AD-A215 698

R-3659-AF

The Economic Cost of Soviet Military Manpower Requirements

Steven W. Popper

March 1989

A Project AIR FORCE report
prepared for the
United States Air Force

RAND

Approved for public release; distribution unlimited

The research reported here was sponsored by the United States Air Force under Contract F49620-86-C-0008. Further information may be obtained from the Long Range Planning and Doctrine Division, Directorate of Plans, Hq USAF.

Library of Congress Cataloging in Publication Data

Popper, Steven W., 1953-

The economic cost of Soviet military manpower requirements / Steven W. Popper.

p. cm.

"A Project AIR FORCE report prepared for the United States Air Force."

"March 1989."

"R-3659-AF."

Bibliography: p.

ISBN 0-8330-0934-6

1. Draft—Soviet Union. 2. Soviet Union—Armed Forces—Recruiting, enlistment, etc. 3. War—Economic aspects—Soviet Union. 4. Manpower—Soviet Union. 5. Labor supply—Soviet Union. I. Project AIR FORCE (RAND Corporation) II. United States. Air Force. III. Title.

UB345.S713P67 1989

333.4'0355220947—dc19

88-38974

CIP

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of The RAND Corporation do not necessarily reflect the opinions or policies of the sponsors of RAND research.

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Published by The RAND Corporation

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: R-3659-AF
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): The Economic Cost of Soviet Military Manpower Requirements
5. TYPE OF REPORT & PERIOD COVERED: interim
6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): Steven W. Popper
8. CONTRACT OR GRANT NUMBER(s): F49620-86-C-0008

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
The RAND Corporation
1700 Main Street
Santa Monica, CA 90406
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS:
Long Range Planning & Doctrine
Div. (AF/XOXFP) Directorate of Plans, Ofc.
DC/Plans & Operations Hq. USAF Wash, DC
12. REPORT DATE: March 1989
13. NUMBER OF PAGES: 69

14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)
15. SECURITY CLASS. (of this report): unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

No Restrictions

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

USSR
Military Forces (Foreign)
Military Force Levels
Manpower
Military Requirements
Economics

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

see reverse side

DD FORM 1 JAN 73 1473

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

89 12 21 013

Labor has become a serious constraint on further growth of the Soviet economy. However, since 1970, the manpower demands of the Soviet military have increased. This report considers both the degree to which current military staffing levels can be maintained and the costs of doing so. It also discusses the reliability of estimates of Soviet force size. The author suggests that, if the Soviet leadership faces a choice between maintaining present forces but endangering the current program of reform and restructuring, or reducing military expenditures to relieve pressure on the economy, the military may be asked to make substantial sacrifices in the interest of prospects of both the military and the nation.

Keywords: military force levels. (ICR)

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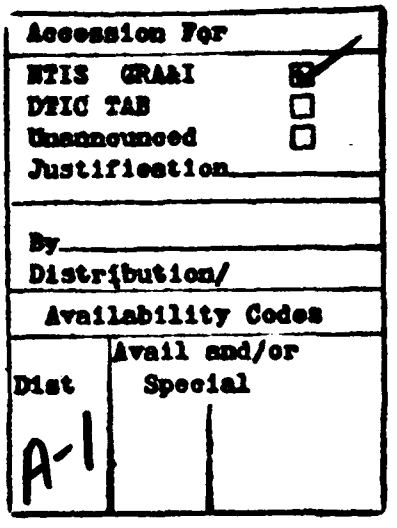
PREFACE

This report presents an assessment of the costs to the Soviet economy of the increase in military manpower that has taken place since 1970. It also considers the reliability of estimates of Soviet forces.

The study is an integral part of the Contingency of Soviet Force Reductions project. The findings will be of interest to those who are concerned with estimating the size of Soviet forces, the burden placed upon the Soviet economy by its defense efforts, and the economics of labor allocation in the Soviet Union.

The research was undertaken as part of a project entitled "Concept Development and Project Formulation," conducted in the National Security Strategies Program of RAND's Project AIR FORCE.

This report is based upon data available through September 1988.



SUMMARY

During the past two decades, while labor has become a serious constraint on further growth of the Soviet economy, the manpower demands of the Soviet military have increased. This report considers both the degree to which current military staffing levels can be maintained and the costs of doing so. In passing, it also considers the reliability of estimates of Soviet force size.

Soviet demographics are currently being affected by a downturn caused by the losses of World War II. Yet Western estimates of Soviet forces show an increase in the number of Soviet military manpower. The estimates used in this report show a 21.5 percent increase in the size of the Soviet military over the period 1970–1986.

Even with a conscription model assuming drastically curtailed student deferments yielding an implied conscription rate of 84.7–86.5 percent, rates that are at the limit of the credible, there is still a shortfall of 60,000–100,000 conscripts in 1987. Given the conservative assumptions of the analysis, this leads to the conclusion that total Soviet military manpower must be little more than 5.4 million at the outside, and the increase since 1970 has been under one million.

A hypothesis consistent with the data for the years through 1980 is that the size of the forces is made to conform to the available manpower pool. In other words, unlike the United States where force building proceeds from the desired force composition to determine the manpower required, the supply side could have been playing a larger, perhaps even a dominant, role in the process in the Soviet Union. Although calling up a large draft-age cohort imposes a burden, the institution of conscription in itself may be viewed as beneficial by the regime. It is not certain that the perception of a reduced external threat would lead to a reduction in the ratio of callups to eligible manpower below a certain level.

In normal circumstances, two mechanisms might be used to adjust military utilization of conscript resources. One is the system of maintaining units at different levels of their authorized strength. This may mean that a nominal reduction in Soviet ground forces may be unlikely at the divisional level, although there may be reductions in the number of lower echelon units or de facto changes in the readiness level of units.

The second mechanism to adjust demand to conscript supply would be to alter the composition of noncombatant branches, subjecting these forces to large swings in manpower levels without affecting the army's

muscle. There is a possibility that some circularity has entered into the estimation of these forces by assuming that a "tooth-to-tail" ratio estimated for one period has held for the full term.

The costs (and benefits) of conscripting recruits into the military may be divided into direct and indirect. Among the direct costs, the preponderant one is the cost of procuring the equipment to be used by the conscripts during their term of military service. At the same time, real increases in procurement may be due not only to force increases but to force modernization as well. Although since 1970 the Soviets appear to have embarked on a course entailing both force increases and force modernization, the actual costs of these parallel policies need not have been as great as they would initially appear. A decision to modernize forces need not imply that all forces are to be modernized. In fact, we might expect to see the creation of lower readiness divisions as a natural concomitant to military force modernization, given what we know of the nature of Soviet weapons development and procurement policies.

The largest indirect cost of placing able-bodied workers in the armed forces is to remove them from the civilian work force. There are two major reasons to believe that the opportunity costs in the Soviet Union might be less than would be the case in a Western industrialized economy. First, there is reason to believe that Soviet labor and other factor inputs are not allocated efficiently at the margin. Second, labor productivity in the Soviet Union is lower than in other industrialized countries. If labor is not used efficiently, the opportunity cost of military service is less. And, even if the force increase has been on the order of one million men, returning the million to the civilian labor force and raising the latter's total by 0.7 percent is unlikely to have a great effect on economic performance in the aggregate.

A simple model of the Soviet economy assesses the magnitude of costs incurred by the buildup of forces as an aid in determining the extent that economic considerations will affect the Soviet leadership's willingness to sustain current levels. If we assume that the increase in military manpower during those years was diverted instead to building up the size of the civilian labor force, but force modernization still occurred, the model yields a GNP in 1985 that is only 1.4 percent greater than the historical result. Within the framework of this model, the costs of force modernization dominate the economic costs of increased manpower demands. The conclusion from this exercise is that the small contribution to input flows from the manpower that was actually diverted to the increase of forces would not have been sufficient to greatly affect the ability of the Soviet economy to grow. The material costs of force modernization were greater.

On a less aggregate level, in 1980 the Soviets were driven to curtail student deferments. The most obvious reason is that the military decided to borrow against the future, more ample supply of youth guaranteed by the upswing after the demographic trough of 1987–88. Another reason is that perhaps what concerned the military establishment more than the short-term loss of conscriptable youth was the permanent loss of conscripts for the military. This number would equal the total of those graduating students who manage to avoid service completely added to the total of those who serve but whose service must be normalized for the shortened period of service for graduates. During the years 1975–81 this would yield a permanent loss equal to 4–5 percent of the cohort size. Further, to the extent that students do avoid service entirely, it deprives the military disproportionately of the more intelligent, and perhaps more ethnically desirable, potential recruits.

It is difficult to state with precision what the costs to the Soviet economy that stem from the curtailment of student deferments might be. One factor may be measured: skilled man-years lost because of the decrease in student deferments. One calculation suggests that 174,000 worker-years of university-trained professionals are lost because of the decrease in deferments. This amounts to a loss of approximately 6.7 percent of the annual worker-years provided by the cadre of university-trained professionals. A loss of this size could conceivably be costly to the Soviet economy over the long term.

A critical sector of the economy, the energy and resource extractive industry located in Siberia, was examined to see if some sectors might be disproportionately disadvantaged by the priority given to the military. The evidence of the Soviet press is that the conflicting claims are not as directly opposed as might first appear. The problem appears to be less one of attracting migrants to Siberia than of being able to sustain and efficiently utilize the migrants after they have arrived. To the extent that the problem is one of management and adequate infrastructure it reduces the importance of the conflict with the military over manpower.

There are measures currently under discussion in the Soviet Union to make better use of the nation's labor by means of economic reform, which, if successful, would affect the military staffing question in two different directions. The first result would obviously be to ease the manpower pinch. The second result could affect Soviet manpower deployment thinking over the longer term. The argument that because of systemic inefficiencies the opportunity cost of removing a potential worker from the economy is low would no longer hold true, which could

conceivably lead to a reappraisal of the value to the nation of keeping so many men under arms.

Although it is unlikely that economic factors related solely to the need for labor in the economy will affect decisions over force reductions, the difficulties of maintaining military unit strength at the authorized levels could force the hand of the Soviet leadership. Procurement and maintenance costs for a large armed force are a greater concern. Force reductions may occur as a result of calculations that give weight to external political considerations or to the increasing expenditures necessary to maintain a sufficient level of modernity in Soviet forces; or they could stem from a reassessment of the priorities for resource allocation in the domestic economy or from reassessing military doctrine. If the choice is between maintaining present forces but endangering the current program of reform and restructuring, or reducing military expenditures to relieve pressure in the economy, the military may be asked to make substantial sacrifices in the interest of future prospects of both the military and the nation.

An addendum considers the recent announcement at a 500,000 man reduction in the size of the military over the next two years. If this number is applied within the conscription model presented in the study, by 1990 the present shortfall of available conscripts will convert to a slight surplus.

ACKNOWLEDGMENTS

This report has considerably benefited from the insightful comments of the author's RAND colleagues, Kent Osband, Abraham Becker, and Keith Crane. Gregory Hildebrandt, Peter Stan, and Nancy Nimitz provided helpful reviews. David Hillinck performed valuable and skillful research assistance. Any remaining errors are the sole responsibility of the author.

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I. INTRODUCTION

BACKGROUND

Far from being the almost limitless resource upon which the first wave of extensive Soviet growth was based, labor has become a serious constraint on further growth of the Soviet economy. The sources of the increasing scarcity of labor are both demographic, stemming from reduced birth rates and unfavorable trends in rates of life expectancy, and systemic. The economic system is not constituted to conserve labor inputs nor to allocate this resource efficiently among competing demands. Unfavorable trends in geographic distribution, skill levels, and (from the standpoint of the largely Russian leadership) nationality composition serve to further darken the picture.

At the same time, the manpower demands of the Soviet military have increased. The Soviets have been able to widen their set of foreign policy options by virtue of their willingness to increase deployments in Central Asia, the Far East, and Eastern Europe. One can postulate future exigencies (increased unrest or heterodoxy in East Europe, opportunities or threats developing in the Middle East, etc.) for which the leadership might consider the option of increasing the Soviet presence or military posture as an appropriate response. In light of the constraint on manpower currently being experienced in the Soviet economy, the question becomes to what extent this option is available. It is also germane to ask whether even current staffing levels may be maintained.

This study assesses the economic costs of military manpower demand for the Soviet Union. The intention is not to consider the total burden stemming from manpower drawoffs necessary to sustain the entire Soviet military establishment. That would not address the needs of the present analysis because this structure is unlikely to be completely dismantled. Rather, this study assesses the cost of the buildup in manpower that has occurred on the margin over the course of the past two decades. The question is whether the current levels may be sustained. Will economic pressures stemming from the manpower shortage force a builddown of Soviet forces? In the course of addressing these questions, the analysis also considers the reliability of estimates of the size of Soviet military manpower.

The study will examine the military buildup that occurred from 1970 on. This decision stems in part from the nature of the available data sources, but it also derives from the observation that although Soviet

forces have apparently been increasing since the mid-1960s, the 1965–1970 phenomenon could be viewed as a readjustment to levels of manpower that had obtained before they were reduced under Khrushchev. The buildup since 1970 may be viewed as a separate phenomenon in posing problems in interpretation and policy for the West.

OUTLINE OF THE STUDY

Section II discusses the size of the Soviet military, the nature of the demographic problem, and the means employed to overcome it. The primary contribution of Sec. II is to provide specificity to the balance of the study: What is the size of the increase in manpower under arms since 1970, and what burden is being imposed upon the civilian labor pool? In the course of providing answers to these questions, the discussion also considers the reliability of estimates of Soviet military manpower and the extent to which these must be limited by the capacity of the Soviets to maintain the postulated structure.

Section III considers the costs of the buildup in manpower from the perspective of the economy as a whole. Several possible sources of economic costs are described and, where possible, bounds and estimates provided. The costs of drawing potential workers from the civilian labor force and placing them in the armed forces are estimated by means of a simple econometric model of the Soviet economy. This method allows costs attached to modernization, as isolated from force size increases, to be considered.

Section IV discusses several topics. Two cases are presented of areas of the economy below the aggregate level that might have more substantial costs imposed upon them by the need to sustain military manpower levels; specifically, one skill group, specialists trained at institutions of higher education, and one sector, the extractive industry in a region (Siberia and the Far East) that might suffer inordinately from military manpower drawoffs. The final topic is a brief look at the prospects for economic reform and what they might portend for the ability to maintain present force size.

Section V briefly states the major conclusions of this study.

II. THE NATURE OF THE MILITARY MANPOWER REQUIREMENT

INTRODUCTION

As a first step in determining the economic effect of the Soviet military's manpower needs, we must consider how many individuals are diverted from civilian pursuits to the military and who these people are. This section presents data from three broad areas: demographic analyses, information on the conscription and manpower management institutions of the Soviet military, and estimates of the historical trend in Soviet military manpower levels and force structure. The purpose is to determine an estimate of Soviet military manpower to be used in the analysis in later sections. In passing, the section will examine the apparent paradox of increasing force size at a time of declining draft-age cohorts.

The Soviets are notorious for classifying as state secrets even information that would be considered mundane by Western standards. Therefore, much of the information we possess on the military manpower question is a result of Western estimates whose accuracy must be judged on an individual basis. When alternative assumptions are available, I have chosen those that are most conservative, in the sense of being most favorable and least restrictive to Soviet interests.

DEMOGRAPHIC ANALYSES OF THE SOVIET POPULATION

The first demographic echo from the losses suffered during World War II began to appear as a downturn in the size of draft age cohorts in the early 1960s. This echo coincided with a Soviet decision to reduce the level of military manpower. The reason Khrushchev offered for the reduction at that time was that the emerging importance of the strategic forces reduced the need for such a massive conventional force. However, the demographic balance must have surely weighed heavily in the decision to build down.

