Conclusions

The U.S. Army could face serious recruiting problems throughout the remainder of the 1980's. The two primary causes of this shortfall would be economic gains and the continued decline in the population of eligible males. The model demonstrates that unemployment rates are an important determinant of peacetime enlistment, in contrast with many previous studies, and that military compensation relative to civilian earnings is of paramount importance to potential recruits. The recruitment shortfall can be reduced if appropriate manpower management policies are implemented. The number of recruiters is also significant, as are national advertising expenditures.

The model appears to fit the data well over the entire period, while the one-period-ahead forecasts for the four quarters of 1984 differ from actual contracts by between 1.5 and 3.0 percent. Of course, the forecasts are expected to be less accurate as the projections approach 1990, because they depend upon the state of the economy as well as military personnel policy. □

———*FOOTNOTES*———

[1] The characteristics of the Armed Forces are discussed in Carol Boyd Leon, "Working for Uncle Sam: a look at members of the armed forces," *Monthly Labor Review*, July 1984, pp. 3–9.

[2] *Projections of the Population of the United States, by Age, Sex, and Race: 1983 to 2080, Current Population Reports*, Series P–25, No. 952 (U.S. Bureau of the Census, 1984).

[3] A one-period model is described in Anthony C. Fisher, "The Cost of the Draft and the Cost of Ending the Draft," *American Economic Review*, June 1969, pp. 239–54.

[4] In a life-cycle framework the model becomes more complex. The impact of the enlistment decision on future income must be considered. Training and educational opportunities may have little effect on current wages, but are reflected in future income. The life-cycle model thus provides a more realistic approach to the enlistment problem. See David K. Horne, *An Economic Analysis of Army Enlistment Supply*, Technical Report 85–4 (Alexandria, VA, Army Research Institute, 1985).

[5] Examples include Lee D. Olvey, James R. Golden, and Robert C. Kelley, *The Economics of National Security* (Wayne, NJ, Avery Publishing Group, 1984); Richard L. Fernandez, *Forecasting Enlisted Supply: Projections for 1979–1990* (Santa Monica, CA, The Rand Corp., 1979); and Colin Ash, Bernard Udis, and Robert F. McNown, "A Military Personnel Supply Model and Its Forecasts," *American Economic Review*, March 1983, pp. 145–55. For a critique of Ash and others, see Charles Dale and Curtis Gilroy, "Enlistments in the All-Volunteer Force: Note," *American Economic Review*, June 1985.

[6] Insignificant unemployment effects are found in Lawrence Goldberg, *Enlisted Supply: Past, Present, and Future* (Alexandria, VA, Center for Naval Analyses, 1982), as well as in Ash and others, "A Military Personnel Supply Model," and Fernandez, *Forecasting Enlisted Supply*.

[7] See Charles Dale and Curtis L. Gilroy, "The Effects of the Business Cycle on the Size and Composition of the U.S. Army," *Atlantic Economic Journal*, March 1983, pp. 45–53.

[8] Problems with the teen wage series are discussed in Charles Brown, *Military Enlistments: What Can We Learn From Geographic Variation?* Working Paper 1261 (Cambridge, MA, National Bureau of Economic Research, Inc., January 1984). An extract appears in the *American Economic Review*, March 1985, pp. 228–34.

[9] For example, Dale and Gilroy, "The Effects," use a 2-month lead on pay to obtain the correct sign.

[10] The advertising expenditure data, as well as the contract and recruiting data, were provided by the U.S. Army Recruiting Command.

[11] Simultaneity is a potentially serious problem, specifically between the male population statistic in the denominator and independent variables such as civilian earnings and unemployment. However, the time horizon covered in the estimation (7 years) is relatively short, and the variation in the size of the male population during the period is small. This simultaneity is likely to be more of a problem in the long run if the decline in the male population age 16 to 21 begins to exert downward pressure on unemployment and upward pressure on age-specific wages. For short-run prediction and modeling, one would expect the effect of changes in the cohort size to have a small effect on age-specific unemployment and wages. The wage effect is estimated by Hong W. Tan and Michael P. Ward, *Forecasting the Wages of Young Men: The Effects of Cohort Size* (Santa Monica, CA, The Rand Corp., 1984).

