WAGE and a dummy variable equal to 1 for individuals with 13 through 19 good years credited towards reserve retirement. Thus, reserve wage for this group of individuals is RES\_WAGE plus RD2\_I\_RW. Similarly, reserve wage rate for individuals with 20 or more years of good service credited towards reserve retirement, i.e., individuals who are already vested in their reserve retirement benefits, is RES\_WAGE plus RD3\_I\_RW. RES\_WAGE is reserve wage for the reference group, i.e., for individuals with 12 or fewer good years credited towards retirement.

Reserve wages have the expected positive impact on intentions to reenlist. However, the interaction terms show that the impacts vary depending on the number of good years of service a reservist has credited toward retirement. Reserve wages have a greater impact on the reenlistment intentions of reservists who have fewer than

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<sup>21</sup> See Appendix C for an explanation of how the wage was estimated.

20 years of good service. Presumably, individuals who have more than 20 years are more concerned about the value of their retirement than they are about their current reserve wage.

NLBRINC measures all nonlabor income received by the reservist's family. The negative effect that it has on the reenlistment decision could be interpreted to mean that households with high nonlabor income have assets that make a second job in the reserve unnecessary. This interpretation is consistent with the moonlighting model; however, it is contrary to Regets'<sup>22</sup> finding that the probability of participating in the reserves increases with nonlabor income. Nonetheless, the coefficient estimate is small and not statistically significant.

WKHRS\_D2 is a measure of hours worked on the primary civilian job. Long work hours on the primary job should have a negative effect on the decision to reenlist, which it does in this model. Long hours have been defined to be a dummy variable equal to 1 if the individual works more than 45 hours per week on the primary job and to 0 otherwise.

UNEMP85 is the 1985 unemployment rate in the state where the Reserve/National Guard unit is located. State unemployment rate is obtained from the Bureau of Labor Statistics (BLS) Survey of Earnings and Employment. Unemployment rates and reenlistment decisions should be inversely related if the unemployment rate is an indicator of second job opportunities in the civilian sector, which is what this model suggests.

PS\_ACTIV is a dummy variable indicating that the individual had prior active duty service in the Armed Forces. PS\_ACTIV takes a value of 1 if the individual ever served in the active military force and a value of 0 otherwise. According to GAO,<sup>23</sup> individuals who had active duty service before enlisting in the reserves have higher attrition rates than non-prior service personnel. However, this model shows a positive, albeit insignificant, relationship between prior active duty service and reenlistment intentions.

MOS\_PER shows the percentage of time each reservist spent working in the MOS in which he was trained. It has a positive effect on the retention intention decision. This is consistent with studies on reserve attrition. Presumably, reservists who work a high percentage of time in their primary MOS are more satisfied with their positions than are other reservists.

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<sup>22</sup> Regets, op cit.

<sup>23</sup> General Accounting Office, op cit.



ED3 is a dummy variable equal to 1 for individuals who have 16 or more years of education. The positive, albeit statistically insignificant, coefficient indicates a greater likelihood of reenlistment by college educated reservists. There is no theoretical basis for explaining this relationship, but it could reflect a greater appreciation of the value of a reserve retirement income by college educated reservists.

CURRMARR is a dummy variable that takes a value of 1 if the individual was married at the time of the survey and a value of 0 otherwise. The statistically significant positive coefficient on the variable indicates that married reservists have a greater propensity to reenlist than single reservists, all other factors held constant. One explanation for this result would be that married reservists have relatively more time for the reserves because their spouses handle household duties that normally would reduce time available for activities such as a second job.

SPOU\_WK1 is a dummy variable indicating the presence of a working spouse when it is equal to one. This variable has a negative and statistically significant effect on the reenlistment decision. We would argue that this result is consistent with the moonlighting model and household production theory because households that include two workers would have limited time for household activities, creating a disincentive for an individual to remain in the reserves.

In sum, the retention intention model appears quite reasonable. The estimated alternative wage in a second civilian job has the correct sign and is statistically significant at the 10 percent level. By including this variable with the other two wage rates, we have estimated a model that contains three theoretically relevant wages with correct and statistically significant signs. No other empirical work on reserve behavior has included all three of these variables.

In addition, most of the remaining variables in the model are statistically significant with the expected signs. The dummy variables for prior active duty service and marital status are the two explanatory variables that are ambiguous in terms of their impact on reenlistment intentions. We had no *a priori* expectations concerning the effects of these variables on the reenlistment decision, but a number of ad hoc explanations would be consistent with our empirical results.