In the early 1970s, Western students of Soviet demographics began to speak of a coming manpower crunch in the 1980s as the second echo of the war losses began to appear. The second echo was not estimated to be as severe as the first in terms of absolute decline in the number of young (male) adults. However, the situation would be considerably

exacerbated by two important developments. The first would be the changes in the nature of labor demand brought about by a further two decades of industrial development in the Soviet Union. Shortages in the industrial labor force would be an active constraint on the ability of the Soviet economy to grow. The second was the fact that during the 1970s and into the 1980s Soviet military forces appeared to be undergoing considerable expansion as well as force modernization. How were both the military and industrial maws to be adequately fed?

In general, earlier demographic projections by Western analysts estimated that the demographic downturn of the 1980s and the subsequent recovery would be more exaggerated than have the more recent projections. Figure 1 shows two series of demographic estimates and projections generated by the U.S. Bureau of the Census, those current in 1982 and the most recent ones.[1] Several points from an earlier

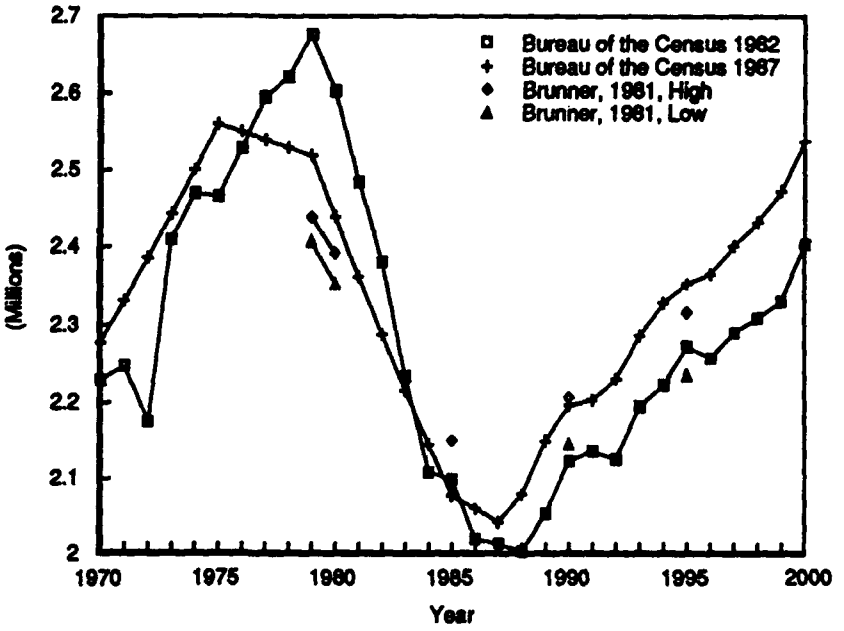

Fig. 1—Soviet demographic projections: Number of 18-year-old males by year

[1]The sources for the 1982 series are DIA, 1984; Rapawy and Baldwin, 1982. The sources for the 1987 series are Kingkade, 1987, and data provided on tape by the Soviet Branch, Center for International Research, U.S. Bureau of the Census. Note that the

RAND study, forming several bounded regions, are also shown for comparison (Brunner, 1981). The estimates and projections differ in the nature of the extrapolation methods used and in updates of information on mortality (which has an immediate effect on projections) and fertility (which has longer-run implications for demographic projections). The 1987 series shows a demographic dip of less amplitude and earlier recovery than does the 1982 series.

The general shape of the two series is similar. Both find the crisis of the downturn to be occurring currently, in the years 1987 and 1988. This report will use the more recent of the two demographic series in the analysis.

THE INSTITUTIONS OF THE SOVIET MILITARY

Soviet forces are generally fairly junior—conscript-intensive with short average terms of service—compared with most Western armed forces. Estimates of military personnel suggest that at any given time 20 percent are officers, 3–4 percent are cadets in service academies,[2] and 5 percent are career (second term or greater) enlisted men (A. Smith, 1980).[3] This means that at least some 70 percent are conscripts.

The officer and cadet corps, amounting to 23–24 percent of total military manpower, is exceptionally large. The figure probably represents a reasonable upper bound. Similarly, although the figure of 5 percent for long-term enlisted personnel is low by Western standards, it seems to accord well with our institutional knowledge of the Soviet armed forces. Therefore an estimate of 70 percent conscripts would seem to be conservative. The actual percentage could be higher.[4] At the current manpower levels estimated for Soviet forces by Collins and Victory (1987), a 1 percent difference between the estimated and actual fraction of conscripts would change the military requirement for recruits by 26,000 a year. This is a bit over 1.4 percent of the recruit intake estimated for 1987.

Draftees are conscripted under the 1967 Law on Universal Military Service. The law cut the prevailing induction age from 19 to 18. Thus conscription begins at an age less detrimental to the national economy

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points for the 1987 series between the years 1970, 1975, 1980, and 1985 are my straight-line interpolations.

[2]If officers serve for 20 years, then the annual accession rate to maintain an officer corps of 1,000,000 is 50,000. Therefore, there could be from 150,000 to 200,000 cadets in military academies.

[3]"Men," because only about 10,000 women serve in the peacetime forces (Jones, 1985).

[4]Feshbach and Rapawy, 1976, estimate the share of conscripts as 75 percent.

as it is likely to occur at a less disruptive time of life. The legal vulnerability to conscription was extended through age 26, providing a much larger and more stable pool to draw on if need be than was the case before 1967. At the same time the period of service was reduced from three or four years, depending on service branch, to two or three years. The justification for the latter change is that it is easier for the better educated conscripts of today to master the necessary military skills more rapidly (Collins, 1980). The effect is to create a large pool of reservists. Callups are not continuous during the year but are conducted twice annually (previously only once) in spring and autumn. This means that twice a year the armed forces lose a bit less than 25 percent of their trained inductees.

It is not known what percentage of eligible males are conscripted annually. The 1967 law does allow flexibility in discharge times. A conscript may be retained for as long as five months after the normally mandated time of service, and time may be forgiven as well, resulting in early discharge. This could provide some flexibility to fulfilling military manpower requirements.

ESTIMATE OF SOVIET MILITARY MANPOWER

The actual size and structure of Soviet forces are the most uncertain parts of the puzzle. Estimates are derived from both inside the intelligence community and open sources. Of the latter, the two most often cited are the series constructed by the International Institute for Strategic Studies (IISS) for their annual *Military Balance* publication, and the studies produced by John Collins of the Congressional Research Service. The 1987 edition of *Soviet Military Power* of the Department of Defense (DoD) also provides a single total estimate of Soviet military personnel strength not broken down by service arm or type (DoD, 1987).

This study will utilize the Collins estimates.[5] There is some difference between these and those of IISS in the absolute size of military manpower levels, but little in their rate of increase. The Collins numbers are more consistent by year and are presented in a manner more readily useful for the present purpose because they distinguish between combat and support troops for each service branch. Using these as the standard numbers for this study is to state the Soviet manpower problem conservatively as the IISS numbers are higher if the broadest definition of Soviet military forces is used.

[5]The source of the estimates of Soviet manpower presented in Collins is the Defense Intelligence Agency (1980, p. 427). Some data differ in detail from classified documents but portray dependable patterns (p. 425).

The actual magnitude of the increase in overall military manpower levels during the period 1970–1986 depends on the definition of what constitutes the military. Because a major effect of the military draft is to remove workers from the labor force, the wide interpretation (congruent with the Soviet definition under the 1967 law on universal military service) is used to assess economic effect. In addition to the five main combat service branches,[6] this would include the military units of the KGB, the militarized police units of the MVD, and the uniformed full-time civil defense troops, all of which require conscripts. This yields an overall 21.5 precent increase in the size of the Soviet military over the period 1970–1986 when command and support troops are included. In terms of assessing political influence and threat, the narrow definition, limited to the five combat service branches, would be operative. These branches have seen an increase of 17.8 percent. Table 1 provides data on the increase in total military manpower levels using the broad definition.[7]

The combat troops include the personnel assigned to the operational units of the Strategic Rocket Forces, the Ground Forces, the Air Defense Forces, the Air Force, and the Navy as well as the military units of the KGB and the internal police. In 1986, these services accounted for 3,904,000 personnel.

The category of general and support troops includes Ministry of Defense, branch, service, and military district headquarters personnel, special and administrative forces, rear service support forces, civil defense, construction, railroad, and billeting forces. The data in the IISS annual series suggest that these forces were not counted rigorously by Western analysts before the late 1970s. When they began to be estimated and included, their size accentuated the increase in Soviet military manpower levels that had been detected. The estimate for these troops given by Collins for 1986 is 1,574,000, yielding a total for Soviet military manpower of 5,478,000.[8]

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[6]The Strategic Rocket Forces, the Ground Forces, the Air Defense Forces, the Air Force, and the Navy.

[7]A more detailed breakdown by service branch may be found in App. A.

[8]The IISS estimate of total Soviet military manpower for 1986 is 5,850,000 if border troops, internal troops, and the troops assigned to civil defense are included as they are in the Collins figures. Similarly, *Soviet Military Power* says that "Soviet Armed Forces personnel strength currently exceeds 5.6 million" (DoD, 1987, p. 97). The interpretation of this passage is problematic. Throughout the publication, the Soviet armed forces appear to be restricted to a narrow definition, not including the border, internal, and civil defense forces (see, e.g., DoD, 1987, pp. 18–19). If this restriction also applies to the total manpower figure given, and we use the very similar estimates of Collins and the IISS for manpower in those forces, which must be added to the five combat service branches to yield the wide definition of Soviet military manpower, this implies an estimate more in the range of 6.3 million.

Table 1

BUILDUP OF SOVIET MILITARY MANPOWER, 1970–1986
(Thousands)

Year	Manpower[a]			Ratios of Support to Total	Overall Increase Since 1970
	Combat	Support	Total		
1970	3165	1341	4506	0.30	0
1971	3258	1338	4596	0.29	90
1972	3293	1337	4630	0.29	124
1973	3371	1341	4712	0.28	206
1974	3479	1333	4812	0.28	306
1975	3401	1362	4763	0.29	257
1976	3487	1384	4871	0.28	365
1977	3498	1369	4867	0.28	361
1978	3453	1391	4844	0.29	338
1979	3432	1390	4822	0.29	316
1980	3445	1382	4827	0.29	321
1981	3562	1708	5270	0.32	764
1982	3589	1566	5155	0.30	649
1983	3686	1569	5255	0.30	749
1984	3816	1572	5388	0.29	882
1985	3857	1579	5436	0.29	930
1986	3904	1574	5478	0.29	972

SOURCE: Collins, 1980, 1985; Collins and Victory, 1987.
[a]Includes five service branches and KGB and MVD military formations.

Several factors have contributed to the increase in Soviet military manpower. One is that the fundamental table of organization of major operational units was changed in the early 1980s, placing more men in tank and motorized rifle divisions (although reducing the size of airborne divisions.) Another is that the number of divisions increased. The absolute number of divisions that are estimated for Soviet Ground Forces differs according to the source used, but their increase in number from 1970 to 1986 is generally agreed to be on the order of 50 tank and motorized rifle divisions, 35 or so since 1975. The balance of the section considers how it has been possible for the Soviets to manage this substantial increase, given what we know of Soviet military institutions and the declining demographic trend.

THE MANPOWER PINCH

As noted above, an average of 70 percent of Soviet military manpower is assumed to be made up of conscripts; for no less than 90 percent of the conscripts the term of service is assumed to be 24 months, and for 10 percent the term is 36 months.[9] Therefore, the average term of service is 25.2 months.

Combining these assumptions with the most recent data on the size of the Soviet military, using Collins and Victory, 1987, as a source, suggests that the Soviet military's demand for conscripts for 1987 is 1,826,000. The U.S. Bureau of the Census currently estimates the total number of 18-year-olds for that year as 2,043,000. Therefore, to satisfy the demand implied by the estimates of the current Soviet force structure would require the induction of 89.4 percent of the class of 1987. With the IISS estimates of current Soviet force structure, the need would be for 97 percent inductions.

Such invasive depredations by the military upon the annual increment to the draft-age pool would be difficult to imagine even in the course of a major wartime mobilization. By comparison, the medical evaluation standards for U.S. conscription practices set in 1963 would yield a combined medical and moral disqualification rate of 20 percent (Collins, 1980, p. 97).[10] It is difficult to believe that the Soviet peacetime rate could be any less than half of this number, say 10 percent (but probably closer to 15 percent).[11] This means that current Soviet military manpower requirements demand the absolute, theoretical maximum conscription rates to meet military needs. Indeed, even these may not be sufficient.

The Soviets do, however, offer deferments for several reasons besides ill health and medical liability. There is a second group of deferments on the grounds of family hardship, including deferments in the case of disabled and dependent parents, dependent children (two or more) or disabled wife; deferment for sons whose mothers are

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[9]Conscripts on board naval vessels or serving in coast guard combat units or maritime border units are required to serve 36 months. This probably amounts to somewhat less than 10 percent of all who serve, so this assumption is, again, a conservative one.

[10]During the height of the U.S. manpower crunch in 1944–45, 14.0–17.1 percent of all 18–25 year olds were classified as IV-F (Blum, 1967, p. 157). The actual rate of IV-F deferments for 18-year-olds in the years 1965 through 1968 was about 25 percent. About half that number were classified as available for conscription in the case of a national emergency (Gerhardt, 1971).

[11]Officials of the Moscow military registration and enlistment office recently criticised the conscripts who arrived at the city's induction center saying that many do not meet the "fit for labor and defense" standard. The article states that, "almost 12 percent are discharged from military service each year for health reasons" (*Pravda*, 18 May 1987, p. 4; reported in JPRS *Soviet Union: Military Affairs*, 8 July 1987, pp. 47–51).

unmarried and have two other children under the age of eight; and deferment for sons with dependent siblings under the age of 16 or with disabled siblings of any age with no one to care for them.[12] These provisions probably do not affect a large number of 18-year-olds but would become more important for the older members of the draft-age pool. Ellen Jones estimates that 3–10 percent of the otherwise eligible pool may be exempt for family reasons (Jones, 1985, p. 54).

Besides family hardship, there are also (formal as well as informal) possibilities for deferment on the basis of occupation, criminal activity, and participation in court proceedings. All of these nonmedical deferments together may amount to a further deferment rate of 4–5 percent.[13]

The Soviets have in the past offered deferments to full-time students in higher educational institutions and in specialized secondary and vocational training schools. Many of these were subsequently called up, but not all. As many as 300,000 per year may, in effect, have been exempted from callup for service (Collins, 1980, p. 97). When translated into a fraction of 18-year-olds, this meant another 15 percent deduction from the age cohort. That accords with intuition. Total induction rates of 70–75 percent would seem to be about the largest callup rate that would be supportable without undue hardship under peacetime conditions.[14]

In recent years, the Soviets appear to have drastically curtailed the number of student deferments. This issue will be analyzed in much greater detail in Sec. IV. For present purposes, whereas the student deferment rate might have amounted to some 13–15 percent before 1982, the current rate may be anywhere from 0–5 percent. For the purpose of discussion I have settled on 2 percent. Putting all current sources of deferments together, while tending toward conservative estimates where required, suggests that the minimum rate of deferments, stated in terms of the class of 18-year-olds, would be in the neighborhood of 16–17 percent, leaving 83–84 percent available for conscription.

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[12]*Chelovek i Zakon*, No. 2, February 1984, pp. 55–60, in JPRS *USSR: Military Affairs*, 9 May 1984, pp. 55–61.

[13]This is implied by the calculations in Feshbach and Rapawy, 1976.

[14]Again by way of comparison, the U.S. manpower crunch in 1944–45 was viewed at the time as being quite serious. It prevented the number of military units and actual number of men under arms from achieving the planned levels. It also, at the same time, caused serious dislocations in many priority industries. During this time, 73.6 percent of all registrants aged 18–25 years were classified as available for conscription. This means, of course, that the actual rate for 18-year-olds alone must have been higher, but the figure is the maximum percentage of those eligible for conscription, not those actually selected (Blum, 1967, p. 157).