[12] The Almon polynomial technique may be briefly described as follows: If the current value of the dependent variable, y_t, depends upon both current and past values of an independent variable x, the distributed-lag regression model can be written:

$$y_t = \beta_0 x_t + \beta_1 x_{t-1} + \cdots + \beta_k x_{t-k} - u_t$$

Least squares estimation of the model loses k degrees of freedom, and the x's exhibit multicollinearity. Some structure can be imposed on the β's, such as a quadratic polynomial where $\beta_i = \alpha_0 + \alpha_1 i + \alpha_2 i^2$. Substituting for the β's, the regression model is $y_t = \alpha_0 z_{0t} + \alpha_1 z_{1t} + \alpha_2 z_{2t} + u_t$, where $z_{0t} = \Sigma_{i=0}^{k} x_{t-i}$, $z_{1t} = \Sigma_{i=0}^{k} i x_{t-i}$, and $z_{2t} = \Sigma_{i=0}^{k} i x_{t-1}^2$. The y_t is regressed on the constructed z variables. The estimated α's are then used to derive the β's. For more information, see G.S. Maddala, *Econometrics* (London, McGraw–Hill International Book Co., 1977), pp. 355–59.

[13] This is suggested by James R. Hosek, Richard L. Fernandez, and David W. Grissmer, *Active Enlisted Supply: Prospects and Policy Options*, mimeo (Santa Monica, CA, The Rand Corp., 1984).

[14] Henri Theil, *Applied Economic Forecasting* (Amsterdam, North Holland Publishing Co., 1966).

[15] The impact of the recruiting of other services is significant in the pooled time-series model in Thomas V. Daula and D. Alton Smith, "Estimating Enlistment Models for the U.S. Army," in Ronald G. Ehrenberg, ed., *Research in Labor Economics*, vol. 7 (Greenwich, CT, JAI Press Inc., forthcoming 1985).

Establishment survey incorporates March 1984 employment benchmarks

JOHN B. FARRELL

With the release of data for May 1985, the Bureau of Labor Statistics introduced its annual revision of national estimates of employment, hours, and earnings from the monthly survey of establishments. These revisions are based on March 1984 benchmark employment counts, the most recent available. As is the usual practice with the introduction of updated benchmarks, the Bureau has also revised the seasonally adjusted series for the previous 5-year period and has introduced new seasonal adjustment factors.

Adjustment procedure. Monthly employment estimates from the establishment survey are based on information provided by a sample of establishments. Each year, the "bench-

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marking'' procedure adjusts these estimates to accord with independently derived, comprehensive counts of employment. These comprehensive counts are obtained primarily from summations of the mandatory unemployment insurance (UI) reports filed by employers with their State employment security agencies. For the 2 percent of employment not covered by unemployment insurance, such as employees of religious and charitable organizations, other sources are used to derive the benchmark. Because estimates of hours and earnings are weighted by employment estimates, they are also subject to change as a result of benchmarking.

The comprehensive benchmark employment counts are compared with sample-based estimates in table 1. The March 1984 benchmark for total nonagricultural employment—92.6 million—was 353,000 above the corresponding sample-based estimate, a difference of 0.4 percent. Note that a downward revision of 172,000 in manufacturing was more than offset by upward revisions of 262,000 in retail trade and 120,000 in construction.

The current revision affects unadjusted series from April 1983 (the month following the previous benchmark) forward to the current month's estimate. Revision of the seasonal adjustment factors affects seasonally adjusted series from January 1980 forward. Unadjusted series from April 1984 forward and seasonally adjusted series from January 1981 forward are subject to revision in future benchmark adjustments.

The benchmark procedure serves as a quality control process by providing a more accurate measure of employment levels and thus a better perspective on trends. Normally, new benchmarks are determined for March of each year for the most detailed industrial classification levels at which estimates are made.

The time required for compiling UI summaries and processing a benchmark is generally about 15 months. Employment estimates for the period between benchmarks, in this case April 1983 through February 1984, usually are adjusted by applying a ratio of the March 1984 difference between the benchmark and the estimate. Approximately 1/12 of the March 1984 difference is added to the April 1983 estimate, 2/12 to the May 1983 estimate, and so forth, so that the difference is ''wedged'' over the 12-month period from the preceding benchmark to the new one. Summaries of UI data may also be substituted for the ''wedged'' results, if it is apparent that the UI employment data more accurately reflect the trend of the series. Data subsequent to the new benchmark, in this case from April 1984 forward, usually are revised by linking the sample trend for each successive month to the new March 1984 levels.