### **Relationship Between Reenlistment Intentions and Behavior**

In order to use the retention intention decision as an intervening variable in the reenlistment decision, intentions and behavior must be correlated. To test the correlation between intentions and behavior, the stated intentions of 7,455 reservists in the RCS were compared to their actual behavior between January 1986 and December 1987. The results are contained in Table 3 below. A discussion of the methods used to create the variable reflecting behavior is contained in Appendix D.

**Table 3**

#### ***Reenlistment Behavior vs. Reenlistment Intentions***

	<b>Did not intend to reenlist/extend</b>	<b>Intended to reenlist/extend</b>	<b>Total</b>
Reenlisted/extended	1717	4194	5911
Did not reenlist/extend	1084	460	1544
Total	2801	4654	7455

The cross-tabulations indicate that 90 percent of those individuals who said that they intended to reenlist actually did reenlist by December 1987. This is a strong correlation between intentions and behavior of individuals who indicated a desire to remain in the Reserves. On the other hand, only 39 percent of the individuals who said that they would not reenlist actually left the Reserves. The remaining 61 percent reenlisted or extended their stay in the Reserves.

### **The Stay-Until-Retirement Decision**

A somewhat different intention decision is the one concerning the reservist's decision to remain in the Reserves or National Guard until he or she is vested in a reserve pension. This decision may be different from that of deciding whether or not to reenlist in the reserves. In one sense, the reenlistment decision is a short-run decision that may be appropriately modeled as an extension of the moonlighting theory, i.e., individuals are seeking additional current income. On the other hand, the stay-until-retirement decision is a long-run decision that reflects the desire of individuals to receive future income, i.e., retirement benefits.

As before, the sample was limited to male Army Reserve/National Guard enlisted personnel 18 through 55 years of age who work full time in the private or government sectors and have an ETS falling between the time they took the survey and December 1987. Outlier data on reserve earnings also were screened from the data

set. Additional restrictions imposed on the data include: eliminating any observations for individuals who reported 20 or more good years credited towards retirement, who answered already qualified or not sure/don't know when asked whether they planned to stay until retirement, or who responded inconsistently to the RCS questions regarding their intention to reenlist and their intention to stay until retirement. Descriptive statistics for this sample are contained in Table 4.

**Table 4**

***Descriptive Statistics for Reservists in  
Stay-Until-Retirement Intention Model Sample***

	All reservists		Reservists with stated intention to stay until retirement		Reservists with stated intention not to stay until retirement	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Reserve earnings	3,079.30	924.74	3157.30	915.72	2350.50	652.88
Nonlabor family income	821.31	1735.10	821.14	1733.70	822.85	1755.30
Percentage with prior active duty service	0.62	—	0.64	—	0.42	—

The descriptive statistics for individuals in the stay-until-retirement sample are revealing. Individuals who plan to stay until retirement average 35 percent higher reserve earnings than their counterparts who do not plan to stay until they are vested in the reserve retirement plan. In addition, the former group includes about 50 percent more individuals with prior active duty service. The combination of high reserve earnings and prior active duty service would suggest that individuals who plan to stay until retirement would earn a much larger military pension than individuals who do not intend to stay until retirement.

Using a binomial logit technique, an equation is estimated on the factors affecting the intention to stay in the reserves until retirement. Table 5 contains the coefficients and standard errors of the stay-until-retirement decision. The dependent variable takes the value 1 if the individual indicated that he will stay in the reserves until retirement; otherwise it is 0. The right-hand side variables include factors that affect the long-run decision to stay in the reserves until vested in the retirement plan. Ideally, in an equation to discuss retirement, it is appropriate to include an estimate of the individual's discounted present value of expected retirement benefits and some measure of wealth. Due to limitations in the data, the intention to reenlist equation only includes the following variables: annual reserve earnings, prior active duty service, and nonlabor income.