High callup rates for a trough year aside, the historical data illustrate the long-term nature of the problem for the Soviet Union. Figure 2 shows the induction rate for 18-year-olds, 1970–1986, derived from the Collins military manpower numbers and the assumptions outlined above. During the entire period from 1970–1980, callup rates were consistently around 65 percent of the annual 18-year-old class, what we might term the "historical" rate. After 1980, the increase in necessary projected conscription has been great, easily passing the maximum 70–75 percent rate obtaining in the era of wide student deferment, and by 1983 even exceeding the revised maximum rate of 83–84 percent calculated above that takes into account the more draconian deferment policies of recent years. Figure 3 projects the necessary conscription rate that would be required to maintain the 1986 Soviet estimated force structure to the year 2000. Only at the end of the millennium will callups come back to something approaching the "historical" callup rate.

The reality of this apparent paradox must be better understood. The demographic downturn of the 1980s might have suggested a priori

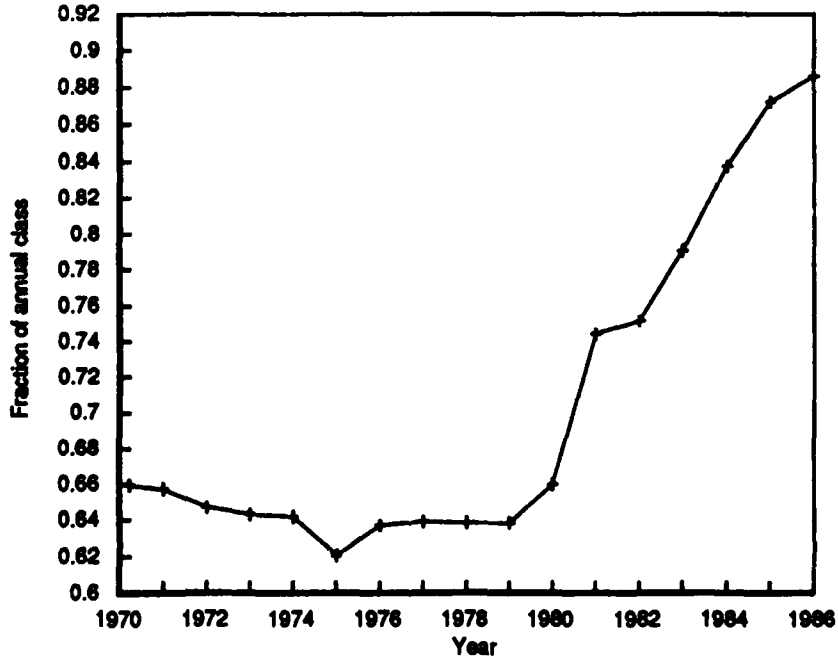

Fig. 2—Estimate of callup rates for 18-year-olds, 1970–1986

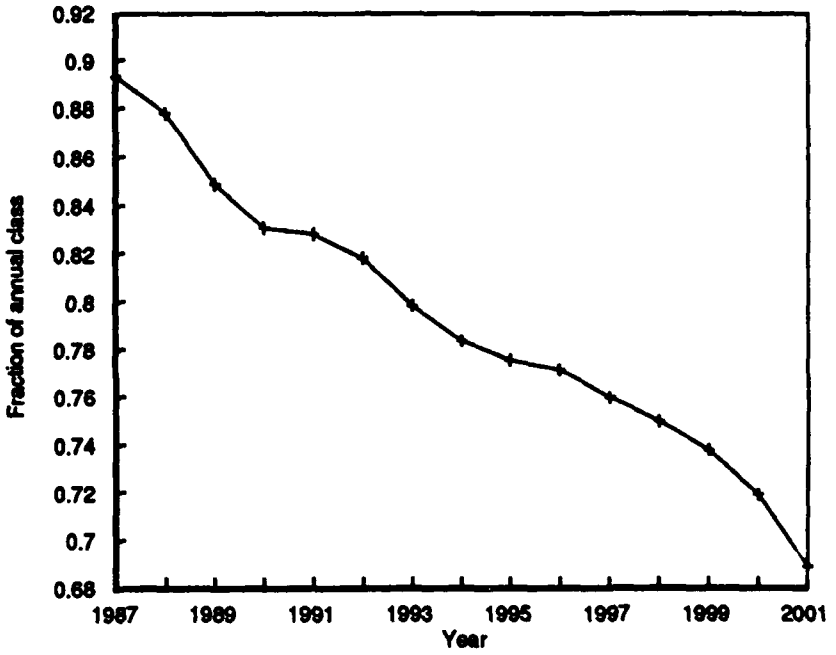

Fig. 3—Projection of callup rates for 18-year-olds, 1987–2001

that the reality of the manpower shortage would force a partial build-down of Soviet forces during the course of that decade. Instead, the bulk of the observed increase since 1970 occurred in the 1980s. Are the Soviets sufficiently insensitive to manpower opportunity costs that we cannot project changes in their force posture based upon what we know of the exigencies of the civil economy (military/political needs are the fixed points around which all else must be arranged)?[15] Or does it suggest that the analysis is at least partly erroneous and that the military buildup was not as costly as these figures make it appear? These questions must be addressed to enable us to make predictions about forces based upon the need for economic tradeoffs or to assess the costs to the economy of maintaining these forces.

[15]This is to ignore for the present the possibility that changes in the civil economy (mechanization, de facto postponement of retirement, etc.) might have reduced the need for labor inputs.

POSSIBLE MEANS FOR ALLEVIATING THE MANPOWER PINCH

Allocation of Manpower Within the Military Establishment

A hypothesis consistent with the data for at least the years from 1970 through 1980, and perhaps from as early as 1960 through 1980, is that the size of the forces is made to conform to both the available manpower pool and a given rate of conscription considered to be socially desirable and economically acceptable. During this period, military manpower was built up at a rate to match the increased size of draft-age cohorts (see Fig. 3). In other words, unlike the West where force building proceeds from the desired force composition to determine the manpower required, the supply side could have been playing a larger, perhaps even a dominant role in the process in the Soviet Union. Military service may have been viewed, in part, as a social or political good in itself. The implication for this study, if the hypothesis is correct, is that the analyst must exercise caution in gauging the range of policy options the Soviet leadership would actually employ to reduce the conscription rate below some threshold, as that might not be a highly desired goal in itself. The Soviet leadership may not consider filling the military manpower requirement to be quite the same burden that it appears to be to a Western analyst.

The logic inherent in the 1967 Law on Universal Military Service would seem to support this view. Although calling up a large draft-age cohort imposes a burden on the economy, the institution of conscription in itself is beneficial to the regime. The process increases and stabilizes the pool of trained reservists and provides a venue for intense political indoctrination. It also socializes young men by emphasizing the needs of the collective over the individual, provides some basic education in Russian and other useful nonmilitary skills, and shows recruits from labor-rich republics other parts of the country, possibly increasing the mobility of labor. It is by design that the manpower needs of the Soviet armed forces are filled by a system that is conscript-intensive and has the widest possible effect upon the pool of available 18-year-olds. It is not certain that the perception of a reduced external threat would lead to a reduction in the ratio of callups to eligible manpower below a certain level.

If "supply-side" considerations have indeed played some part in informing Soviet conscription practices, the logic of the policy would demand a reduction in the number of men under arms during the demographic downturn of the 1980s. That does not appear to have occurred. One possible explanation is that what began in 1967 as a

deliberate policy resulting in increased military manpower in the face of a demographic upturn may have taken on an institutional life of its own, as did so much else in the Soviet Union, by the late 1970s, the period of late Brezhnevism. In the face of increased commitments abroad during the course of the 1970s, a renewed challenge from the United States, an unwillingness to face the hard decisions necessary to run the policy in reverse, and a situation where the priorities and prerogatives of the military appear to have been strong enough to gainsay attempts at retrenchment, military manpower was not decreased and forces were even enlarged. The mechanisms used to adopt the policy remain, however.

Under normal circumstances, two mechanisms might be used to adjust military utilization of conscript resources if the process is actually driven by supply to as large an extent as demand, or larger. The first applies to the most manpower-intensive branch, the Ground Forces. This refers to the familiar system of maintaining units at different levels of their authorized strength. Divisions may be at one of three readiness states.[16] The mix among these three types may be altered with considerable effect upon manpower requirements.

As noted earlier, one of the more dramatic manifestations of the Soviet buildup since 1970 is the increase in the number of divisions in the Soviet Ground Forces. This buildup has a direct effect on the ability of the Soviet Union to project an image of strength and to provide a greater potential for intimidation by virtue of the presence of this force on the Soviet borders and in the Central Region in Europe. Considering only the manpower required,[17] if we make the rough assumptions that each tank or motorized rifle division has 12,000 men at full strength and that the Category I and II divisions have, on average, 80 percent of full strength and those of Category III have 15 percent, then the total manpower required for the 35 division increase that has been observed since 1975 is slightly under 110,000.[18] If the ratio of cadre to

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[16]The most common classification scheme has been the one where divisions of Category I have 75–95 percent of their full manpower complement, those of Category II 50–75 percent, and Category III 10–20 percent. This has been superseded by a more detailed scheme of classification, but the Category I-II-III form is the one still used by the sources drawn upon in this study.

[17]Section III will consider the implications of this buildup for growth of procurement expenditure in greater detail.

[18]There are two major complications to this simple calculation. First, most divisions were reorganized in 1982 yielding a formal increase of 500 men for each motorized rifle division and 2,000 for tank divisions. If we use the actual establishment strengths rather than an average for the period, the total increase to 1986 would require about 175,000 men. Second, a considerable portion of the Ground Forces manpower lies in nondivisional combat assets and in command and support units. Therefore, the manpower required to increase the size of the Ground Forces by the number of divisions added since

ready divisions remains constant, this leverage will operate as strongly to prevent a large downturn in manpower levels in the case of deletions of divisions from the order of battle.[19] Given that there are some 200 divisions in the Soviet Ground Forces, a great reduction in nominal division number, on the order of 35 divisions, would not greatly alter the manpower requirement.[20] What this may mean is that a nominal reduction in Soviet Ground Forces may be unlikely in the near term at the divisional level. There may be reductions in the number of lower echelon units or de facto changes in the readiness level of units, both of which would be more difficult to detect by foreign analysts.

The second mechanism to adjust demand to conscript supply would be to alter the ratios of military "tooth" to "tail." Noncombatant branches such as railroad, construction, and civil defense troops are included in the category of general and support manpower. The fact that these branches exist under the rubric of the military but are administratively separated from the "shooting army," again differing from typical Western military practice, means that this area could be subjected to large and rapid swings in manpower levels without really affecting the army's muscle. In times when the available supply of conscripts is low, the levels of command and support services could be rapidly changed while the combat arms were insulated from the need to adjust too greatly. Given the wide range of tasks assigned to the support branches, tasks that vary in their importance to the direct sustenance of the military, the size of these forces may be altered to suit the balance between the force posture of the five service arms and the demographic trends. As has been mentioned, these forces have not received as much attention from Western analysts as have the combat arms until quite recently, but they are of great importance for this analysis. The data in Table 2 imply that the combat-to-support ratio has remained fairly constant during the period under consideration. Yet most of the numbers for the 1970s are post facto reconstructions arrived at after the rear area forces had been reevaluated by Western analysts in the late 1970s (Scott and Scott, 1979, p. 227). Some circularity may have entered into the estimation of these forces if it were assumed that a tooth-to-tail ratio estimated for one period has held for the full term. That might not be the case.

1975 will be greater than the figures given here if the Ground Forces command considers it necessary also to increase the presence of nondivisional units in some rough proportion. The problem, in this case, is in determining whether the manpower required by such auxiliary formations is large if they are added in proportion to the number of division-level headquarters, or small if they are added only in proportion to average readiness status or men under arms.

[19]The ratio need not necessarily remain constant. Modification of the ratio could potentially confer a great degree of flexibility in Soviet force building.

[20]The current estimate places the size of the Ground Forces at over 3 million.

In addition, in times of extreme crisis some support troops could provide a first pool for adding to the cadre combat units as they are already subject to military discipline and regimen even if they are still innocent of actual combat training. For present purposes, it suggests a further sense in which this force might be viewed as a manpower buffer. It allows the leadership to temporarily take on a greater defense role and effectively increase the military by drawing on an internal labor pool that will to an extent be divorced from the civilian labor force. However, the fact that the greatest bulk of these troops appear to be of non-Slavic origin, exactly the reverse of most combat branches, may render this potential expedient unviable.

When conscripts are plentiful, command and support services could be used as a spillover for excess conscripts. A greater proportion of these troops might be used in civilian construction projects in unsalubrious or otherwise inconvenient locales. They are neither a total loss to the economy nor a direct addition to the military burden.

Both of these potential mechanisms for manpower management, shifting the readiness status of units and altering the size and composition of the support services, carry an implication beyond the question of how the Soviets use conscripts. They suggest that there is room for misassessment by Western analysts of the size of Soviet military manpower if force estimates are based upon rules of thumb and extrapolations from sporadic observation. In particular, shifts in readiness status of combat formations or in the size of the auxiliary forces would probably be detected only after an appreciable lag. Of the three main areas of information, demographic, institutional, and military manpower estimates, the last of these appear most fragile. This sensitivity stems not from any lack of diligence or persistence on the part of those engaged in the exercise of estimating the size of Soviet forces and the manpower they include, but rather from the inherently more elusive nature of the facts to be clarified.

Means for Reducing the Conscript Shortfall

Leaving the problems of military manpower estimation aside, how could a force of the size currently estimated be maintained in a period of extended demographic downturn? This discussion will present data on the size of the shortfall in the number of available conscripts to be expected under several assumptions.

Table 2 illustrates the dynamic nature of the shortfall.[21] If we retain the assumptions we have explicitly laid out and extrapolate the

[21]For greater clarity, the simple arithmetic of conscript supply and demand used to calculate the shortfall in available manpower under various assumptions is presented in App. B.

Table 2

SHORTFALL OF AVAILABLE CONSCRIPTS UNDER ALTERNATIVE ASSUMPTIONS, 1981–2000[a]

	Assuming Conscription of			
	70 Percent of 18-Year-Olds		75 Percent of 18-Year-Olds	
Year	000	Fraction of Requirement	000	Fraction of Requirement
1981	−103	0.06	15	na
1982	−117	0.07	−2	0.00
1983	−201	0.11	−90	0.05
1984	−294	0.16	−187	0.10
1985	−357	0.20	−254	0.14
1986	−383	0.21	−280	0.15
1987	−396	0.22	−294	0.16
1988	−370	0.20	−267	0.15
1989	−321	0.18	−214	0.12
1990	−288	0.16	−178	0.10
1991	−284	0.16	−174	0.10
1992	−264	0.14	−153	0.08
1993	−226	0.12	−111	0.06
1994	−196	0.11	−80	0.04
1995	−179	0.10	−61	0.03
1996	−170	0.09	−52	0.03
1997	−145	0.08	−25	0.01
1998	−123	0.07	−1	0.00
1999	−95	0.05	29	na
2000	−50	0.03	77	na

SOURCES: Collins 1980, 1985, Collins and Victory, 1987; U.S. Bureau of the Census.

[a]Includes five service branches and KGB and MVD military formations.

"historical" rate of conscription observed during the 1970s—that is, no more than 70 percent of each class of 18-year-olds being drafted—into the present and future, how great is the annual deficit compared with the number that need to be conscripted to maintain the estimated military manpower level?[22]

[22]This is similar in approach to the model developed by Feshbach and Rapawy, 1976. They used a different demographic series and series of military manpower estimates, as well as differing assumptions on deferments, proportion of conscripts in the military, and conscription period. The methodology of modeling conscription of older males also differs.

