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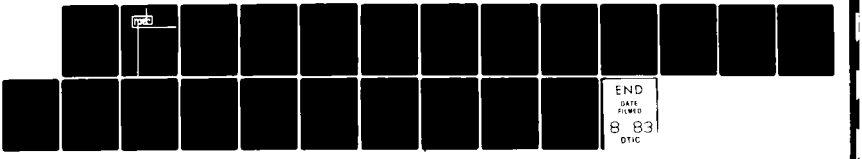

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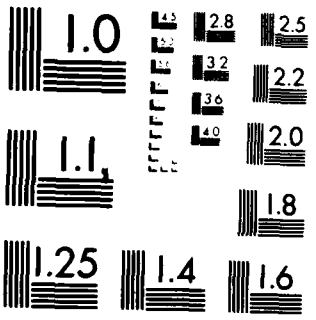

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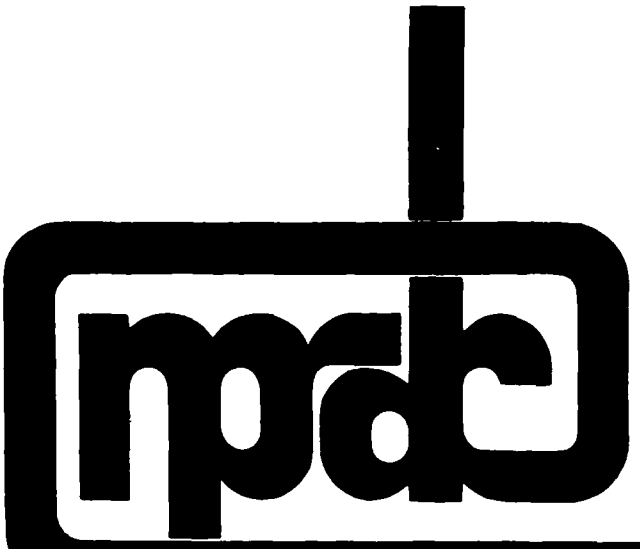

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MANPOWER FORECASTING: PROBLEMS IN DETERMINING THE LONG-RANGE SUPPLY OF MILITARY MANPOWER

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MANPOWER FORECASTING: PROBLEMS IN DETERMINING THE LONG-RANGE SUPPLY OF MILITARY MANPOWER

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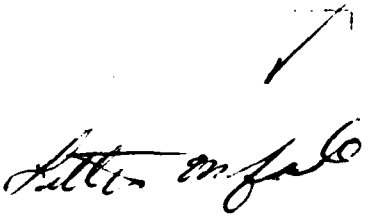

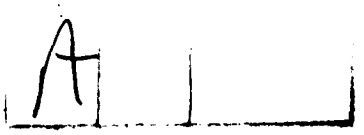

Navy Personnel Research and Development Center
San Diego, California 92152

FOREWORD

This report contains the results of a preliminary investigation in support of Advanced Development Project Z0109-PN, Requirements Development System, under the sponsorship of the Deputy Chief of Naval Operations (Manpower). Specifically, the intent is to develop background information necessary to proceed with Subproject Z0109-PN.02, Long Range Manpower Supply Forecasting, which focuses on many of the questions raised here.

J. J. CLARKIN
Commanding Officer

SUMMARY

Problem

Accurate forecasting of the national pool of young men in the 1990's has become an area of concern within the Department of Defense, particularly since Bureau of the Census projections have indicated that the supply from which the military must attract its enlistees will decline until the 1990's, at which time it will be 15 to 25 percent below the current levels, and then will level off. Because of the impact these projections would have on manpower policies and planning, a number of questions arise as to their accuracy and implications.

Purpose

The purposes of this effort were (1) to assess the validity of the underlying assumptions related to fertility in Census Bureau projections of the national manpower pool by evaluating existing evidence as to the determinants of fertility changes and (2) to identify other research problem areas.

Approach

The literature on the determinants of fertility change was surveyed and results were reported under either economic or sociological approaches. Social variables that appear to be closely related to fertility rates were analyzed. Finally, means for solving other problem areas were identified.