**Table 5*****Estimated Stay-Until-Retirement Intention Equation***

Variable	Coefficient	Standard error	t-ratio
CONSTANT <sup>a</sup>	-1.517	0.445	-3.410
RES_EARN <sup>a</sup>	0.001	0.178E-03	5.948
PS_ACTIV <sup>a</sup>	0.957	0.219	4.367
NLBRINC	-0.533E-04	0.667E-04	-0.799
RD2_I_RE <sup>a</sup>	0.932E-03	0.214E-03	4.354
RD2_I_NL	-0.154E-03	0.152E-03	-1.011

*Note:* Sample = 1,170

<sup>a</sup> Significant at the 0.01 Level

In order to differentiate the impact of current reserve wage for reservists who are close to retirement, an interaction term between reserve earnings and years credited towards retirement was introduced. RD2\_I\_RE is the interaction between RES\_WAGE and a dummy variable equal to 1 for individuals with 13 through 19 good years credited towards reserve retirement. Thus, reserve earnings for this group of individuals is RES\_EARN plus RD2\_I\_RW. The interpretation of the coefficient on RES\_EARN is reserve earnings for the reference group, i.e., for individuals with 12 or fewer good years credited towards retirement.

In this model, reserve earnings is included as a proxy for reserve retirement income because the expected value of the reserve retirement income is partly a function of the reserve salary. All other factors being equal, it is expected that individuals with a higher expected value of reserve retirement income are more likely to stay until retirement. We would also expect reserve retirement income to be more important for individuals who have more years credited toward reserve retirement income. The positive and statistically significant coefficients on RES\_EARN and RD2\_I\_RE are consistent with this hypothesis.

PS\_ACTIV is a dummy variable indicating that the individual had prior active duty service in the Armed Forces when it is equal to one. As is the case, prior active duty service should have a positive effect on the stay-until-retirement decision because of the contribution that active duty points would make to retirement pay.

NLBRINC measures all nonlabor income received by the family for individuals with less than 14 years credited towards retirement. RD2\_I\_NL is an interaction term between nonlabor family income and a dummy variable identifying reservists with 14 through 19 years credited toward reserve retirement. Nonlabor income for this group is

equal to RES\_EARN plus RD2\_I\_NL. We view nonlabor income as a proxy for wealth, expecting individuals with high nonlabor income to be less likely than other reservists to stay in the reserves until retirement. And we expect nonlabor income to be more important for individuals closer to retirement. Nonlabor income has the expected negative sign for both groups in our model and is more important for individuals with 14 or more years credited towards retirement. However, the coefficients are extremely small in both cases and not statistically significant.

### **Conclusions and Policy Implications**

The results of this paper suggest that the intentions of reservists can be used to influence their reenlistment behavior. Retention intention decisions can be modeled by using binomial logit procedures, and the explanatory variables provide valuable information about the extent to which economic factors, demographics, and institutional characteristics of the reserves affect the decision to reenlist. Moreover, intentions and behavior seem strongly correlated, which is a necessary condition for using information on intentions to influence behavior.

One of the more important contributions of the model used to explain retention intention decisions in this paper is that it includes three key economic variables—reserve wages, civilian wages, and alternative wages in a civilian moonlighting job. Other researchers have developed similar models, but none has included a measure of the opportunity cost implied by the wage that a reservist could earn in a civilian moonlighting job. Without this wage rate, a moonlighting model would be misspecified, and the results would be suspect as variables in the model could be influenced by the omitted variable.

However, as Hogan and Villa have pointed out, the response rate in the 1986 RCS was about 65 percent and may have been biased toward individuals who intended to reenlist. This potential bias in the sample would dictate caution in using the retention intention model presented in this paper, since the results may not apply to a more representative group of reservists.

Potential bias in the model could be tested by reestimating it with current information. The 1991 RCCDPS and the 1991 RCS could be used in conjunction with a May 1991 Dual Job Holders Supplement to the CPS to duplicate the work in this paper. The 1991 RCS data may be more complete than earlier data, which would solve the problem of working with a possibly unrepresentative sample of reservists. In addition, the 1991 RCCDPS data include information on reserve retirement points that could be used to determine the extent to which expected Reserve retirement income influences the reenlistment decision. This additional information would substantially enhance the current model.

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**APPENDIX A**  
**SUMMARY OF EMPIRICAL LITERATURE**



## Summary of Empirical Literature

The following tables summarize the empirical literature on the moonlighting model and reserve enlistment, attrition, and reenlistment. An asterisk (\*) marks the variables in the estimated equations that are significant at the 5 percent level or higher.