The Collins estimates of the current military manpower level have been used for 1981 through 1986 and then the 1986 force maintained until the year 2000. The first two columns of Table 2 illustrate these assumptions. The shortage remains above 10 percent of the total requirement for conscripts for most of the period.[23] If the assumptions change and fully 75 percent of the 18-year-old cohort is taken each year, and the marginally greater damage to the growth prospects for the economy is accepted, then the burden is alleviated somewhat. However, the fractional shortfall will remain above 10 percent until after 1991. This is illustrated in the two right-hand columns of Table 2.

What if a more sophisticated conscription model is employed? Table 2 assumed that only the 18-year-old cohort was called upon to provide conscripts. It is convenient to speak in terms of 18-year-olds as the fundamental unit of account. Anyone who is conscripted at some later age was also once an 18-year-old; the number of 18-year-olds establishes the maximum size of the later age cohorts. However, the size of neither this age cohort nor the later ones is constant from year to year. Therefore, if the needs of the military are more widely spread among the age cohorts during a time of demographic trough, the resulting conscript shortfall might be reduced.

Table 3 illustrates the model presented in App. B. According to the 1967 conscription law, the vulnerable ages are 18–26. Naturally, it is least injurious to the economy and the social fabric to take a recruit when he is the youngest and the opportunity cost to society of his induction is least. But the military need must also be considered. Of those who have been deferred, some become available at a later age. The model used to generate the data in Table 3 followed two sets of assumptions. In the first, illustrated by the data in the first two columns, it was assumed that the rate of conscription for 18-year-olds conformed to the "historical" rate of 65 percent. In the second it was assumed that 70 percent of 18-year-olds are conscripted when they become available. For both specifications of the model, 25 percent of those who reach 19 without having been conscripted are then taken into the military, as well as 10 percent of the previously uncalled 20-year-olds.[24] After that it is deemed unlikely that selection of 21- to 26-year-olds is anything but a scattered

[23]Again, using the Collins numbers represents a conservative assumption. If the higher total estimates of IISS are used instead for the crisis year of 1987, the shortfall is greater than 550,000 conscripts, or 30 percent of the total requirement necessary to maintain the estimated military manpower level.

[24]The model also assumes an annual mortality rate of less than two per thousand. If the mortality consideration is ignored for the moment, it means that in the first specification 76.4 percent of 18-year-old equivalents are eventually taken by age 20 and, in the second, 79.8 percent is the effective rate of conscription. With mortality taken into account the rates would be slightly greater.

Table 3

SHORTFALL OF AVAILABLE CONSCRIPTS USING THE CONSCRIPTION MODEL FOR 18- TO 20-YEAR-OLDS,[a] 1981–2000

	Assuming Conscription of			
	65 Percent of 18-Year-Olds		70 Percent of 18-Year-Olds	
Year	000	Fraction of Requirement	000	Fraction of Requirement
1981	59	na	171	na
1982	38	na	121	na
1983	−51	0.03	22	na
1984	−149	0.08	−78	0.04
1985	−217	0.12	−148	0.08
1986	−250	0.14	−181	0.10
1987	−265	0.15	−196	0.11
1988	−243	0.13	−173	0.09
1989	−195	0.11	−121	0.07
1990	−157	0.09	−82	0.04
1991	−147	0.08	−72	0.04
1992	−127	0.07	−51	0.03
1993	−89	0.05	−11	0.01
1994	−56	0.03	24	na
1995	−34	0.02	46	na
1996	−23	0.01	57	na
1997	2	na	84	na
1998	26	na	109	na
1999	56	na	140	na
2000	102	na	189	na

SOURCES: Collins, 1980 and 1985; Collins and Victory, 1987; U.S. Bureau of the Census.

[a]Includes five service branches and KGB and MVD military formations.

phenomenon because military value would decline rapidly with increasing age from morale problems, and the cost to the economy would begin to rise.[25]

[25]Although it is clear from the outcry in the Soviet press that a far from unanimous decision has been taken to reduce the number of student deferments, there has been no similar indication that the induction of older draft-eligible males has increased. This suggests that there is a preference for youth even in a time of shortage, but this proof is by no means conclusive.

Table 3 shows that, depending upon assumptions about the rate of callup, this model considerably reduces the shortfall, although it is not eradicated. In the specification assuming a 65 percent callup rate for 18-year-olds, 130,000 more conscripts than in the previous model are found for the crisis year of 1987, although the shortfall is still 265,000 recruits, 15 percent short of the maintenance requirement. The year 1987 still sees a shortfall of nearly 200,000 conscripts, 11 percent less than the required number, if they are conscripted at the higher rate of 70 percent when age 18. But only that year and 1986 show a shortfall at the 10 percent level.[26]

Can the newly calculated shortfall of 200,000 conscripts for 1987 under a nearly 80 percent conscription regime be reconciled with the estimated military manpower level, thus resolving the paradox? This figure represents about 3.6 percent of total military manpower. Plus or minus 5 percent would certainly seem to be within the acceptable range for such estimates. The problem, however, is that the direction of error in estimation is biased. As has been pointed out, the Collins numbers upon which these calculations are largely based are on the low side of published estimates of Soviet military manpower. We have also used the most conservative assumptions in the analysis so far. This suggests serious difficulty in accepting the IISS and *Soviet Military Power* estimates, which are higher still.

Another expedient available to the Soviet leadership could aid in managing the shortfall. The terms of service of recruits might be lengthened, thus reducing conscript demand. The 1967 law on conscription allows recruits to be held for up to an additional five months before finally being discharged. What would be the effect on the demand for conscripts if three-year service men were discharged on time but two-year recruits were held for an additional 60 days?[27] This would involve minimal additional injury to the economy. There has been no indication in the Soviet press or from Western observers that such a practice might now be occurring. That is not in itself conclusive, but it is suggestive of the seriousness with which Soviet leaders must view such an expedient. Nevertheless, the effect of increasing service terms should be explored as part of the analysis of the manpower puzzle.

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[26]Again, if the IISS estimates are used, the shortfall in 1987 is more than 350,000, 18 percent of requirements, even if a 70 percent conscription rate at age 18 (effectively meaning that nearly 80 percent of all those reaching 18 years old will eventually serve) is assumed. The account would not then come into surplus until the year 2000 and would continue to result in a shortfall with respect to the maintenance requirement of 10 percent or greater until 1993.

[27]The choice of 60 days is arbitrary. It seems to be a long enough time to make some difference without being so long that the morale of the soon-to-be-discharged recruits would be too sorely tried.

Table 4 gives a sense of the effect that a 60 day "surcharge" to the time of service would have on the shortfall in conscript supply. The analysis uses the multi-age recruitment algorithm with its most draconian assumptions, taking 70 percent of 18-year-olds as recruits. The result is to further reduce the conscript shortfall to the point where it is not likely to distress Soviet military planners. In other words, if the Soviets are willing to place virtually every able-bodied male into the service (effectively 80 percent of each age cohort) and extend the service term by two months, then the currently estimated military manpower levels can come very close to being supported adequately.[28]

Table 4

SHORTFALL OR SURPLUS OF AVAILABLE CONSCRIPTS USING THE 18- TO 20-YEAR-OLD CONSCRIPTION MODEL AND EXTENDING SERVICE BY SIXTY DAYS, 1981-2000[a]

Year	000	Fraction of Requirement
1981	323	na
1982	247	na
1983	140	na
1984	42	na
1985	-28	0.02
1986	-59	0.03
1987	-75	0.04
1988	-51	0.03
1989	1	na
1990	40	na
1991	49	na
1992	70	na
1993	111	na
1994	146	na
1995	167	na
1996	179	na
1997	205	na
1998	230	na
1999	262	na
2000	317	na

SOURCES: Collins, 1980, 1985; Collins and Victory, 1987; U.S. Bureau of the Census.

[a]Includes five service branches and KGB and MVD military formations.

[28]If the IISS estimates are used, the problem remains. The year 1987 would still see a shortfall of 220,000 recruits (11 percent of requirements), and the shortfall would remain until the year 1994.

Soviet callup practices make this expedient a bit less tractable and efficacious than might otherwise be the case. Callups and discharges are not continuous during the year. They occur twice yearly, in the spring and the fall. To hold men longer might create personnel problems, because recruits are usually directly assigned to units. Also, units would again be understaffed when the additional 60 days expired. Extension for the full five months allowed by law would wipe out the shortfall as well as smoothing the problem of "lumpiness," but the morale problems within the military would be severe. Therefore, although this might appear to be an attractive policy in a regime where callups and discharges are continuous, in the Soviet setting the solution is more apparent than real.

The Soviets appear instead to have decided to reduce the number of deferments available to 18-year-olds by cutting back on eligibility for student deferments. The net effect is to increase the conscription share of each draft-eligible cohort. Table 5 illustrates the effect of this practice. In this model, fully 80 percent of all 18-year-olds are conscripted when they first become eligible. The first case reported in the left-hand columns is consistent with the previous ones in that 25 percent of 19-year-olds and 10 percent of 20-year-olds previously deferred are subsequently conscripted. The second assumes that because of a tightening up of deferment standards for 18-year-olds, only 15 percent of the deferred 19-year-olds will be taken. At that rate of conscription for 18-year-olds the effective differential in overall conscription is small. These conscription algorithms imply that 86.5 percent of all eligible males in the first case and 84.7 percent in the second will eventually be conscripted (again, ignoring mortality). Conversely, it means that deferments of all types—medical, moral, psychological, hardship, criminal, occupational, and student, de jure and de facto—are restricted to only 13.5–15.3 percent.

These are effectively wartime rates of conscription. Indeed, they are scarcely credible. They are matched only by the conscription rate for the Israeli armed forces, which are in many ways better designed than the Soviet to minimize the economic and social dislocation caused by military manpower demands; and the Israeli rates represent the rates for only the select part of the community not exempted from conscription. Even under the conscription regime modeled in Table 5 there is a shortfall, albeit a minimal one.

In view of this, for the purpose of this study, the Collins numbers must be regarded as a theoretical upper bound to the size of the Soviet armed forces. Even these are likely to reflect only the ideal condition when all units are staffed at their authorized level of readiness. If the Soviet forces actually do consist of the number of divisions and other large formations represented in the Collins estimates, then it is quite possible that they are not meeting these staffing targets.

Table 5

SHORTFALL OR SURPLUS OF AVAILABLE CONSCRIPTS USING THE 18- TO 20-YEAR-OLD CONSCRIPTION MODEL UNDER REGIME OF REDUCED DEFERMENTS, 1981–2000[a]

	Assuming Conscription of			
	25 Percent of 19-Year-Olds		15 Percent of 19-Year-Olds	
	Not Conscripted at Age 18			
Year	000	Fraction of Requirement	000	Fraction of Requirement
1981	407	na	334	na
1982	324	na	272	na
1983	207	na	156	na
1984	78	na	37	na
1985	–9	0.00	–47	0.01
1986	–43	0.01	–80	0.02
1987	–59	0.02	–96	0.03
1988	–31	0.01	–68	0.02
1989	27	na	–10	0.00
1990	69	na	30	na
1991	77	na	38	na
1992	100	na	61	na
1993	146	na	106	na
1994	184	na	142	na
1995	215	na	170	na
1996	234	na	187	na
1997	268	na	219	na
1998	303	na	251	na
1999	346	na	291	na
2000	409	na	351	na

SOURCES: Collins, 1980, 1985; Collins and Victory, 1987; U.S. Bureau of the Census.

[a]Includes five service branches and KGB and MVD military formations.

Finally, the conservative nature of this analysis is underscored by the fact that the entire previous discussion has been focused only on the problem of staffing the 70 percent of the Soviet military manpower that is conscripted. The provenance of the 30 percent who are officers or long-term servicemen has been ignored.

CONCLUSIONS

It would be just possible for the Soviets to conscript sufficient recruits each year to meet the military manpower numbers estimated by Collins. But it is made only just possible—within a construct that utilizes quite conservative, perhaps even unrealistic, assumptions—if the Soviets used measures just short of those that would be viewed as inexpedient at any time other than during a national emergency. This implies a theoretical ceiling to Soviet forces of not much over 5.4 million men.

The second finding flows from the first. Any estimate of Soviet military manpower calling for an aggregate strength greater than that given by Collins must be held open to serious question. A higher estimate could not be considered if it did not include an analysis of military manpower management policy that convincingly calls into question the basic assumptions used in this study. Of the three classes of data used in this section, the one that must be considered primary because of the firm foundation of its sources and the general agreement in interpretation of those sources is the demographic. If the level of analysis is made more disaggregate and such questions as the desired ethnic composition of Soviet forces relative to the varying rates of increase of the Slavic and non-Slavic populations are also considered, the problem of maintaining even the Collins force structure estimate is that much less tractable.

After the demographic data, the institutional insights, gained in hundreds of interviews with emigrés, defectors, and others, have an internal consistency suggesting they cannot be discarded without additional and contradictory information of a higher order. What this means is that any estimates of Soviet military manpower must be constructed so as to fit within the parameters framed by these two bodies of information. Estimates and projections that do not fit within these limits must be held open to question.

Overestimation of Soviet military manpower can stem from several sources. First is the ever-present potential for double counting or for counting individuals who are essentially uniformed civilians (e.g., medical service personnel) in military manpower totals. A second source stems quite naturally from the fact that estimates of Soviet force posture are derived for the practical purpose of assessing threat. It is reasonable to use estimation techniques with asymmetric bias because it is the greater disaster to underestimate the power of a potential adversary. However, using such techniques without the checks provided by an analysis including demographic and institutional insights can lead to circularity that will quickly expand estimates beyond reasonable bounds.

This section also suggested other specific factors that could cause military manpower estimates to err. Substantial increases in manpower could be perceived if the readiness status of units is overestimated. There would be a primary effect, stemming from miscalculation of the number of men under arms in combat divisions, but also a secondary effect if multipliers and rules of thumb based upon these numbers are then used to estimate the size of ancillary and support units. To estimate the "tail" in this manner might be to miss the importance of a means for balancing the military manpower equation: adjusting the size of rear area and support services to shifts in conscript supply and service demands. The difficulty of detecting major changes in the support forces might reinforce the apparent validity of the erroneous estimates of the combat forces if the rules of thumb are then applied in reverse. Of the three main areas of data, it is the estimate of actual military manpower that must be brought into conformity with what we know of the other two.

The use of the Collins estimates in the analysis to follow carries an implicit assumption that should be rendered explicit. The discussion will proceed from the supposition, as inferred from the non-decreasing trend in Collins's manpower estimates, that the Soviets have not reduced their force posture to date and that the buildup has been maintained in the face of the manpower pinch. Given the problems of estimation alluded to above, this assumption may be a strong one. The rest of the study will assess the costs of this buildup.

III. THE ECONOMY-WIDE COSTS OF MILITARY MANPOWER DEMAND

This section examines the costs to the Soviet economy, considered as a whole, of military manpower demand. The costs (and benefits) of conscripting recruits into the military may be divided into the direct and the indirect. These points vary in their importance to the economy as a whole and in our ability to ascribe quantitative point estimates to them. This section presents a qualitative overview of the major issues that enter into the analysis of military manpower costs. In addition, the discussion addresses a selected subset of these issues to provide estimates that give a sense of the relative size of the costs that must be borne.

DIRECT COSTS[1]

Military Hardware

Among the direct costs of increasing the size of the military, the preponderant one is that of procuring the equipment to be used by the conscripts during their term of military service. At the same time, real increases in procurement costs may be due not only to force increases—which would, of course, carry a strong implication for military manpower demand—but to force modernization as well. Force modernization is a policy decision to increase the rate of retirement for military capital of an earlier vintage and is an option that may be exercised independently of a decision to increase the number or size of units that make up the organization of the armed forces. This would certainly be the case if the decision is taken to transform the technological base of the military. Costs would increase because of the sophistication of the weaponry and equipment acquired and because of a concomitant need to develop the infrastructure of logistic support to ensure their proper use and maintenance.