Table 1. Difference between nonagricultural employment benchmarks and estimates, by industry, March 1984

[Numbers in thousands]

Industry	Benchmark	Estimate	Difference	
			Number	Percent
Total nonagricultural employment	92,587	92,234	353	0.4
Total private	76,371	76,030	341	.4
Mining	952	967	−15	−1.6
Construction	3,914	3,794	120	3.1
Manufacturing	19,151	19,323	−172	−.9
Transportation and public utilities	5,063	5,055	8	.2
Wholesale trade	5,447	5,421	26	.5
Retail trade	15,891	15,629	262	1.6
Finance, insurance, and real estate	5,588	5,565	23	.4
Services	20,365	20,276	89	.4
Government	16,216	16,204	12	.1
Federal	2,779	2,756	23	.8
State	3,793	3,785	8	.2
Local	9,644	9,662	−18	−.2

Benchmarks for BLS series on women workers, production or nonsupervisory workers, hours, and earnings are not available. The women and production or nonsupervisory worker series are revised by applying ratios derived from the sample to the revised all-employee figures. Revisions at the basic cell level are then added to become the summary level revisions.

Average weekly hours and average hourly earnings are estimated directly from reported figures at the cell level and are not revised. However, broader industry groupings of hours and earnings series require a weighting mechanism to yield meaningful averages. The production or nonsupervisory worker employment estimates for the basic cells are used as weights for the hours and earnings estimates for broader industry groupings. Adjustments of the all-employee estimates to new benchmarks may alter the weights, which in turn may change the estimates for hours and earnings of production and nonsupervisory workers at higher levels of aggregation.

Seasonal adjustment. Most economic time series display a regular seasonal movement, which can be estimated on the basis of experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the underlying cyclical and other nonseasonal movements in the series.

Each year, employment, hours, and earnings data from the new benchmark are incorporated into the calculation of updated seasonal adjustment factors. The Bureau uses the X–11 ARIMA (Auto-Regressive Integrated Moving Average) seasonal adjustment methodology, developed by Statistics Canada.[1] X–11 ARIMA is an adaption of the standard ratio-to-moving average method, which provides for ''moving'' adjustment factors to take account of changing seasonal patterns. The ARIMA method is used to project the unadjusted data forward for 1 year prior to seasonally adjusting the series, so as to lessen the need for revisions of historical data in future seasonal adjustments. (ARIMA projections are not used in series where the projections do not meet test requirements.)

Seasonal adjustment factors are recalculated annually, and updated factors are published in *Employment and Earn-*

ings in conjunction with the new benchmark. Seasonally adjusted data are not published for four series characterized by small seasonal components relative to their irregular components.[2] However, these series are used in aggregating to broader seasonally adjusted levels.

Publication plans. Revised estimates of employment, hours, and earnings appeared in the June issue of *Employment and Earnings*, along with a more complete discussion of the benchmarking procedure. Estimates reflecting the new benchmark also appeared in the Current Labor Statistics section of the *Monthly Labor Review* beginning with the July issue.

All historical data revised in this benchmark appear in *Supplement to Employment and Earnings* issued in July 1985. The supplement contains revised seasonally adjusted data for January 1980 through February 1985 and revised unadjusted data for April 1983 through February 1985. Data for earlier periods have not been revised and can be found in *Employment, Hours, and Earnings, United States, 1909–84*, Bulletin 1312–12 (Bureau of Labor Statistics, April 1985). All publications may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

FOOTNOTES

[1] A detailed description of the procedure appears in Estella Bee Dagum, *The X–11 ARIMA Seasonal Adjustment Method*, Catalogue No. 12–564E (Statistics Canada, February 1980).

[2] The four series are average hourly earnings for mining, and average weekly hours for mining, tobacco manufactures, and rubber and miscellaneous plastics products.

A note on communications

The *Monthly Labor Review* welcomes communications that supplement, challenge, or expand on research published in its pages. To be considered for publication, communications should be factual and analytical, not polemical in tone. Communications should be addressed to the Editor-in-Chief, *Monthly Labor Review*, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.