**Table A1**

Paper/data set	Dependent variable	Explanatory variables	Major results	Econometric technique
Burright, Grissmer & Doering (1982)	Reenlistment	Annual net drill and camp pay	The effect of pay raises on reservists was	OLS
		Net reserve time	overestimated in previous studies. Demographic and other factors significantly contribute to the reenlistment decision.	
1978 Reenlistment Bonus Test Survey		Pay grade E3 or below		
	(+)	Pay grade E5		
	(+)*	Pay grade E6		
	(+)*	Pay grade E7 or above		
	(-)*	National Guard		
	(-)*	Combat job		
	(-)*	Years of service		
	(-)*	Draft motivation		
	(+)*	Prior reenlistment		
	(+)	Free time		
	(-)*	Civilian hourly wage		
	(-)*	Availability of paid overtime		
	(-)*	Must use vacation		
	(-)*	Employer's attitude		

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Table A1

Paper/data set	Dependent variable	Explanatory variables	Major results	Econometric technique
		(-) Federal government employment		
		(+) State/local government employment		
		(+) Middle sized firm employment		
		(+) Small firm employment		
		(+) Self-employed		
		(-) Spouse's annual earnings		
		(+) Female		
		(+)* Black		
		(+)* Age		
		(-) Married		
		(+)* Number in household		
		(+)* Not high school graduate		
		(-)* College graduate		
		(+) Middle sized urban area		
		(-) Small urban area		
		(-) Rural area		
		(+) Suburban area		
		(-) 1978/77 Local inflation factor		

Table A2

Paper/data set	Dependent variable	Explanatory variables			Major results	Econometric technique
		National Guard	Army Reserve			
GAO (1991)	Attrition	(+)	(-)*	Reserve bonus	Job conflicts and dissatisfaction with training and enlistment terms significantly contribute to attrition	Logit
1986 Reserve Component Survey		(+)*	(+)*	Lost opportunity for overtime on civilian job		
		(+)*	(+)*	Job mismatch		
		(-)*	(-)*	White collar		
		(+)*	(+)*	Unemployment rate		
		(+)*	(-)	New England states		
		(+)*	(-)	Middle Atlantic states		
		(+)	(+)	East North Central states		
		(-)*	(-)*	West North Central states		
		(-)*	(-)*	South Atlantic states		
		(+)*	(+)*	West South Central states		
		(-)	(+)*	Mountain states		
		(-)	(+)	Pacific states		
		(-)	(-)	Prior active service		
		(-)	(-)*	Nonprior service		
		(+)	(+)*	Years of education		
		(-)*	(-)	Labor force experience		
		(+)*	(-)	Female		
		(+)	(+)	White		
		(-)	(-)	Married		

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Table A2

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
		National Guard	Army Reserve		
		(-)*	(-)	Grade	
		(-)	(-)*	Reserve annual income	
		(+)*	(+)	Average weekly civilian income	
		(+)	(+)*	Average weekly civilian hours worked	

Table A3

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
		(+)*	(+)*		
Gorman & Thomas (1991)	Motivation for enlistment	(+)*	High school student, no transfer plans	Desire for self improvement significantly and positively influenced enlistment	Generalized Logit
		(+)*	High school student, transfer plans		
		(+)*	High school graduate w/o post-secondary education & dropouts, no transfer plans		
		(+)*	High school graduate w/o post-secondary education & dropouts, transfer plans		
		(+)*	Post-secondary education, no transfer plans		
		(+)*	Some post-secondary education, transfer plans		

Table A4

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
Grissmer & Kirby (1985)	Attrition	(+)	(-)*	Black	Multinomial logit
		(+)*	(+)*	Female	
		(+)*	(+)*	High school nongraduate	
		(-)*	(-)*	Less than 18 years old	
		(+)*	(+)*	21 years or older	
		(+)*	(-)	Single, with dependents	
		(+)*	(-)	Married, no dependents	
		(+)	(+)	Married, with dependents	
		(-)*	(-)*	AFQT Category I	
		(-)*	(-)*	AFQT Category II	
		(+)*	(+)*	AFQT Category IV	
		(-)	(+)*	Black, high school nongraduate	
		(-)	(+)	Black, less than 18 years old	
		(-)	(-)	Black, 21 years or older	
		(-)	(-)*	Female, high school nongraduate	
Reserve Components Common Personnel Data System (1980 Cohort)		(+)	(+)*	Female, less than 18 years old	
		(-)*	(-)	Female, 21 years or older	