The broad question of procurement expense lies at the heart of the analysis of the full burden inflicted by the Soviet military upon the Soviet economy. It cannot be fully dealt with in this study. A later analysis will attempt to separate the defense burdens placed upon the

[1]Both this and the following sub-section benefited from discussion with RAND colleague Kent Osband.

economy by force size increase from those placed by force modernization and will discuss them as they pertain to the narrower manpower issue. The present discussion will be limited to factors of a more institutional character.

Since 1970 the Soviets seem to have embarked on a course entailing both force increases and force modernization, but the actual costs of these parallel policies need not necessarily have been as great as they would initially appear. In fact, the decision to increase the size of forces could have been partly a consequence of an independent decision to modernize. This proposition rests upon two observations. The first is that Soviet forces are not homogeneous in their equipment and may have grown more heterogeneous since 1970. A decision to modernize forces need not imply that all forces are to be modernized; only a portion of forces need be affected. Second, given the institutions that exist in the Soviet Union for the design and production of new weapons systems, a decision to modernize in a fundamental fashion would lead to a great increase in the amount of military hardware in existence.

The most apparent indication of Soviet force growth since 1970 has been the increase in the number of divisions in the Ground Forces. Impressive—and politically useful—as this is, the increase may have been cheaply bought. Considering just the divisions themselves and ignoring support elements, the increase in the number of category I and II divisions was on the order of 8 percent, and those of category III showed a 29 percent increase (Collins, 1980, 1985).[2] Category III divisions are mostly equipped with hardware that has been cut out from the stocks of category I and II divisions, so those divisions could be largely equipped without any serious increase in the production of military goods. In fact, the creation of lower readiness divisions might be a natural concomitant to military force modernization, given what is known of the nature of Soviet weapon development and procurement policies. Changes in the characteristics of weapons are most often introduced incrementally in the course of an extensive production run.[3] The tendency is to produce batches of weapons incorporating successive improvements to existing platforms rather than to bring out radically new prototypes. A result of this process is to generate a great deal of hardware. During a period of force modernization, this policy is likely to yield new equipment before the old has reached its full service life, so retirement rates would not keep up with new production.

[2]The latest figures provided by Collins and Victory (1987) indicate that of the 202 active tank and motorized rifle divisions in the Soviet order of battle, 36 percent are estimated to be category I or II and 64 percent are category III.

[3]See Alexander, 1982, for an extensive discussion of this process.

Earlier prototypes and the weapons rendered less effective by the later stages of the development process may then be used for export or to equip the category III formations.

A decision to modernize the Ground Forces can, in a limited sense, be viewed as a decision to modernize only the third that is kept in readiness status, corresponding to categories I and II, making the prospect less expensive. From 1967 to 1977, for example, procurement of equipment (which in the Soviet definition would include more spares and repair costs than would its U.S. counterpart) for the Ground Forces accounted for approximately 10 percent of total defense spending. By contrast, procurement spending for the Air Forces and the Navy each was over 15 percent of total defense spending on average (CIA, 1978). However, on the manpower side of the ledger, the Ground Forces accounted for 83 percent (300,000 of 360,000 troops) of the buildup in all service branches, with the wide definition of the military including the internal and border troops, from 1970 to 1977. Some 19 divisions were added as well for a 12 percent increase in the number of standing divisions. (Collins, 1980, 1985; Collins and Victory, 1987).

Modernization of the Ground Forces, clearly the most manpower-intensive of the five main service branches, is apparently less expensive per soldier than might have been supposed. This question will receive a more quantitative treatment below.

Military Consumption

Given the generally low level of living standards in the Soviet Union relative to those of other industrialized countries, and the even lower level of subsistence for military enlisted personnel, military consumption is unlikely to represent too great a drain. From 1956 to 1972, the average value of military subsistence expenditures in current rubles was approximately 33 rubles per month, including food, shelter, clothing, and medical care, among other expenses. For conscripts the value was 27 rubles, 80 percent of the average, because of unequal distribution of payments in kind (Brubaker, 1973). Direct pay to conscripts was 3 rubles a month per man. By way of comparison, in 1966, 42 percent of all workers in the socialized sector in the Soviet Union (excluding *kolkhozniks*) earned between 80 and 140 rubles per month, the mid-range of incomes (Brubaker, 1973).

These figures suggest that from the regime's point of view, conscription actually represents a form of poll tax. It allows the government to obtain the services of individuals whose next best alternative would almost certainly be much higher paying employment in the civilian economy leading to increased consumer demand. In addition, Western

analysts usually model Soviet military expenditures as coming largely at the expense of civilian consumption (see, e.g., CIA, 1979; and Bond and Levine, 1981). Even so, it certainly does not confer *carte blanche* upon the regime in the ability to draw down consumption levels to support a military buildup. There is also a real need to balance defense expenditure against the political requirement of demonstrating an ability to maintain consumption per capita at some slowly increasing level. To the extent that universal conscription allows the regime to artificially decrease the absolute level of civilian consumption through the simple expedient of reducing the number of civilians, it would provide a benefit to a leadership trying to balance alternative end uses for national output. (The negative implications for national income of this loss of civilian workers will be discussed below.)

Training Costs

The final direct cost of maintaining military manpower is the need to provide training in militarily desirable skills. It is difficult to assess what these costs might be, but they are likely to be increasing. Once again, part of the increase is due to the marginal additions to Soviet forces, but part is also due to the increasing sophistication of the military equipment that recruits are being asked to operate. Even in the face of force reductions, these costs are not likely to be dramatically decreased. The military might be saved the time and expense of certain rudimentary training by the practice of instructing secondary school students in basic military skills, but the ultimate purpose of this preparation is probably more psychological and political indoctrination. The military usefulness is doubtful.

Again, the costs of military training may not be placed completely on the debit side of the ledger. Part of what the military teaches are such skills as truck driving, machine operation, maintenance and electrical work that may well be transferable to the civilian economy after military service. Soviet sources suggest that one-third of the conscripts who have had skill training in the construction troops later ply these skills as a specialty in civilian life (Jones, 1982).[4] In addition to obvious technical skills, military skill-building might also include a better understanding of Russian for nonnative speakers, and more of an ability to conform to the discipline of the industrial work place for recruits from rural, non-European parts of the country. Beyond this is the training recruits receive in their moral and political development, something in which the regime places great store.

[4]This should not be construed as implying that one-third of all construction troops learn civilian trades in the army because the majority of such troops must receive no such training at all (see Wimbush and Alexiev, 1988).

In all these areas, we have anecdotal evidence from emigrés and others that the quality of education and the usefulness of the indoctrination received can often be quite low (Wimbush and Alexiev, 1988). Many skills that typically need to be performed by enlisted troops or naval ratings in most Western armed forces are usually performed by long term officers in the Soviet Army, so they would not be included as part of a conscript's training. In addition, there is segregation among the technical and non-technical branches along ethnic lines.[5] This would also tend to decrease the effect of army service as a means for instructing in Russian. This notwithstanding, when calculating the cost of maintaining a given level of forces the Soviet leadership is more likely to place credence in the ability of military training to provide a non-martial return for its expense than is the more skeptical Western observer. This will lower the cost in their estimation.

INDIRECT COSTS

The Utilization of Productive Capacity

There is a literature on the economics of military expenditures suggesting that there may also be an economic benefit from expenditures on military hardware procurement (beyond the role they play in providing the intangible public good, national security).[6] The partisans of this contention argue that such expenditures lead to fuller use of industrial capacities, may counteract cycles in the trend for civilian orders, and can lead, through Keynesian multiplier effects, to an overall expansion of the economy.

These factors are unlikely to hold in an analysis of Soviet military procurement. The crises of the Soviet economy are due to a chronic insufficiency of supply rather than to shortfalls in demand. Given the priority usually attached to production for the military in the Soviet Union, their demands are more likely to lead to a crowding out of civilian production for the civilian sector because of capacity constraints

[5]In contrast to beliefs held among most Western analysts, Jones believes that a detailed examination of conscription, stationing, and assignment policies suggests that draftees are evaluated on an individual basis and that blanket nationality policies are not used in making unit or branch assignments (1982, p. 119). However, even if that is so, the de facto result would still be over- and underrepresentation in certain branches because of ethnic and geographic trends in language skill and education.

[6]The studies concern the effects of military expenditures in developed Western countries. Most of this work has been generated from the political left, but the fundamental insights are not inconsistent with mainstream Keynesian views. See, for example, Griffin, Wallace, and Devine, 1982; Nincic and Cusack, 1979; and Reich, 1972. There are dissenters from this view. See, for example, R. Smith, 1977, 1980.

and supply bottlenecks. This can lead to shortfalls in the quality of civilian products as well as in their quantity.

This effect is still likely to be true even though earlier ideas of the Soviet economy as being separable into two largely self-contained sectors, the civil and the military, must be modified in view of the military's need for a growing assortment of ever more sophisticated products.[7] The result will be a growing interdependence over time. However, in the absence of more detailed information on the nature of military production in the Soviet economy, it is beyond the scope of this report to estimate the possible magnitude of this crowding out.

Reduced Supply of Civilian Labor

The largest indirect cost of placing able-bodied workers in the armed forces is that of removing them from the civilian work force. The larger the number of potential workers diverted from production and the higher the skill level of those recruits taken in by the military, the higher the cost in terms of potential output forgone. This is less of a consideration when the ranks of the military are made up of the unemployed or the less skilled, but in the Soviet context it is especially important because of the chronic labor shortages that characterize most sectors of the economy. An assessment of the costs of maintaining forces at a high level should cause the leadership to consider that some reductions might be necessary to alleviate shortages in the economy. However, Several factors could mitigate the possible strength of this effect.

Initially, there are two major reasons to believe that the opportunity costs engendered by military force increases in the Soviet Union might be less than would be the case in a Western industrialized economy facing a shortage of labor. The first is that there is no reason to believe (and quite a few good reasons not to believe) that Soviet labor and other factor inputs are allocated efficiently at the margin. Indeed, this is one of the major reasons for a labor shortage. Although there is no formal unemployment, there is considerable underemployment. Under the prevailing economic institutions it behooves the managers of production units to maintain a good share of their work force as idle supernumeraries for much of the time. These function as an internal labor reserve for those times when surges in production are necessary to meet output targets. There are sectors of the economy that are seriously constrained by a shortage of labor, especially for particular skills, but the instruments of policy are insufficient to guarantee that

[7]See Becker, 1987, for a discussion.

labor is allocated to the enterprises in most need.[8] There is no a priori reason to believe that labor released from obligation to military service would be allocated to the most crucial sectors or would even discernibly affect whatever sector they were employed in.

Another reason to believe that the opportunity cost of military service might be lower is related to the issue of labor allocation. Labor productivity in the Soviet Union is lower than in other industrialized countries. If the labor forgone by the military by reducing their manpower demands is not used efficiently, the opportunity cost of their military service is less. Again, sectors vary in the degree of labor productivity; but there is no guarantee, under current labor and wage practices, that released labor would tend toward those sectors where productivity is highest.

There is a further reason to believe that the conscription of able-bodied workers is not a straight debit from the size of potential gross national product in the minds of Soviet policy planners. A certain amount of capital, particularly structures and installations, is produced by units formally attached to the Ministry of Defense. These are the battalions and brigades of the railroad and construction troops. The productivity of these conscript forces is probably lower still than that of civilian workers, particularly because they are composed disproportionately of lower skilled draftees from the Central Asian and Transcaucasian republics; but they often do work that civilian workers would not willingly undertake. A good example of this is the Baikal-Amur Mainline (BAM) railroad being built in the Soviet Far East. The railroad troops of the Ministry of Defense have been a major source of labor for the BAM since their involvement in the project began in August 1974.

Such troops do not engage solely in work that civilian workers would be unwilling to perform. Often they augment civilian labor resources, particularly in construction. Sheremet'yevo Airport outside Moscow and many of the new buildings on Kalinin Prospect in the city itself were built by troops of the construction service (Scott and Scott, 1979, p. 241).[9] Construction troops are also involved in building roads, schools, factories, recreation facilities, civilian housing, and barracks and are used to provide disaster relief (Jones, 1982). Both regular combat and support units routinely assist in the harvest in all parts of the Soviet Union. In addition, the Ministry of Defense's rear area services are responsible for operating and maintaining the military *sovkhozes*.

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[8]Furthermore, in a multi-ethnic, multi-lingual country with a tradition of extended families, worker mobility will never be as great as in the United States. This is compounded by the problem of scarce housing, which could be (and has been) used as a lever to reallocate labor geographically.

[9]These may number in the region of 600,000 troops (Jones, 1982).

These provide a significant portion of the grains, vegetables, and meat consumed by the military, especially in the Central Asian, Siberian, and the Far Eastern Military Districts. The number and size of these farms is secret (Scott and Scott, 1979, p. 238). Again, one may well question the efficiency, and in some cases even the ultimate usefulness, of these military contributions to economic output; but they will suggest themselves as offsets to the cost of maintaining the military establishment in the minds of the Soviet leadership.

A final point on the matter of labor drawn off from the civilian economy is that although the gross burden of maintaining the existing level of Soviet forces may be high, the marginal burden of the increase in forces since 1970 has not been large in relation to the civilian labor force. Even if the increase has been on the order of one million men, this must be compared with a civilian labor force in 1985 of over 140 million (Rapawy, 1987). Returning the million to the civilian labor force and raising the latter's total by 0.7 percent is unlikely to have a great effect on economic performance in the aggregate.

MODELING THE COSTS OF MILITARY MANPOWER DEMANDS

In many ways, the analysis presented in Sec. II and in the preceding part of Sec. III suggests an approximate response to the question of how great are the opportunity costs engendered by large-scale conscription. Bear in mind that this study concerns the marginal increases in Soviet forces, not the incontrovertible fact of the large absolute size of the Soviet military establishment. The Soviet forces are large, represent a great investment of resources over time, and constitute an economic burden by reason of diversion from other potential uses of accumulated national wealth.[10] But even with the widest definition of the military, the marginal increase in force size since 1970 could not have been greater than one million additional men under arms, and may well have been less. It remains to ask what the cost of this increase has been and what it portends for projections of Soviet forces in the future.

One approach to determining the cost to the Soviet economy of its military buildup since 1970 is to explore the counterfactual hypothesis. What would have been the growth of Soviet national income if young men who became conscripts had instead been added to the civilian work force? As with all exercises in counterfactual analysis, the results

[10]See Becker, 1981, for an able discussion of this larger issue.

depend crucially upon the assumptions used and may only be relied upon to give a crude impression of what might have been. In what follows, a simple model of the Soviet economy has been developed to give a better sense of the effect that several factors might have had in affecting Soviet growth. An assessment of the magnitude of costs incurred by the buildup of forces in the past will be helpful in assessing the extent that economic considerations will affect the Soviet leadership's willingness to sustain current levels.

The full econometric model that estimates Soviet national income in gross national product (GNP) terms is detailed in App. C. For the purpose of the model, GNP consists of the total value added in the sectors of industry, agriculture, trade and services, construction, transportation and communication, and a residual from other sources. The model is a simple one in that the industrial sector has been made the focus of the model; the relationship between the labor force and capital stock is made explicit only for industry. Value added in the industrial sector is derived from a Cobb-Douglas production function, and the capital stock of this sector is calculated by applying the historical rates for depreciation and industry's share of total investment.[11] Applying the model to the historical data from 1970 through 1985 yields a GNP result after 16 years that is within 0.1 percent of the historical result.

What would have been the effect on the Soviet economy if forces had remained at their 1970 levels and the increase in military manpower during those years was diverted instead to building up the size of the civilian labor force?[12] It is assumed that workers would be allocated to the various sectors in the same proportion as occurred historically.