Findings

The economic theories regarding the determinants of fertility generally are not congruent with empirical evidence. The sociological studies have produced a great deal of information, most of which is fragmentary and nonconclusive. However, a range of social variables, such as the level of women's education and their labor force participation rates, appear to be closely related to fertility change.

Conclusion

There is no systematic and general theory to explain how much of the recent variation in fertility rates is due to specific social variables. In the next stage of this study, fertility rate variation will be investigated by analyzing the impact that specific social variables have on these rates.

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INTRODUCTION

Background

Recent Bureau of the Census projections of the U. S. population indicate a downward trend until the early 1990's, at which time the trend begins to turn upward and level out. Figure 1, which illustrates projections made under Survey Series I, II, and III (from Tables 7, 8, and 9 of Bureau of the Census, October 1975), shows that there is substantial uncertainty or variance after 1992; that is, when the generation now being born reaches the age of military eligibility (i.e., from 17 to 21). The variance in the three projections arises from uncertainty over assumed future fertility rates, the most significant component in population change, as well as the most difficult to predict. The other two components of population change, mortality and immigration rates, are held constant in all three series.

It should be noted that the authors of the population projections refuse to call them "forecasts." According to them, a forecast must be accompanied by an indication of its accuracy, ideally in the form of a statistical confidence interval. It is not possible to provide such indications for population projections since the factors influencing population trends (social, economic, and other) are neither perfectly understood nor predictable themselves.

Problem

Accurate forecasting of the national population is of vital concern to the Department of Defense, particularly in view of the advent of the All-Volunteer Forces. If the Bureau of the Census projections shown in Figure 1 prove to be correct, the manpower supply from which the military services must attract their enlistees will decline until the 1990's, at which time it will be roughly 15 to 25 percent below current levels, and then level out.

Because of the impact these projections would have on military manpower policies and planning, the following questions arise in regard to their accuracy and implications:

1. How much confidence can be placed in the assumptions underlying the projections--particularly, the assumption that the deep decline in fertility over the past 15 years will level out by the 1990's? This assumption is perhaps the weakest, but yet the most crucial, for manpower projection.

2. How will the elasticity of the supply of this manpower pool change with regard to compensation? For example, will a 20 percent drop in the size of the national pool require a 50 percent increase in compensation to attract the required number of enlistees?

3. How will the quality of this manpower change, as measured by aptitude and educational attainment? By way of illustration, if ships are designed to be less manpower intensive, will the supply be able to meet higher mental qualifications in more sophisticated hardware systems?

4. How will the proportion of qualified and available military manpower to the total manpower pool change within the next 25 years?