Table A5

Paper/data set	Dependent variable	Explanatory variables			Major results	Econometric technique
		0-6 Years of service	7-9 Years of service	10-11 Years of service		
Hogan and Villa (1991)	Reenlistment	(+)	(+)	(-)*	Attrition was influenced by different factors for groups with different years of service.	Logit
1986 Reserve Components Survey		(+)*	(+)*	(+)*	Reserve pay	
		(+)*	(+)*	(+)*	Family income	
		(+)*	(+)*	(+)*	Hours of work	
		(-)*	(-)*	(-)*	Average overtime	
1987 Reserve Components Common Personnel Data System		(+)*	(+)*	(+)*	Married	
		(+)*	(+)*	(-)	Dependents	
		(+)*	(+)*	(-)	Army Reserve	
		(+)	(+)	(+)	Fulltime spouse	
		(-)*	(-)*	(-)*	Female	
		(-)*	(-)*	(-)*	Nonwhite	
		(+)*	(+)*	(+)*	Student	
		(-)	(-)	(+)*	Prior service	
		(-)	(-)	(+)	Age	
		(-)	(-)	(-)	End of term of service between 6/86 and 9/86	
		(-)	(-)	(-)*	End of term of service between 9/86 and 3/87	
		(+)	(+)	(+)*	End of term of service between 7/86 and 9/87	

Table A6

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
		Nonprior service personnel	Prior service personnel		
McNaught (1981)	Labor supply	(+)*	(+)*	Nonprior service personnel are more sensitive to high rates of unemployment.	OLS
1108 Personnel Data (1st Quarter 1973 through 2nd Quarter 1976)		(-)	(+)*	Unemployment rate	
		(-)	(+)	Quarter 1	
		(-)	(-)	Quarter 2	
		(-)	(-)*	Quarter 3	
		(+)	(+)*	Time trend	
Reserve Components Common Personnel Data System (3rd Quarter 1976 through 1st Quarter 1979)					

Table A7

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
		Officers	Enlistees		
Lakhani and Fugita (1992)	Retention Intention	(-)	(+)*	Reserve wage	OLS
		(-)	(+)	Civilian wage	
1986 Reserve		(-)	(-)	Nonlabor income	
Component Survey		(-)	(-)*	Spouse's earnings	
		(+)	(+)*	Spouse's attitude	
				Strong support for attitudinal variables in moonlighting and compensated leisure models; stronger support for compensated leisure	

Table A8

Paper/data set	Dependent variable	Explanatory variables		Major results	Econometric technique
Rostker (1974)	Reserve enlistment	(+)*	Population	Wage increases are a costly way of increasing enlistment	OLS
		(+)*	Present value of civilian income		
		(+)*	Present value of reserve income		
		(+)*	Age cohort 17 - 17.5		
		(+)*	Age cohort 17.5 - 18		
		(+)*	Age cohort 18 - 18.5		
		(+)*	Age cohort 18.5 - 19		
		(+)*	Age cohort 19 - 19.5		
		(-)*	Region = New England		
		(+)	Region = South Atlantic		
		(-)	Region = East South Central		
		(+)*	Region = West South Central		



Table A9

Paper/data set	Dependent variable	Exp. variables	Major results	Econometric technique
Rostker & Shishko (1973) PSID	Moonlighting labor supply	(-) Age (+)* Family size (+)* Cost of housing (-)* Primary wage rate (+)* Secondary wage rate (-)* Hours on primary job Family income: (+) Asset income (-) Transfer payments (-) Labor income less moonlighting income	Support for the moonlighting model: the labor supply for a 2nd job is increasing in wages for the 2nd job.	Tobit

## **APPENDIX B**

### **DATA AND VARIABLES USED TO ESTIMATE THE REENLISTMENT INTENTION MODEL**

#### ***Data***

To estimate the reenlistment intention decision model for enlisted personnel, data from the Reserve Component Common Personnel Data System (RCCPDS) were matched to data from the 1986 Reserve Components Survey (RCS) for Army Selected Reserve enlisted personnel. The RCCPDS is an automated personnel data system maintained by the Defense Manpower Data Center (DMDC). It contains information collected from individuals or maintained about them, primarily for record-keeping purposes. Data contained in RCCPDS Master Files for 1985 through 1991 were used or examined in this study. DMDC periodically collects information from members of all reserve components through the RCS. RCS data include information on military background, military plans, military training, benefits and programs, military life, individual and family characteristics, civilian work, and family resources.