The level of civilian consumption would need to be increased. The model has added an increment to the historical annual consumption figures by multiplying the historical per capita civilian consumption by the number of military personnel freed up by this counterfactual exercise for absorption into the civilian labor force.

Historical defense expenditures also need to be modified. The model assumes that the historical force modernization continued to take place

[11]Specifically, the rate of depreciation of the capital stock was set at 1.5 percent per year, the share of total investment going to industry set at 35.3 percent, and the output elasticities of labor and capital at 0.65 and 0.35, respectively. The sources for these parameters may be found in App. C. The model implicitly assumes that the growth slowdown of the late 1970s and 1980s was due to systemic factors, not directly treated in the model, that adversely affected total factor productivity—the measure of efficiency in the utilization of factors of production. The figures for total factor productivity obtained by running the model against the historical data series were used unless otherwise specified.

[12]This implies the conservative assumption that the incremental worker added to the civilian labor force possessed the average level of skills. In fact, those workers redirected from the military (had no increase in military manpower levels occurred) would have been among the youngest and least experienced industrial laborers.

even though the size of the military remained constant. The historical series on defense expenditure was used to calculate ruble defense expenditure per capita of military personnel per year as a proxy for defense expenditure including modernization costs. The historical per capita defense outlay multiplied by the fixed number of military personnel (4,506,000 men) yielded the counterfactual annual defense expenditure per capita of military personnel, giving a total for defense outlays in constant rubles that increases 42 percent during the 1970–1985 period, even though military manpower is frozen at the 1970 level.

The results of this exercise indicate that the number of potential workers diverted from the civilian labor force to the military by the buildup of Soviet forces was not large enough to have much effect on economic performance. The model yields a GNP in 1985 that is only 1.4 percent greater than the historical result.[13] The model also yields a reduction in overall defense burden from 14.0 percent to 11.5 percent of GNP because of expenditures forgone by keeping the manning level constant.[14]

This result depends crucially upon assumptions in the trend of total factor productivity and input factor shares—as do, indeed, all results from analyses of this type. In this case, if one of the events leading to the decline in Soviet rates of total factor productivity was that industry's labor resources were insufficient to adequately operate the new capital added to that sector, then the assumption that the historical rates of total factor productivity would still pertain under the new conditions would be incorrect.[15] Depending on the degree of change, the growth in hypothetical compared with historical GNP would be greater. If, for example, inadequate manning of new fixed capital were a major contributing factor to the post-1975 decline in industrial total factor productivity and the model used the 1975 value for the ten following years (total factor productivity held constant), the resulting

[13]If instead *all* additional workers are placed into industry alone without distributing them evenly throughout the economy, GNP in 1985 would be 2.3 percent greater than was historically the case. This requires the large assumption that the other sectors of the economy would have functioned just as adequately as they did historically with a disproportionately small increase in the size of their labor forces.

[14]The numerator in the calculation, total defense expenditure, does not include the value of dual-use durable goods, which are split out from defense expenditures in the model. Including these in defense outlays would, of course, raise the share of the defense burden on GNP.

[15]There is evidence to suggest that a common practice in Soviet enterprises has been to add new machinery to the existing establishment rather than to replace obsolescent equipment if the old equipment is still functional (Levine, 1962). This could adversely affect the performance of the new capital because of inadequate staffing and support, thereby lowering the ratio of output to capital.

hypothetical 1985 Soviet GNP would be 5.2 percent greater than the historical result, with a concomitant defense burden of 11.1 percent of GNP.[16] A difference in average annual growth rates of over 0.3 percent per year from 1970 to 1985 would be a significant addition to the historical rates, but the assumptions necessary to have the model yield this rate are strong ones.

To provide an upper bound to the possible (which is not to say probable) rate of growth under the counterfactual hypothesis, we can calculate how much higher 1985 GNP would have been if the Soviets had forgone both a manpower buildup *and* force modernization after 1970. By construction, the model assumes that defense outlays come at the expense of investment. Lowering defense expenditure would increase the rate of investment and leave consumption constant.[17]

Setting both the manpower and defense expenditure per capita of military personnel constant from 1970 through 1985 yields a hypothetical 1985 GNP that is 3.1 percent greater than historical GNP and a defense burden of 8.2 percent of GNP.[18] This result utilizes the historical trend in total factor productivity. Force modernization, however, also requires applying resources to research, development, testing, and evaluation (RDT&E) activities—resources that might otherwise have been used to ameliorate total factor productivity. If we assume constant total factor productivity from 1975 on, the result is 6.8 percent higher than would be a 1985 historical GNP and a concomitant defense burden of 7.9 percent of GNP.

The limitations inherent in the model prevent the hypothetical GNP figure from being greater. For example, if institutional factors were

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[16]Again, if all the freed conscripts were placed solely in the ranks of the industrial labor force, the hypothetical GNP would have been 6.2 percent greater than the historical.

[17]This runs contrary to other analyses of this sort (see above) because consumption is not treated as a residual. When viewing the most recent period of Soviet economic history, however, a case can be made that the latitude the Soviet leadership might once have enjoyed in suppressing per capita rates of current consumption is now circumscribed. Allowing this rate to fall below some minimum level during peacetime could have unacceptably adverse political consequences. However, the model does indicate consumption as a share of GNP would fall at a rate greater than the historic one.

[18]What may appear as unresponsiveness of GNP to changes in the defense burden is mainly explained by the fact that only the portion of savings on defense outlays that goes to investment in industry (35.3 percent of the total) is explicitly treated in the model specifications. The distribution of the balance of these savings to all other investment uses is implicit. A more efficient allocation scheme would almost certainly be feasible. Further, the resulting value added in industry crucially depends upon the value for the output elasticity we impute to capital. If, for example, the model were to use an elasticity of 0.5 rather than 0.35, and total factor productivit· values were adjusted accordingly, the resulting change in GNP would be 4.8 percent greater than the historical value.

operating that had a deleterious effect on industrial growth because of the priority allocation of resources and outputs to support the military modernization program, such factors would remain implicitly factored into the equations for industrial growth even though "crowding out" by military orders would no longer pertain. Also, the model is driven by the equations for the industrial sector. It assumes that there is even and sufficient investment in other sectors so that they can fulfill the supporting role prescribed in the econometric equations. There is no allowance for a counterfactual investment strategy that might more effectively maximize national income. Still, an annual average rate of growth adding a further 0.2–0.5 percent to the historical rate would not have been insignificant during a period when the actual performance of the economy overall led to average growth of GNP on the order of 1.9 percent a year (Kurtzweg, 1987).[19]

Within the framework of this model, the costs of force modernization dominate the economic costs of increased manpower demands. If the counterfactual is structured to allow for the historical buildup of manpower but to restrict real defense spending per capita of military personnel to the 1970 level—no increased expenditure for force modernization—the 1985 GNP would still have been 2.4 percent above the historical level and the defense burden would have been 8.2 percent of GNP.

The conclusion from this exercise in counterfactual analysis is that the small contribution to input flows from the manpower and material that was actually diverted to the marginal increase (as opposed to the gross total) of the size of Soviet forces would not have been sufficiently large to greatly affect the ability of the Soviet economy to grow. This need not hold true in the future. In particular, this conclusion becomes less certain for the inputs required to modernize the incremental increase along with the existing forces, especially if a more favorable trend is assumed in total factor productivity as a result of forgoing modernization. Forgoing modernization of forces would have a greater effect on the economy than reduction of the number of men under arms, and the costs of remaining current in military technology are likely to cause modernization expenditures to rise substantially in the future. But considerations of apparent labor scarcity in the civil economy are unlikely to be a decisive factor in Soviet decisions over military manpower levels.

[19]This is the figure for 1981–1985. Over the full 1970–1985 period the average would be more on the order of 2.3 percent a year.

IV. SECTORAL ISSUES IN MILITARY MANPOWER DEMAND

This section will address three topics. The first two consider aspects of the economy that might be more affected by the military's demand for certain types of manpower than the previous analysis of the effect on the economy has indicated. First, the question of skilled manpower drawoffs will be considered, particularly the effect of reducing student deferments. Second, the effect on the extractive industry in Siberia will be discussed. Finally, the section will consider the possible trends in labor utilization as a result of various reform proposals.[1]

THE DEMAND FOR SKILLED MANPOWER

One concomitant of the course of economic development is an increasing differentiation among, and development of, the types of human capital available to an economy. It has long been clear that the days of "storming" the development milestones set by the Soviet leadership through the sheer mass of workers assigned to a project have given way to a need to efficiently employ a skill-differentiated labor force. As a result, phenomena that impede the process of skill-building or that reduce the number of skilled workers and technicians available to the economy must be viewed as costly.[2] In other words, the quantity of skilled and technically trained labor becomes in itself an important argument in sectoral production functions.

Military demand for more skilled manpower has also increased. The first and most direct reason for this growth is that the technical sophistication of military capital has increased at as great a rate as that of the civilian capital stock, or greater. To preserve relative military effectiveness, recruits must operate weapons that demand more from the operator than was previously the case. In addition, more technically complex equipment usually requires a greater base of skilled maintenance and logistic support. Both of these trends place a premium on the more intelligent and skilled conscript.

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[1]This section benefited considerably from the able research assistance of David Hillinck.

[2]This is not, of course, to suggest that skilled labor is currently used in an efficient manner at the margin in the Soviet Union or that a person trained in some technical skill will necessarily be free to apply that skill in an unconstrained fashion.

The second reason for the military's demand for skilled manpower is less direct, stemming from the general manpower squeeze. As force levels rise while the annual availability of draft-age males declines, the military is likely to place more pressure on groups of potential conscripts who have been previously deferred from service. The most obvious (and desirable) untapped source of potential conscripts is the pool of young men who have previously been deferred because of studies or the vital nature of their occupations. The debate over the long-term net benefit to society of drafting students has recently become an open and surprisingly heated one in the Soviet Union.

Students and Deferments

Article 35 of the 1967 Law on Universal Military Service provided a legal basis for granting deferments to students attending high schools (available only through age 20), and to full-time day students of higher educational institutions (*VUZy,*) which include universities, and other specialized secondary educational institutions (*SSUZy*). The deferments of students who fell into the latter two categories depended upon satisfactory progress and regular day-time attendance.

Deferment did not necessarily mean a blanket excuse from military service. Students might be enrolled in reserve officer training courses (particularly those in the engineering fields) and then called up after graduation for a three or four year tour as an officer. Other students might be conscripted after graduation through the regular system, albeit for shortened terms of 18 or 24 months rather than two or three years (Jones, 1985). This again emphasizes the regime's commitment to universal conscription as a social good rather than merely as an expedient to fill the ranks. The period of service for graduates of higher educational institutions was sufficient to provide basic military skills, a taste of military discipline, and whatever social and political indoctrination a standard course in Soviet military instruction is intended to impart.

In December 1980, the Presidium approved a decree to introduce changes to the 1967 law to take effect as of January 1982.[3] The legislation pertaining to student deferments was substantially amended. Although no major changes were introduced in the first category of deferments (those for students still attending high school), only students enrolled at higher educational institutions (VUZy and SSUZy) appearing on a list approved by the Ministry of Defense and the State Planning Commission (Gosplan) would be eligible thereafter for

[3]*Krasnaya Zvezda*, 19 March 1982, p. 4.

student deferments. For the SSUZy students, a necessary condition for deferment eligibility was enrollment in a reserve officer training course. Loopholes in the previous law were also eliminated.

There are two points of interest in this connection. The first is to consider the timing of the December 1980 decree while examining Fig. 1. The period 1980–1981 is precisely the time when the 18-year-old callup rate necessary to sustain the estimated level of Soviet forces departed from the "historical" rate set in the previous decade and began its climb. The coincidence of these events would suggest that although the absolute size of the increase in Soviet forces is not certain at this time, the phenomenon was more than just an artifact of Western analysis and estimation methods. A buildup did occur.

The second point is that the decree was specifically the result of a joint recommendation by the Ministry of Defense and Gosplan. No doubt the recommendation came as the result of heated discussion, probably at the level of the Military-Industrial Commission (VPK). The need for consultation with Gosplan bespeaks an awareness on the part of the Council of Ministers that economic costs would attend an effective reduction in the pool of trained technicians available to the civil economy. It also suggests that the allocation of manpower inputs is as much a part of the agenda of the VPK as is the allocation of other factors of production and of the resulting output.

Certainly, the most visible manifestation to Western observers of this change in policy was the acrimonious debate displayed on the pages of *Literaturnaya Gazeta* in 1987. In the course of a roundtable discussion under the title "Why Do We Have So Few Well-Educated People?" a panel of academics suggested that one answer was increased military demands for service by students and potential students.[4] The participants alluded to "the recently introduced practice of calling up students in the first and second courses and making them soldiers." They cited a certain rate of failure to return to their studies after military service, a reduction in the ability of the ex-soldiers to think creatively, and to historical examples of lost growth opportunities because of the "stupid and shortsighted" (*glupo i nedal'novidno*) practice of drafting students. These views were strongly challenged in a letter written by Col. Gen. M. A. Gareyev, the Soviet Deputy Chief of Staff.[5] His basic points were that military service need not be viewed as a loss either to the individual or to the state, that as a matter of equity students should not be exempted from service required by law of all Soviet citizens of draft age, and that military service was vital for

[4]*Literaturnaya Gazeta*, 13 May 1987, p. 12.

[5]*Literaturnaya Gazeta*, 3 June 1987, p. 11.

inculcating deep moral principles and a Marxist-Leninist world view. Other articles followed from the exchange.[6]

This fascinating eruption into the open press certainly suggests that substantial cuts are being made in student deferments, but it is difficult to determine how deep these cuts actually go. The actual list of deferment-eligible institutions and faculties has never been made public. The increased bite that restricted deferment places on the Soviet student population can only be inferred indirectly. We are told that the number of exempted institutions may be "counted on one's fingers,"[7] and there are stories of students drafted two months into their freshman year from as lofty an institution as Moscow State University.[8] In Lithuania, however, both the Academy of Agriculture with 6,800 students and the Kaunas State Medical Institute with an enrollment of 27,000 were stated to be on the exempted list.[9] Although these represent fully half of the Lithuanian student population, the large majority of students at the Medical Institute are almost certain to be female, so male students deferred must be well under one-half of the total.

Nor can we conclude that all students attending agricultural academies are necessarily deferred. A 1987 Soviet television program carried an interview with a senior sergeant in a tank division who identified himself as a student at the Ivanovskii Agricultural Institute to which he would return after his service.[10] It may be that the state of agricultural performance in Lithuania, or some particularity of the training program at the Academy, caused it to be placed upon the protected list. It may also be that priorities have shifted over time. An article from early 1984 lists acutely scarce specialties for which admission requirements will be eased: metallurgy, mining, oil production, construction, transportation, agriculture, "and other leading sectors."[11] However, when Ligachev recently enumerated a list of specialties not being prepared in sufficient numbers by VUZy, they included electronics, instrument making, automation, and robotics as well as economic management, law, applied sociology, and psychology.[12] It is by no

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[6]See, for example, "To Whom Is It Painful to Serve?" in *Komsomol'skaya Pravda*, 13 June 1987.

[7]*Komsomol'skaya Pravda*, 13 June 1987.

[8]*Sovyetskaya Rossiya*, 2 November 1984, p. 6.

[9]*Sovyetskaya Litva*, 20 March 1982, as quoted in Jones, 1985.

[10]*Sluzhu Sovyetskomu Soyuzu*, broadcast 15 February 1987.

[11]*Krasnaya Zvezda*, 26 May 1984, p. 5, as reported in JPRS, "Soviet Union: Military Affairs," 13 September 1984.