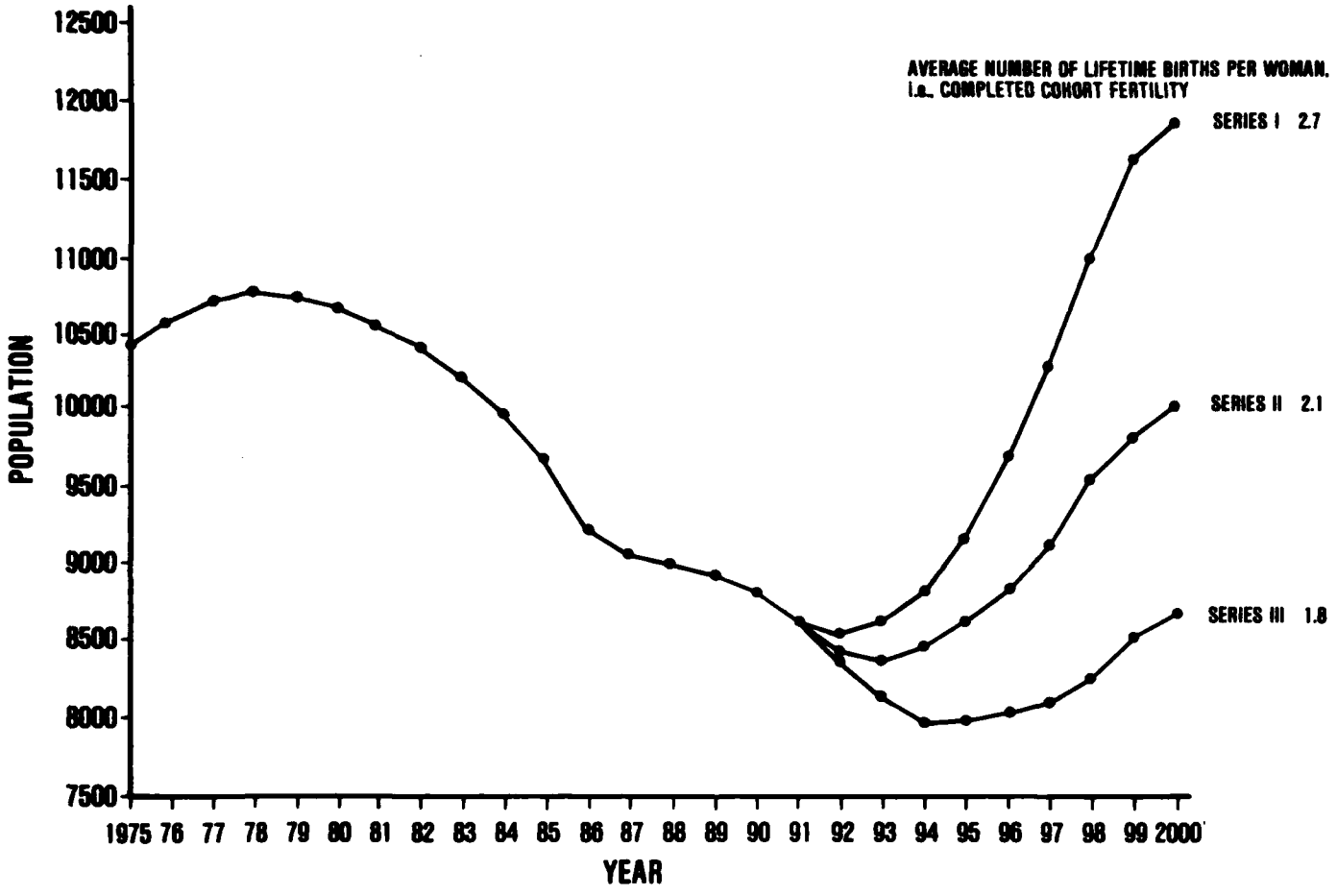

Figure 1. Estimates (in thousands) of U.S. male population age 16 to 21, including armed forces overseas, 1975 to 2000 (from U.S. Bureau of the Census, October 1975, Tables 7-9, pp. 41-118).

Purpose

The primary purpose of this effort was to assess the validity of the underlying assumptions related to fertility in Census Bureau projections by evaluating existing evidence as to the determinants of fertility change. A secondary purpose was to identify areas for further investigation of such determinants as well as for addressing the other questions noted above.

APPROACH

Previous studies conducted on the determinants of fertility rate changes were reviewed, and results reported under major categories: economic or sociological. The difference between these two approaches can be characterized by Duesenberry's quip: "Economics is all about how people make choices. Sociology is all about why they don't have any choices to make" (Duesenberry, 1960). In identifying areas for further investigation, relevant social variables were identified. Finally, research needed for addressing such problems as providing better estimates of the number of qualified military availables (QMAs) in the population pool and the quality of future military manpower was discussed.

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RESULTS

Previous Research on Fertility Determinants

Economic Approaches

Until about 1960, studies of fertility determinants were largely conducted by demographers. Economists tended to feel that the subject was not related to economics, or at least, believed that it was properly outside the scope of economic theory. However, when demographers were unable to predict Western birth rates accurately in the Post-WW II period, Becker (1960) was prompted to write his seminal analysis within a microeconomic framework.