The 35,055 individuals in the Army Selected Reserve (Army Reserve and Army National Guard) who responded to the 1986 RCS included 6,011 officers and 29,044 enlisted personnel. After subsetting this data to include only records for enlisted personnel with an expiration of term of service (ETS) between the time they took the survey December 1987, the number of records was reduced to 9,559. The sample was restricted further to exclude observations with missing data for any of the variables included in the model, reducing the sample to 5,473 observations. Limiting the sample to males 18 through 55 years old who are employed full time in the private or government sector reduced the sample to 2,427. Further restrictions to eliminate individuals with outlying values on civilian wage, civilian earnings, reserve earnings, or inconsistent responses to questions regarding intention to reenlist and intention to stay until retirement produced the data set used to estimate the equation of 1,747 responses.

#### ***Variable Definition and Construction***

WAGE2 is an estimated alternative civilian second job hourly wage rate for reservists. See Appendix C for a complete discussion of the method used to calculate alternative second job wage rates.

CIV\_WAGE is the civilian primary job hourly wage rate. Civilian hourly wage rate was calculated by dividing 1985 usual weekly earnings on main civilian job before taxes and deductions (RCS Q104) by 1985 usual hours worked per week on main civilian job (RCS Q100). Outlying values of civilian wage rate, e.g., less than \$3.35 and greater than \$40.00 per hour, were screened from the data.

RES\_WAGE is the reserve hourly wage rate. Reserve hourly wage rate was calculated by dividing 1985 reserve earnings, as reported in Q36 of RCS, by estimated 1985 reserve hours. Reserve hours were calculated according to the following steps. Eight hours were allowed for each day of active duty training (ACDUTRA) reported in RCS question Q32, resulting in total active duty hours. Active duty pay was computed as the number of days of ACDUTRA times one thirtieth of monthly basic pay which was based on the pay grade reported in RCS Q4. Drill pay was calculated as reserve earnings (RCS Q36) minus active duty pay. The number of drills was then calculated as drill income divided by one thirtieth of monthly basic pay amount. Total drill hours were computed as 4 times the number of drills. Estimated reserve hours for 1985 were set equal to total active duty hours plus total drill hours. Outlying values of reserve earnings i.e., less than \$1,065 and greater than \$7,000, were screened from the data before calculating RES\_WAGE.

RD2\_I\_RW is the interaction between RES\_WAGE and a dummy variable equal to 1 for individuals with 13 through 19 good years credited towards Reserve retirement. Good years credited towards retirement is reported in RCS QO22E21B. Reserve wage for this group of individuals is RES\_WAGE plus RD2\_I\_RW.

Similarly, RD3\_I\_RW represents the interaction between RES\_WAGE and a dummy variable equal to 1 for individuals with 20 or more years credited towards reserve retirement, i.e., individuals who are already vested in their reserve retirement. Reserve wage for this group of individuals is RES\_WAGE plus RD3\_I\_RW.

WKHRS\_D2 is a dummy variable equal to 1 if the individuals works more than 45 hours per week on his primary job. Primary job usual weekly hours are reported in RCS Q100.

UNEMP85 is the 1985 state unemployment rate for the state in which the reservist's unit is located. Unemployment rate information from the Bureau of Labor Statistics Survey of Employment and Earnings was matched to unit state information extracted from the December 1985 RCCPDS Master file and matched and merged to the reservist's RCS record.

PS\_ACTIV is a dummy variable set equal to 1 if the reservist had prior active duty service. Active duty service is represented by a value of 1 on PRITYP1 or PRITYP2, variables created by DMDC based on the response to RCS Q3 and RCS Q10 regarding prior active duty service in the Army or a different service, respectively.

ED3 is a dummy variable equal to 1 if the reservist has completed 16 or more years of education. Completed years of education are reported in RCS Q69.

MOS\_PER is the percentage of time spent working in the reservist's primary MOS. The percentage is based on reported answers to RCS Q28, where except for the top category (100%), all responses were recoded to the midpoint of the allowed range.

SPOU\_WK1 is a dummy variable equal to 1 when a working spouse is present as indicated by the response to SLF1, a variable created by DMDC from the answers to the multiple parts of RCS Q112. The presence of a nonworking spouse or the absence of a spouse are both coded to 0.

NLBRINC is nonlabor family income as reported in RCS Q116. Nonlabor income includes income from any of the following sources: interest and dividends on savings, stocks, bonds, and other investments; alimony, child support, and any other regular income; unemployment and worker's compensation benefits; government pensions; private and union pension; veterans benefits and pensions; income from the GI Bill; Social Security or railroad Retirement Board pension; Supplemental Security Income; public welfare/assistance; WIC benefits; government food stamps; and other income (not wages or salaries).