[12]*Pravda*, 18 February 1988, pp. 1–4, as reported in FBIS, "Soviet Union: Daily Report," 18 February 1988.

means certain that such a listing would correspond to the official list of deferment-eligible institutions. (It is, however, a fascinating insight into how the official view of what constitute the prime sources of economic growth has changed since the Gorbachev ascendancy.) But it would also appear that an institution of higher learning need not have a direct military connection to be on the list. As an example, we may infer from the content of a muckraking 1985 article that students at the Moscow State Institute for International Relations receive deferments.[13]

That the list is susceptible to modification is attested to by a filler piece that appeared recently in the back pages of *Literaturnaya Gazeta*.[14] It stated that the newspaper had received information that the deferments of students at a number of VUZy throughout the country were to be restored.[15] This step was being taken in specific recognition of the need to raise the quality of specialists required in a time of acceleration and restructuring. It bespeaks a consciousness on the part of the leadership of the possible economic costs of the military's demand for manpower.

The actual number of students involved is difficult to estimate. We do not know how many educational establishments are on the list that makes their students eligible for deferment. If, as we are told, that of some 896 VUZy and 4,506 SSUZy[16] in the Soviet Union you could "count on your fingers" the number whose students are granted deferments, then the number must be small indeed. However, this statement is likely to be hyperbole, especially as one of the major official justifications for reducing the numbers of students deferred is to affirm the principle of socialist equality before the law. Any calculation of affected males is further complicated by the fact that the student rolls reported in *Nar. Khoz.* apparently also include students who have been conscripted. They are listed by the universities as being enrolled but

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[13]Major V. Svetikov, "The Collapse of Patronage," *Krasnaya Zvezda*, 29 June 1985, p. 2.

[14]*Literaturnaya Gazeta*, 3 June 1987, p. 11.

[15]The decision to take this step may have been the result of considerable internal debate during which pressure was placed on the military to try and find less intrusive means of filling its ranks. For example, in 1986, the induction procedures were changed so that students would be drafted only once a year rather than twice, and only in the spring after the completion of that year's round of examinations. See the interview with Major Gen. L. L. Sharashenidze in *Molodezh Gruzii*, 29 June 1986, p. 4, reported in JPRS, "Soviet Union: Military Affairs," 23 October 1986.

[16]*Nar. Khoz.* 1986, pp. 548–549. Note, however, that the majority of students in SSUZy are 15–19 years old.

on official leave of absence.[17] These serious impediments notwithstanding, what follows is an attempt to set bounds on the possible effect of the decision to refuse deferments to the majority of male students at VUZy and SSUZy.

Table 6 shows a calculation of the rate of student deferments in higher educational institutions from 1975 through the 1981–82 academic year, the last before the change in the conscription law was enacted. It assumes that the male/female ratio of all types of students, the only ratio that is officially reported, holds true for those enrolled as daytime students, the only ones eligible for deferment. When this number is compared with the number of 18-year-olds for each year, it suggests a student deferment rate for students in VUZy in the region of 12–13 percent. This is a maximum possible rate. It must be diminished by whatever fraction of the incoming daytime male students have already performed their military service. If only 75 percent of the

Table 6

THE RATE OF DEFERMENT FOR VUZy AND SSUZy STUDENTS, 1975–1982
(Thousands)

	Numbers of Male Students Affected[a]							
	in VUZy		in SSUZy[b]					
Year	Entering Class	Graduating Class	Entering Class	18 Yrs. or Older[c]	Graduating Class	Students Deferred[d]	Size of 18-Year-Old Pool	Deferment Rate (Percent)
1975–76	297.0	216.7	412.2	209	346.0	327.1	2560	12.8
1976–77	298.7	219.6	411.1	210	341.5	329.2	2549	12.9
1977–78	300.5	226.5	416.1	213	351.8	332.1	2539	13.1
1978–79	305.9	234.6	411.1	211	354.5	334.9	2529	13.2
1979–80	306.1	236.4	413.0	213	360.7	335.8	2519	13.3
1980–81	307.2	248.6	416.3	214	367.0	337.6	2439	13.8
1981–82	309.1	253.2	406.6	209	358.7	336.4	2362	14.2

SOURCES: *Nar. Khoz.*; Kingkade, 1987.

[a]Calculated from the male/female ratio found in *Nar. Khoz.*

[b]Daytime only.

[c]Assumes 35 percent are 15–17 years old and 90 percent of these attend daytime.

[d]Assumes 75 percent of VUZy and 50 percent of SSUZy entering students, 18 years or older, are draft eligible if not deferred.

[17]*Sovyetskaya Rossiya*, 2 November 1984, p. 6.

entering class are 18-year-olds without prior military service,[18] then the deferment rate for VUZy students is on the order of 9–10 percent.

The average annual enrollment in daytime SSUZy is half again the size of that for the VUZy. However, over 35 percent of all entering SSUZ students have not yet completed secondary education, presumably because they are 15–17 years old.[19] If we assume that 90 percent of these are enrolled in daytime courses, and the total male/female ratio in SSUZy is applied to these students, then a maximum of approximately 200,000 male students 18 years or over entered SSUZy on average in the years 1975–1981. However, a large share of these, perhaps 50 percent, are likely to have already served in the military; and even under the 1967 law a deferment at a SSUZ for the others was obtainable only if the student was enrolled in an officer candidate course.[20] Therefore, these probably contributed only another 4 percent or so to the deferment rate. Adding these to the figures for the VUZy deferments yields a pre-1982 student deferment rate of 13–14 percent.

Why should the military take on the issue of student deferment? The most obvious reason is likely to be the most important one. As Table 6 shows, as the size of the 18-year-old cohort dropped, not only did the maintenance conscription rate of the military rise, but under the pre-1980 rules the rate of student deferments increased as well. Indeed, by 1986–87, they might have increased to 16 percent or more in total compared with less than 13 percent before 1977. This is not a problem that would have presented itself so starkly during the first World War II demographic echo that had fallen in the early 1960s. The size of the entering class in VUZy and SSUZy was smaller then. In addition, the military was building down rather than increasing its size.

In theory, those deferred are not lost to the military forever. Deferred students will either serve a shortened conscript term after graduation or will be liable for callup as reserve officers. In practice, there must be three main reasons why the military pressed so hard to eliminate or reduce deferment of students.

The first relates to the problem of the demographic downturn. In this sense, the military might be said to have performed a present value calculation with the number of conscripts as their metric. In view of both the manpower buildup and the shortfall of conscript supply, the Ministry of Defense decided to borrow against the future more ample supply of youth available for military service guaranteed by the upswing due at the end of the demographic trough of 1987–88.

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[18]This is probably a lower bound.

[19]*Nar. Khoz.*, 1985.

[20]*Osnovy Sovyetskogo Voennogo Zakonodatel'stva*, Moscow, 1973, p. 59.

The second reason stems from the realities of post-graduation military service in the Soviet Union. Perhaps what concerned the military establishment more than the short-term loss of conscriptable youth who are deferred until graduation was that a high number of student deferments would inevitably lead to a high rate of permanent loss of conscripts for the military. This number would equal the total of those graduating students without previous military service who manage to avoid service completely, added to the total of those who serve but whose service must be normalized for the shortened period of service for graduates. These considerations may be expressed in a loss function, Eq. (1).

$$\Lambda = \alpha\,(DWO) + (1 - \alpha\,)(DWO)(L_n - L_s\,)/L_n + \beta\,(DOT) \qquad (1)$$

where Λ = the number of conscript equivalents permanently lost to the military
DWO = the number of students deferred without participating in reserve officer training
DOT = the number of students deferred who receive officer training
α = is the share of deferred students who avoid service as conscripted enlisted personnel
β = is the share of deferred students with officer training who avoid service as officers
L_n = the average length of service of normally conscripted troops
L_s = the average length of service of conscripted graduates

The first term on the right hand side of Eq. (1) indicates that by greatly reducing the number of student deferments the military reduces its permanent loss skimming from the α term. The value DWO represents a fundamental choice variable for Soviet policymakers. Although the α term itself may depend to some extent on the number of deferments granted and other policy choices, it is not completely subject to the wishes of policymakers. As time passes there is a greater likelihood that any individual deferred student will escape service altogether because of an ability to acquire a deferment of a different type (family hardship, formally or informally protected skill group, greater access to patronage, injury, etc.). The earlier he becomes subject to conscription, however, the less likely this is to be the case, suggesting a further reason why the military might be interested in curtailing educational deferments.

The second term indicates that even if a student eventually serves he is only worth 71 percent (18/25.2) on average what he would be worth to the military if they can enlist him before he becomes a student.[21]

The third term represents the loss due to an inability to call up deferred students who participated in reserve officer training. The term β is also most likely to be influenced by the passage of time.[22]

Equation (1) may be applied to the number of entering students in the years 1975–81 and compared with the size of the 18-year-old cohorts for those years. These results are reported in Table 7. The calculation assumes $\alpha = \beta = 0.25$, that the previous assumptions on the number of otherwise draft-eligible students hold true, and that 100 percent of all draft eligible SSUZ and 50 percent of all VUZ students are in officer training programs. This exercise would yield a permanent loss equal to 4–5 percent of the cohort size.

This loss is significant considering the very high rates of conscription the military is currently forced to press upon the present draft age cohort to maintain present forces. Reducing the number of student deferments could allow the military to have it both ways. The losses due to the first two terms of Eq. (1) are driven close to zero. Further,

Table 7

THE RATE OF PERMANENT LOSS TO THE MILITARY OF DEFERRED VUZy AND SSUZy STUDENTS, 1975–1982

Year	In OTC	Not in OTC	Total Deferred	Permanent Loss	Size of 18-Year-Old Pool	Permanent Loss Rate (Percent)
1975–76	215.7	111.4	327.1	105.6	2560	4.1
1976–77	217.2	112.0	329.2	106.3	2549	4.2
1977–78	219.4	112.7	332.1	107.2	2539	4.2
1978–79	220.2	114.7	334.9	108.3	2529	4.3
1979–80	221.1	114.8	335.8	108.6	2519	4.3
1980–81	222.4	115.2	337.6	109.1	2439	4.5
1981–82	220.5	115.9	336.4	108.9	2362	4.6

SOURCES: *Nar. Khoz.*; Kingkade, 1987.

[21]The first term is not normalized for a shortened term of service because it is intended to capture the military's conception of what its maximum theoretical loss might be. If one never is granted a student deferment, the full service term is obligatory.

[22]There might also be a fourth term because of the reduced service asked of reserve officers. This has been ignored for the present purpose as have all questions about the staffing of the officer corps.

minimizing losses according to the formula above does not reduce the military's supply of reserve officers. Students who enroll in VUZy after military service are still required to take ROTC courses if it is part of their department curriculum and to accept reserve commissions upon graduation.[23] Therefore, if most of those undergoing officer training in VUZy and SSUZy already served in the military before enrolling, the losses due to the third term are notional. This might be less true if there is increased pressure on the military to reduce to a minimum the degree of double jeopardy incurred by officer training graduates, effectively raising the value of β.

Finally, to the extent that students do avoid service entirely according to the loss formula, it deprives the military disproportionately of the more intelligent, and perhaps more ethnically desirable, potential recruits. The changing nature of the military's demand for skilled personnel, especially in view of the larger share of Central Asians in the draft age pool, may also have played a large role in motivating the military to press for drastic cuts in student deferments.

The Cost of Skilled Manpower Drawoffs

It is difficult to state with precision what the costs to the Soviet economy might be from the curtailment of student deferments. Some of the possibly important factors are also intangible. Will a stint of military service in as repressive an environment as that prevailing in the Soviet Army have a deleterious effect upon the creativity and inventiveness the former conscripts will bring to bear in their post-service studies, or will it make them more studious and dedicated? Some factors are difficult to calculate *ex ante*. What is the probable loss of potential students who never re-matriculate after service?[24] To what extent will the time that graduates who accept reserve officer commissions, and who are then actually called upon to spend in the service, be increased or decreased?

One factor may be measured: the number of skilled man-years lost because of the decrease in student deferments. Another way of interpreting Eq. (1) is to posit that the military's loss is the economy's gain. That is, the personnel equivalents permanently lost to the military are free to be employed as skilled, technical personnel in the civilian economy. This dichotomy is overly simplistic but is useful in establishing a rough scale for measuring the loss to the Soviet economy of the

[23]Personal communication from emigré sources.

[24]This might be less of a problem in the Soviet Union where the satisfactory alternatives to attendance at institutions of higher education are limited.

skilled manpower drawn off into the military by comparing this number with those actually working in the civil sector.[25]

Table 7 shows that the permanent loss to the military pre-1982 was on the order of 110,000 average conscript equivalents. Since the average term of service for a conscript is 25.2 months, this yields back to the economy 231,000 worker-years of skilled specialists. Given the assumptions that have been outlined above, this would break down into 174,000 worker-years of VUZ-trained professionals and 57,000 worker-years of SSUZ-trained specialists. How important is this for the economy?

The number of SSUZ trainees affected appears to be of little consequence in either absolute or relative terms. That of VUZ-trained professionals may be another matter. As an example, in 1977, there were 1,479,000 specialists with higher education (VUZ graduates) working in the Science and Science Services sector of the Soviet economy. Also in 1970, 57.4 percent of all specialists with higher education were classified as scientific workers (Nolting and Feshbach, 1979). If this appellation applies to those in the Science and Science Service sector, and the 1970 distribution still held true in 1977, it may be inferred that there were approximately 2,600,000 specialists with higher education at work throughout the economy in 1977. Therefore, the loss to the economy of having the military reduce its loss function by severely curtailing student deferments is approximately 6.7 percent of the annual worker-years provided by its cadre of VUZ-trained professionals.

Many assumptions are left unexamined by this simple exercise, among them the productivity of scientific workers in general and the aggregation of all such workers into one homogeneous type. Yet a loss of this size could conceivably be costly to the Soviet economy over the long term.

EFFECT OF MANPOWER DRAWOFFS ON CRITICAL SECTORS

Section III of this study considered the effect of military manpower requirements on the Soviet economy taken as a whole. The first part of Sec. IV looked at the effect upon a specific skill group. In balance, the conclusion is that although the gross demand for manpower by the military might be a considerable encumbrance upon the economy, the marginal requirement to support the current force levels have a

[25]This metric oversimplifies in the sense that it narrowly defines skilled manpower as consisting solely of those with higher degrees and that it assumes that skilled technical workers not actually in the military are not performing work of interest to the military.

minimally deleterious effect. However, the need to curtail student deferments may affect the development of the nation's scientific cadre. This section asks whether there might not be critical sectors in the Soviet economy that are inordinately affected by the military's demand for men of a certain age and skill class.

Rather than consider all such possibly affected sectors, the analysis will consider only one by way of illustration. The choice is the energy and resource extractive industry located in Siberia, a sector that would appear to be disproportionately disadvantaged by the priority given to the demands of the military. The nature of the industry and of its geography suggests a large need for young, healthy, and unattached males, both skilled and unskilled, precisely the type also sought by the armed forces. There is also reason to believe that shortages of manpower here would have an inordinately large effect on the economy as a whole given the share that Siberian output contributes to the total energy and raw material stock of the Soviet Union.

Accounts of the Siberian manpower shortage have long been a staple of the Soviet press. These shortages are exacerbated by the fact that the rapidly developing industries of the region are located far from the nation's traditional population centers in the Western Soviet Union as well as from the current areas of greatest population growth in Central Asia. Thus, in the early 1980s, the Secretary of the Krasnoyarsk party *kraikom* bemoaned the fact that the XI Five Year Plan called for 500,000 new workers and professionals to be employed in his region when 95 percent of the territory's able-bodied workers were already employed.[26] In the event, more than 86,000 new laborers were added in the Petroleum and Gas Construction Industry, and it may be inferred that a large share of them were employed on Siberian projects (Sedenko, 1987). The problems with providing an adequate labor force for the Siberian extractive industry and for other new regions of economic development (e.g, along the BAM construction project and the non-Black Earth agricultural regions) have been specifically tied in the Soviet press to the second demographic echo of the Second World War II.[27]

The needs of Siberia and the possibilities of its accelerated development seem to be in direct conflict with the manpower needs of the military. The Soviet Union as a whole suffers from a shortage of labor but the problem of assuring adequate labor inputs to Siberian industry appears to be even more acute. There has been considerable

[26]*Sotsialisticheskaya Indyustriya*, 8 January 1983, p. 2.