Basically, Becker's theory was that the household or family unit decides to have children in the same way that it decides to acquire a commodity; that is, by balancing a stream of utilities or benefits to be provided over time against a stream of costs, given income and price. Becker applied his theory to the fertility of different income groups in American society. He argued that, since children were not "inferior" goods, people would want more children as their income increased. He explained that the reason demographic data showed that they didn't have more children with higher income was due to a price effect; that is, since the price of children is not constant, the price effect is more important than the income effect because higher income families wanted "higher quality" children. Becker emphasized the connection between income and fertility, which he believed to be positive, under conditions in which birth control knowledge was equalized across income classes. The weakness of Becker's supporting evidence prompted a number of empirical investigations in the 1960's (e.g., Adelman, 1963; Friedlander, 1967; Easterlin, 1968; Cain, Note 1). Results of these studies were mixed; that is, they did not agree as to whether income had a positive or negative effect on fertility or as to the magnitude of this effect.

Mincer (1963) developed a variant of Becker's theory, which contended that the price effect on fertility depends on the value of the mother's time. He argued that the "opportunity cost" of her time, as measured by her wage rate, was negatively related to fertility. The allocation of time between home and market and within the home was previously discussed by Mincer (1962). Subsequently, Becker (1965) provided a formal theory of time allocation, which has heavily influenced models of fertility used in various empirical studies (Schultz, 1969; Phillips, Votey, & Maxwell, 1969; Nerlove & Schultz, 1970; Willis, 1973). Results of these studies supported Mincer's finding that increases in the cost of the wife's time tend to reduce fertility, while the effect of income is more unsettled.

Leibenstein (1974) criticized the approach of Becker and his followers. He argued that the net opportunity cost of a mother's time is not what she would have earned had she been able to work but, rather, what she would have to pay servants, grandparents, or other substitutes to perform child-rearing activities during her absence. Such babysitting costs would be

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approximately the same for an nth child, whether the family is relatively rich or poor. However, since a high income family could better afford the babysitting costs than a low income family, this price effect is unlikely to have significant impact on the income differential between higher and lower income groups. Leibenstein further argued that the "quality" price effect is not likely to critically influence higher income groups to have fewer children, particularly where most educational costs are provided by the state.

Kirk (1960) studied the influence of the business cycle on marriage and birth rates. He found that even though deviations in fertility rate trends seem to move in the same direction as those of economic indicator trends of the business cycle, they have a distinctive character of their own and occur quite independent of economic conditions. Curiously, the surface "waves" of such deviations appear to be much influenced by economic fluctuations, but the underlying "tide" appears to be an independent and surprisingly stable force.

Sociological Approaches

Demographers have been relatively successful in population predictions, at least until after WW II, when fertility trends were reversed. This reversal proved that their predictions of impending negative population growth in the U. S. and Western Europe were premature. Although a great deal was known about the causes of differential fertility, this information was most fragmentary, with the exception of one conception called the "Theory of Demographic Transition" (United Nations Department of Social and Economic Affairs, 1953). This theory posits three stages, which permit an organizing framework for further study.

In Stage I, which corresponds to premodern times when life was mean and death rates were high, only those societies that developed mores and institutions consistent with high birth rates survived. In Stage II, population grew at increased rates since mortality was gradually being reduced through improved public health methods and diets, while fertility remained relatively constant because of the stability of supporting social institutions and mores. In Stage III, which corresponds to modern times, fertility is being influenced by a number of factors:

1. An increase in the level of women's education and resultant changes in their roles and aspirations.

2. An increase in female participation in the nonagricultural labor force and changes in attitude toward childbearing.

3. A continued decline in the infant mortality rate.

4. Declines or changes in traditional religious beliefs that support high fertility norms.

5. Increasing urbinization with its alternative to traditional childbearing behavior patterns.

6. An increase in compulsory education and a decrease in the value and use of child labor.

7. An increase in women's rights and expanded roles outside the home.

8. Limitation of the extended family system.

9. Introduction of better contraceptive methods.

10. The growth of social security systems outside of the extended family.

11. Increases in socioeconomic mobility (Coale, Note 2).

Significantly, this theory does not argue that decreases in fertility are primarily due to the introduction of contraceptive technology, as is commonly believed. Some of the significant reductions in fertility in Western Europe occurred prior to and without the assistance of large-scale dissemination of chemical or mechanical contraceptive methods. Further, population control has been practiced in some form even before the industrial revolution, as evidenced by the fact that European fertility rates during that period were less than 60 percent of maximum biological rates (Hawthorn, 1970).