CURRMARR is a dummy variable equal to 1 when the reservist is married for the first time or remarried, i.e., when RCS Q75 is equal to 1 or 2.

## **APPENDIX C**

### **ESTIMATION OF ALTERNATIVE CIVILIAN SECOND JOB WAGES**

#### ***Data***

To estimate alternative civilian moonlighting wages for Army reservists and Army National Guards, data were obtained from the May 1985 Current Population Survey (CPS) and Dual Job Holders Supplement and the March 1985 CPS. Of the 63,009 individuals that responded to the May 1985 Dual Job Holders Supplement, 3,750 held a second job. Due to CPS interviewing procedures, primary job earnings and hours are collected for only one fourth of the sample. Limiting the analysis to individuals with earnings data would reduce the available number of observations to 13,459, of which 765 are dual job holders.

Using criteria specified by the Bureau of Labor Statistics (BLS), annual earnings and hours information were extracted from the March 1985 CPS and matched to the records for respondents to the May 1985 survey. The matching procedure more than doubled the available sample to 29,258 observations and increased the number of dual job holders to 1,560.

Several restrictions were imposed on this expanded sample in order to obtain a representative sample for the analysis. Since the ultimate purpose of this research is to shed light on the policy options that can be used to affect Army Reserve and Army National Guard reenlistment intentions, our final sample is limited to observations for individuals with characteristics that more closely resemble the profile of the reservists and guardsmen for whom data are available; namely, males between the ages of 18 and 55.

Moonlighting theory is most appropriately applied to full time workers who are not self-employed and are not working as unpaid family workers. Consequently, the final sample was also limited to individuals who are employed 35 hours or more per week by private employers or federal, state and local governments. Additional restrictions were imposed on the sample to eliminate outliers from the data. These restrictions required primary and second job wage rates of at least \$3.35 per hour (minimum wage in 1985), second job hours of at least five per week, and combined primary and second job hours of no more than 70 hours per week. Combined, the restrictions resulted in a final sample size of 5,944, including 134 are dual job holders.

#### ***Empirical Results***

The moonlighting model developed for reservists and guardsmen includes a civilian wage rate for secondary job employment in the civilian sector. This wage rate represents the opportunity cost of reenlisting in the Army Reserve or the Army

National Guard rather than taking a second civilian job. Holding all other factors constant, the higher civilian wage, the less likely reservists should be to reenlist.

To incorporate the civilian alternative wage rate into our model, we considered two possibilities: estimating the alternative civilian second job wage rate or developing a proxy for it. Using CPS data, we estimated a second job wage equation for civilian dual job holders using Heckman's Two-Step estimation procedure<sup>24</sup> that incorporates a correction for sample selection bias. This wage equation is used to estimate the reservation wage of reservists in civilian moonlighting activities.

Table C1 presents the wage equation estimated using a loglinear model with the log of the civilian second job wage rate as the dependent variable on the sample of 134 second job holders. Explanatory variables include number of hours worked on the second job (LOG2HOUR), number of hours worked on the primary job (LOG1HOUR) and primary job wage rate (LOG1WAGE). Dummy variables for education, age, marital status, and area of residence also are included in the model. Education categories are a high school education or less (ED1), some college (ED2), and a college degreed reference group (EDR). The four age groups are 18-24 (AGE1), 25-34 (AGE2) and 35-44 years of age (AGE3), and the reference group of individuals 45-55 years of age (AGER). Marital status dummies are included for a reference group of individuals who are not married, individuals who are currently married (CURRMAR), and individuals who are previously married (PREVMAR).

**Table C1**

***Estimated Civilian Second Job Wage Equation***

Variable	Coefficient	Standard error	t-ratio
CONSTANT	2.274	1.868	1.217
LOG2HOUR <sup>a</sup>	-0.323	0.095	-3.390
LOG1HOUR	-0.132	0.431	-0.307
LOG1WAGE <sup>b</sup>	0.264	0.129	2.039
ED1 <sup>c</sup>	-0.259	0.144	-1.801
ED2	-0.217	0.139	-1.561
AGE1	0.163	0.265	0.616
AGE2	-0.130	0.172	-0.754
AGE3	0.097	0.173	0.615

<sup>24</sup> Heckman, J. J. (1979, January). Sample Selection Bias As A Specification Error, *Econometrica*, 47(1), 153-161.

**Table C1*****Estimated Civilian Second Job Wage Equation***

Variable	Coefficient	Standard error	t-ratio
CURRMAR <sup>c</sup>	0.355	0.208	1.706
PREVMAR	0.307	0.561	0.547
LAMBDA	0.172	0.194	0.889

*Note:* Sample = 134

<sup>a</sup> Significant at the 0.01 Level

<sup>b</sup> Significant at the 0.05 Level

<sup>c</sup> Significant at the 0.10 Level

The signs on the variables are intuitively appealing. Although most of the variables do not have statistically significant coefficients, the equation is indicative of the central tendencies of the impact of the explanatory variables. The estimated wage equation for second job wage rates has an R-squared of 0.30, and an adjusted R-squared of 0.23, which is typical of cross-sectional analysis, and most variables have the correct sign. The results indicate that the second job wage rate is negatively related to hours worked on either job and positively related to primary job wages. The negative relationships between second job wage rates and hours worked suggest that low wage earners are likely to work more hours on a second job because they need the income, and workers who put in long hours on their primary job have fewer second job opportunities among which they can choose. The positive relationship between the two job wage rates reflects the ability of high wage workers to exploit their human capital on second jobs.

The dummy variables for education indicate that wage rates on second jobs are an increasing function of education. Age appears to have an ambiguous effect on second job wage rates as the sign alternates between positive and negative for the three age groups. Married and previously married workers appear to earn more than never married workers.

The civilian second job wage equation was used to estimate alternative second job wages for Army reservists and Army National Guards. The wage equation coefficients were applied to DMDC survey and personnel data from the 1986 Reserve Components Survey (RCS) and the Reserve Components Common Personnel Data System (RCCPDS) to predict the reservists alternative civilian second job wage. The RCS contains information on military background, military plans, military training and program participation, individual and family demographic characteristics, civilian employer and position, economic resources, and attitudes about military life. The RCCPDS is a personnel data system containing information about demographic

characteristics, military training, pay grade, retirement points, mental ability and reenlistment eligibility. RCS records for Army reservists and Army National Guardsmen were matched to records in the December 1985, December 1987, September 1990, and September 1991 RCCPDS Master Files.



## APPENDIX D

### DATA FOR EXAMINATION OF RELATIONSHIP BETWEEN REENLISTMENT INTENTIONS AND REENLISTMENT BEHAVIOR

A file containing 30,405 Reserve Components Common Personnel Data System (RCCPDS) transactions records from January 1986 through December 1987 was obtained from the Defense Manpower Data Center (DMDC) for individuals who responded to the 1986 RCS. Only records with the following transaction type were kept: reenlistment (21), extension (22), loss to civil life (31), loss to active duty (32), death (37), change from enlisted to officer status (38), and other loss (39). All records for officers were eliminated. Records also were dropped for individuals with an expiration of term of service (ETS) after December 1987 and for cases in which transactions date was before the time that an individual responded to the RCS.

From this data set, a file containing all of the transactions for individuals with more than one transaction during the study period was created. A flag was constructed to indicate the kind and sequence of transactions for each individual and a frequency distribution was produced. Each of the transaction combinations was checked for logical consistency within the two year period. Implausible cases, assumed to be due to bad data, were identified with the guidance of DMDC staff. All records for an individual were dropped when any one of the following implausible combinations of transaction type was present: 21-21, 21-21-21, 21-21-31, 21-22-22, 22-22-21, 22-22-22, 22-31-31, 22-39-39, and 31-22-22.

For each valid combination of transaction type, a single transaction record was selected for an individual based on transaction type and order of occurrence of the transaction type. The following criteria were applied:

- the first record with transaction type = 21 was selected;
- if there was no record with 21, then the first record with 22 was selected;
- the remaining records were selected based on the first occurrence of other transactions types in the following order: 32 before 31 before 37 before 38 before 39; and
- all single transactions were included in the subset file.

The final data set contained 7,455 records with one transaction record per individual. Transaction type was recoded to 1 for reenlistment (21) or extension (22) and to 0 otherwise. This recoded variable was cross-tabulated with the intention to reenlist

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•  
variable, used in the retention intention model where the variable was set equal to 1 if the probability of the intention to reenlist was 0.60 or more and 0 otherwise.