An interesting alternative approach was developed by Easterlin (1968 and 1973) and empirically validated by Lee (1974). This approach, which became the basis for Series IIR in the latest Census projections, assumes that completed cohort fertility will vary inversely with the size of the birth cohort before leveling off. Since the fluctuations assumed in the lifetime cohort fertility rates (1.87 for 1960 and 1961 and increasing to 2.42 for 1975) are relatively small, they will have only minimum effect of the total population in the next few decades (U. S. Bureau of the Census, October 1975, pp. 30-31).

Another sociological approach has been the various surveys of U. S. birth expectations conducted by the Bureau of the Census (Ryder, 1975). Results of these surveys indicated that the average number of lifetime births expected by women 18 to 24 years old was 2.4 in 1971, 2.3 in 1972 and 1973, and 2.2 in 1974 and 1975 (U. S. Bureau of the Census, 1976). Bumpass and Westoff (1970, pp. 19-29) have demonstrated that, although such birth expectations surveys are subject to error and change, the completed fertility of these young women will probably be within a one-child deviation of their expected rate. However, Blake (1974) has questioned the validity of data obtained from such surveys since they fail to consider findings from other national surveys. For example, these results indicate: (1) a sudden increase in two-child family, (2) a tolerance for the large families of others, (3) an aversion to childlessness and the one-child family although the one-child family is on the increase (U. S. Bureau of the Census, 1976, Table 6), and (4) an inconsistency between respondents' evaluations of the family cycle and childspacing on the one hand and their personal acceptance of the two-child norm on the other.

Another reason for discounting the value of expectation surveys is the very rapid increase in the divorce rate, thus, the percent of singles among the adult population. In 1970, 6.9 percent of all persons between 25 and 54 years old who have ever been married were reported as either divorced (and not remarried) or separated. In 1975, the figure was up to 10.1 percent. Between 1960 and 1975, the unmarried proportion of persons in the 20 to 24 age group (the median age when both men and women enter their first marriage) increased from 28 to 40 percent for women and from 53 to 60 percent for men (U. S. Bureau of the Census, December 1975). While young women who are presently married may intend to have an average of two children in their lifetime, such intentions will change significantly in the event they are divorced.

Areas for Further Investigation

In studying trends in the various social variables that appear to explain much of the decline in fertility, the labor force participation rates of females appeared to have an especially strong inverse correlation with fertility. The relevent data obtained from government reports (Department of Health, Education, and Welfare, 1961 (Table 1E), 1971 (Table I-15), 1976 (Table 4); Department of Labor, 1953-74) is plotted in Figure 2, which shows that the turning point occurred in 1969-1970. The fertility and labor force participation rates for the other childbearing cohorts exhibit similar correlations. The cause of this turning point has not yet been determined.

It may be possible to "explain" the variation in fertility rates by categorizing U. S. women into various age and social (i.e., single, married with children, married without children, divorced and separated, and widowed) groups, and determining the percentage of these age/social groups that decide whether or not to enter the labor force, or, having once entered, to leave the labor force in order to bear children.

The relationship between labor force participation rates and fertility rates is undoubtedly less of a conceptual strain than Becker's "children as a consumer's durable good" theory. Obviously, a woman must leave the labor force for a period of time to bear a child. Thus, to the extent that other reasons for nonparticipation can be isolated, the one dimension should mirror the other. Such an isolation appears to be possible using existing data (Department of Labor, 1975, Table 8). While the relationship between labor force participation rates of wives and their fertility has been established (Cain, 1966; Bowem & Finegan, 1969), the hypothesis that the current decline in fertility is strongly related to the increasing labor force participation of all women (i.e., women that are substituting work for marriage and childrearing) must still be tested. It should be emphasized that, if women's labor force participation rates are a good inverse indicator of fertility, then trends that imply that such participation will continue to rise raises the question as to the feasibility of continuing the All-Volunteer Force without major policy changes.

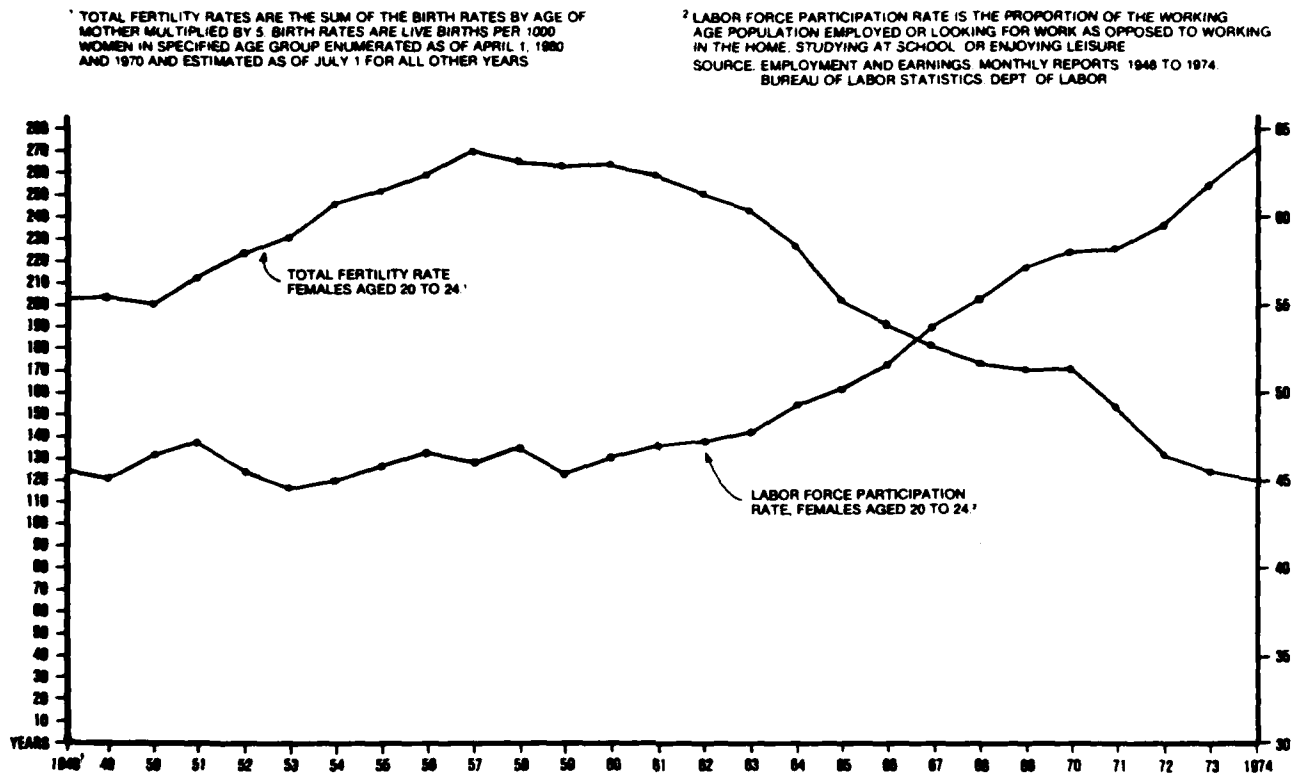

Figure 2. Total fertility rate/labor force participation rates per U.S. females aged 20 to 24, 1948 to 1974 (from U.S. Department of Health, Education, and Welfare, 1961, 1971, and 1974).

Aside from future fertility determinants, a variety of other questions must be answered before the supply of military manpower can be forecast. For example, planners must have some idea of the number or proportion of qualified military availables (QMAs) currently in the total manpower pool, and how this proportion will change as the size of the total pool changes. QMA, a key concept in military manpower planning and recruiting circles, is usually defined as the number or proportion of the manpower pool of a given age group (usually 17 to 21 years old) that can be considered qualified and available for military service. In the past, the number of QMAs has been estimated by subtracting from the 17-to-21 year old population, those of the same age group who were (1) in institutions (prisons or hospitals), (2) unqualified for military service because of physical, mental, or moral reasons, (3) full-time students, adjusted to accommodate first- and second-year dropouts (third- and fourth-year college students are assumed to stay in school), (4) active duty military personnel, and (5) ex military personnel who are not full-time students (Binkin & Johnston, 1973).

Future efforts will evaluate the assumptions underlying this method of estimating QMA. For example, the assumption that full-time students are unavailable for military enlistment, which appears to be particularly weak, will be tested with survey statistics on new recruits compiled by the Armed Forces Entrance and Examination Stations (AFEES) on the four services since mid-1972, the advent of the All-Volunteer Force. Also, projections of enrollment in colleges, apprenticeship programs, trade schools, and federally funded manpower development programs will be reexamined.

Four other studies will be conducted in support of efforts to clarify the concept of "available" manpower. The first is a study of the relationship between differentiable fertility rates by geographic region and the propensity to enlist. For example, rural areas, which generally have higher fertility rates than urban areas, have historically supplied a large proportion of enlistees--especially whites. This phenomenon may be related to the net outmigration of youth from rural to urban areas, which has been decreasing in the past 5 years. If it can be shown that this reduction in outmigration is reflected in the proportion of enlistees with rural backgrounds, manpower planners can use this information in forecasting the geographic sources of future military manpower.

Second, the effect of parental economic status on the propensity to enlist will be tested. To do this, it will be necessary to determine the numbers of enlistees from rural areas coming from low and high income farm families. If a large percentage come from high income families, who have a decreasing birth rate, military recruiters may have to seek a growing proportion of their manpower in urban areas.

The third study will be an attempt to estimate the income elasticity of the supply of military manpower when the size of the total population decreases significantly. Although this subject has been previously researched (Grissmer et al., 1974; Fechter & Grissmer, 1975; Goldberg, 1975), these studies developed their estimates from years when the size of the youth population was stable. It is anticipated that the demand for youth by various sectors can be projected by building on the approach being undertaken by the Wharton School at the University of Pennsylvania and the Urban Institute. This

approach encompasses Wharton's 10-year national economic sector forecasting model and the Urban Institute's labor market model with its planned military labor market segment. Projections made as a result of linking these models should provide indications as to the unemployment rate of youth and their market price. However, it is not clear whether they will be able to determine how much of this unemployment rate is due to jobs being taken over by women, the elderly, or machines.

The final study will address the problem of estimating the quality of future military manpower--as measured by aptitude and educational attainment. Although this study will consider the forecasts made by the National Center for Education Statistics, it will go beyond the simple projection of trends into the future. Rather, it will study and compare the demographic characteristics, family environment, and educational characteristics of those just entering school with those who are now entering the military. Any differentiations noted between these two cohorts will be useful in developing long-range estimates of youth "quality."

CONCLUSIONS

Based on the preliminary investigation of research on fertility determinants, it appears that the economic approaches have not been satisfactory in the sense that the theory on which they are based (Becker, 1960) has not been justified by empirical data. The numerous sociological and demographic approaches, which contend that other, noneconomic factors appear to influence fertility rate changes, have been loosely related under the Theory of Demographic Transition. However, to cite Leibenstein (1974), this theory seems to be a "grand historical generalization buttressed by a variety of ad hoc causal assertions."

A range of social variables, such as the level of women's education and their labor force participation rates, appear to be closely related to fertility change. However, there is no systematic and general theory to explain how much of the recent variation in fertility rates is due to each variable. In the next stage of development, this variation will be investigated through analysis of the impact of social variables on fertility rates.

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