[27]Interview with L. Kostin, *Moscow News*, 10 March 1985, p. 12, reported in JPRS, *USSR National Affairs*, 21 March 1985, pp. S4–S8.

development of the gas, oil, and other extractive industries of the region in the past two decades, yet there is only a sparse indigenous population. To staff the mines, wells, and the refining and smelting industries, the greatest share of new labor inputs must be made up by migration from other regions of the Soviet Union. The question then arises whether the drawing off into the military of young and unattached males—that segment of the population most likely to be drawn to the challenge and potential reward of working in a frontier setting—has a direct ill effect on Siberian economic development. To what extent does the increased share of draft age cohorts inducted by the military affect the rate of Siberian economic growth?

The evidence of the Soviet press is that the conflicting claims are not as directly opposed as might first appear. The existence of military conscription is accepted as a fact of life by commentators on Siberian labor problems and does not enter the discussion of policy prescriptions.[28] The problem is less one of attracting migrants to Siberia than of being able to sustain and efficiently utilize the migrants after they have arrived. To the extent that the problem is one of management and adequate infrastructure, it reduces the importance of the conflict with the military over manpower.

Indeed, one of the phenomena that illustrate the true problems of Siberian development is the problem of uninvited migration. The enterprises of the oil and gas industry in the Tyuman *oblast'* have been regularly overfulfilling their employment plans. Nearly 300,000 workers, both invited and uninvited, have been coming to the oil and gas cities of West Siberia "every year since the beginning of the 1980s."[29] Less than one half of these will stay for any appreciable length of time. Even so, the population of the *oblast'*, which was expected to grow by 370,000 during the years 1981–1985, actually increased by double that amount.[30] The problem is not one of numbers, but rather the more mundane, but no less daunting, problems of matching the skills required by local industry with the skills the migrants bring, managing local labor efficiently, and providing the amenities that make it more likely that the worker coming to Siberia will remain. Siberia's problem is not that workers will not come there; the problem is retaining the workers who do come.

The workers required by Siberian industry are not the young and unskilled taken by the military, but the more skilled specialists. The

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[28]See for example V. Kuzmishchev et al., "Are They Doing Their Job?" *Pravda*, 10 December 1986, pp. 1, 3.

[29]V. Kuzmishchev et al., "How Many People Does the North Need?" *Pravda*, 26 January 1987, p. 2.

[30]Kuzmishchev et al., 1986.

Ministry of Construction for the Petroleum and Gas Industry places 10,000 workers a year in West Siberia. The average age of these workers is 32 years.[31] The other industries of the region are likely to place an even greater premium on older, more skilled workers. Indeed, the appearance of masses of young, unskilled workers at major Siberian projects, and the inability of the system to properly allocate them to tasks, is a major problem.[32]

The manpower problems of Siberia are not due to directly competing claims with the military over a specific body of workers but to the typical Soviet problem of inefficient labor utilization, often exacerbated by Siberian conditions,[33] and to a profound lack of infrastructure and basic amenities. Zaslavskaya, Kalmyk, and Khakhulina (1983), concluded that since wage levels in Siberia have grown more rapidly than republic averages in recent years, a deficient wage level is not the reason for the phenomenon of continuing emigration from Siberia. The solution is to improve the "entire complex of living conditions that promote the retention of the population": commodity supply; the supply of medical, cultural, and personal services; and especially housing.

There is an argument to be made that the priority of the military in the allocation of resources is indirectly a cause of the difficulties in developing Siberia's potential. This may well be the case.[34] But for the present purpose, having selected a sector and a locale that might be expected to provide a bell-wether for the direct conflict between the manpower claims of the economy and of the military, the conclusion must be that evidence for such crowding out in the labor market is lacking.

THE EFFECT OF ECONOMIC REFORM

The discussion so far has proceeded from the assumption that institutions and fundamental Soviet practice will remain the same. However, under the Gorbachev leadership a national reappraisal of basic

[31]V. T. Sedenko, "Man is at the Center of Attention," *Stroitelstvo Truboprovodov*, February 1987, translated in JPRS, *USSR: Economic Affairs*, 16 June 1987, pp. 104–111.

[32]Interview with L. Kostin, *Moscow News*, 10 March 1985, p. 12, reported in JPRS, *USSR National Affairs*, 21 March 1985, pp. S4–S8.

[33]See, for example, A. Isayev, "The Timber Potential of Siberia," in *Sotsialisticheskaya Industriya*, 12 September 1985; and N. Shilo and V. Chichkanov, "Socio-Economic Problems of the Development of the Far East," *Planovoe Khozaistvo*, November 1981, pp. 74–78.

[34]One might also argue conversely that given the presumed contributions of military construction assets to the development of Siberian infrastructure, reductions in support personnel might adversely affect Siberian development prospects.

economic assumptions is currently underway. Among the areas touched upon are the sensitive issues of wage and employment policies.

Heretofore the Soviet economy has been profligate with its labor resources. Underemployment stems from the low real cost to enterprises of maintaining what is essentially an internal labor reserve within the enterprise, employees who are effectively supernumeraries who provide an insurance policy in the case of cyclical surges resulting from the phenomenon of "storming" the plan, or from frequent plan changes. Soviet sources suggest that the practice of overmanning affects as much as 15–20 percent of enterprise personnel on average.[35] Private estimates are even higher. Even if these statements are taken to apply only to industrial enterprises, it suggests that as many as 5–8 million Soviet workers are redundant and could be more effectively employed elsewhere. The phenomenon appears to be more widespread, however. One Soviet estimate is that 12–13 million Soviet people are doing "needless and sometimes counterproductive" work and that 10–20 million should leave their present jobs.[36]

That appears to be the intent of reform measures currently under discussion. The combination of making it possible for socialist enterprises to be dissolved and increasing the cost to enterprises of their work force may force the involuntary dismissal of "millions" of workers.[37] One source is explicit in saying that when speaking of cuts of this magnitude, they expressly apply to production personnel, not merely the oft-abused bureaucracy, and that 16 million Soviet workers should expect to lose their jobs in the next twelve years.[38]

These Soviet sources are not suggesting that there will be massive unemployment in the nation. Rather, the previous Soviet definition of socialist job security—namely, the guarantee of a job in the same city, at the same plant, and at a specific work station—needs to change and labor must be more efficiently allocated. Labor policy has been shaped by actual changes already in place ranging from campaigns against alcohol and for greater discipline to greater mechanization and emphasis on shift work. The more radical changes, yet to be implemented, would include increased wage differentiation, job certification, retraining, and actual layoffs of redundant workers as enterprises are forced to internalize the consequences of their inefficiencies.

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[35] *Sotsialisticheskii Trud*, 1980, No. 1, p. 71; Kvasha, *Demograficheskaya politika v SSSR*, 1961, cited in Porket, 1985.

[36] "The USSR This Week," Radio Liberty, 13 November 1987, p. 2.

[37] *Trud*, 28 January 1988.

[38] *Izvestiya*, 13 February 1988.

It remains to be seen how successfully these reformist sentiments are translated into practice. Hungary and Poland have also attempted to redefine the traditional socialist employment relation. While some success has been achieved in these countries through the de facto reallocation of labor to the cooperative sector, until recently the effect on the efficiency of labor allocation in the state sector has been modest. If the Soviets cannot achieve a greater degree of success in labor and wage reform, then the discussion presented in Sec. II will still hold true. Although the demographic trough will have passed by 1987–1988, the Soviets may not count on any source other than the gradual demographic upswing to ease the manpower pinch. To maintain the military at the present levels will involve the modest but nontrivial costs discussed previously.

In the case of success, two results would affect the military staffing question, if in opposing directions. The first result would obviously be to considerably ease the manpower pinch. If several million workers were to become available to the economy through more efficient allocation, this increment would dominate the number necessary to maintain forces at their current level, thereby reducing the pressure on the civilian labor pool. Indeed, it is clear from the statements quoted above that substantial success in this direction would be of a sufficient magnitude to dwarf the size of the Soviet military in its entirety.

The second result is a bit more subtle but could affect Soviet manpower deployment thinking over the longer term. A more rational reallocation of labor in the economy, if successful, would necessarily increase average productivity per worker. The argument raised above, that because of the inefficiencies of labor allocation and management the opportunity cost of removing a potential worker from the economy and placing him in the military is low, would no longer hold true. The opportunity cost of military manpower would increase. What is more, since successful reform and reallocation would probably be based upon more efficient labor markets and more rational wage rates and tax schedules, the mechanisms used to achieve such reallocation would also make it possible to calculate for the first time the actual cost to the economy of labor forgone through conscription. This could conceivably lead to a reappraisal of the value to the nation of keeping so many men under arms. Finally, if higher productivity is sought from workers, they must receive something in exchange as an incentive to be more productive. This could make more acute the diversion of resources from production of consumer goods to the manufacture of equipment procured by the military, again forcing a reassessment of the opportunity cost of maintaining large forces.

No simple predictions can be offered here. There are too many elements difficult to foretell. The tendency of reform, however, should be in the direction of easing the overall manpower pinch, thereby reducing pressure on the military, while keeping the question of aggregate manpower allocation topical for a long time to come.

V. CONCLUSIONS

In light of Soviet demographic trends and the nature of Soviet institutions, it does not seem likely that the total number of men under arms exceeds 5.4 million, if that. If the 1970 estimates of Soviet force size are taken as accurate, the increase since then could not have been as great as one million men. Even this figure can be arrived at only by making exceedingly generous, even unrealistic, assumptions.

This moots a good deal of the speculation over the economic cost of Soviet military manpower buildups. It means that although there is certainly a labor shortage in the Soviet Union, the leadership will not view it as stemming from the depredations of the military conscription system. Both the manpower pinch of the military and the shortage of labor in the economy stem largely from exogenous demographic trends.

By the end of 1988 the Soviet Union will have turned the demographic corner. It will have passed the trough of the second demographic echo stemming from the losses of World War II. The leadership has weathered the storm of the demographic downturn while apparently increasing or maintaining forces by employing expedients that are just short of what they might resort to in the face of a national emergency. In particular, the drafting of students could have longer run implications for the development of the scientific and professional cadre. Through its first three years, the actions of the present Soviet leadership have reiterated the traditional identification of the strength of the regime with the strength of the armed forces. That having been said, and taking into account how modest would be the contribution to economic growth by taking the military down to its previous staffing level, economic factors related solely to the need for labor in the economy are unlikely to affect decisions over force reductions.

This conclusion rests upon acceptance of the Collins estimates of Soviet force size—that is, that no builddown has occurred to date. This assumption may be a strong one. In particular, it is possible that a *de facto* builddown has already occurred by having military units drop below their authorized staffing levels. The analysis in this report suggests strongly that such is the case. While the economic costs of military manpower may not be great, the hand of the Soviet leadership could be forced by the difficulties of maintaining staffing at the current levels.

Concern over the procurement and maintenance costs for a large armed force may be another matter. The Soviet leadership may hope that substantial reforms in the economic system will lead to better use of the nation's labor resources, but the prospects for instituting fundamental changes in the economy may be threatened by continuing defense expenditures at the current levels. Force reductions may then occur as a result of calculations that give weight to external political considerations or to the increasing expenditures necessary to maintain a sufficient level of modernity in Soviet forces; or they could stem from a reassessment of the priorities for resource allocation in the domestic economy or come about because of reassessing military doctrine. If the choice is between maintaining present forces but endangering the current program of reform and restructuring, or reducing military expenditures to relieve pressure in the economy, the military may be asked to make substantial sacrifices in the interest of future prospects of both the military and the nation.

It is interesting to compare the results of this analysis, completed before Gorbachev's 7 December 1988 speech to the United Nations, with the announcement that the Soviet military is to be cut by 500,000 men over the next two years. The meaning of the unilateral action is still unclear and its effects may be debated. One may certainly speculate that the policy is related to the troubled state of the program for *perestroika*, restructuring, of the Soviet economy and the great effects that defense expenditures have upon the outlays for priority civilian sectors.

The move will bring the manpower equation into balance. Again, using the Collins numbers, the assumptions of Sec. II, and the multi-year conscript model,[1] if the military were reduced by one-half million, by 1990 there would then be a slight surplus of potential recruits amounting to 2 percent of total conscript requirements. The problem that the military must be experiencing in maintaining authorized unit strength levels, as well as that of securing the priority for rebuilding the civil economy, would both be alleviated by this measure.

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[1]Assuming 18-year-olds are conscripted at a rate of 70 percent, 19-year-olds at 15 percent, and 20-year-olds at 10 percent yields an overall conscription rate of 77.1 percent. This rate would permit substantial reinstatement of student deferments.

Appendix A

DETAILED ASSESSMENT OF SOVIET FORCES, 1970–1986

(Collins, 1980, 1985; Collins and Victory, 1986)
(Thousands)

Year	1970	1971	1972	1973	1974	1975
Str. Rocket Force	555	553	548	549	529	508
combat:	370	372	368	369	353	330
support:	185	181	180	180	176	178
of which Long Range						
combat:	235	237	233	234	224	210
support:	115	111	110	110	106	109
of which MRBM/IRBM						
combat:	135	135	135	135	129	120
support:	70	70	70	70	70	69
Ground Forces	2160	2232	2232	2320	2390	2463
combat:	1415	1487	1487	1575	1645	1718
support:	745	745	745	745	745	745
Air Defense	615	618	612	613	602	605
combat:	475	478	473	472	468	465
support:	140	140	139	141	134	140
Air Force	347	393	406	412	465	443
combat:	230	273	285	290	340	319
support:	117	120	121	122	125	124
Navy	497	472	502	488	497	415
combat:	400	375	405	391	400	296
support:	97	97	97	97	97	119
Border Troops	158	156	157	157	157	157
combat:	130	129	130	130	129	129
support:	28	27	27	27	28	28
Internal Troops	174	172	173	173	172	172
combat:	145	144	145	144	144	144
support:	29	28	28	29	28	28
TOTALS:						
Command, Support	1341	1338	1337	1341	1333	1362
Total Combat	3165	3258	3293	3371	3479	3401
Total, est.	4506	4596	4630	4712	4812	4763

Year	1976	1977	1978	1979	1980	1981
Str. Rocket Force	502	473	435	430	425	432
combat:	321	284	270	267	259	274
support:	181	189	165	163	166	158
of which Long Range						
combat:	201	166	157	159	156	164
upport:	109	112	88	90	91	84
of which MRBM/IRBM						
combat:	120	118	113	108	103	110
support:	72	77	77	73	75	74
Ground Forces	2465	2457	2460	2440	2450	2882
combat:	1720	1712	1715	1695	1705	1800
support:	745	745	745	745	745	1082
Air Defense	611	633	654	654	654	664
combat:	471	518	493	490	492	502
support:	140	115	161	164	162	162
Air Force	419	420	421	420	420	425
combat:	298	298	298	299	299	305
support:	121	122	123	121	121	120
Navy	418	428	415	419	419	429
combat:	298	308	295	299	308	309
support:	120	120	120	120	111	120
Border Troops	157	157	160	159	159	158
combat:	129	129	132	132	132	132
support:	28	28	28	27	27	26
Internal Troops	299	299	299	300	300	280
combat:	250	249	250	250	250	240
support:	49	50	49	50	50	40
TOTALS:						
Command, Support	1384	1369	1391	1390	1382	1708
Total Combat	3487	3498	3453	3432	3445	3562
Total, est.	4871	4867	4844	4822	4827	5270

Year	1982	1983	1984	1985	1986
Str. Rocket Force	439	437	429	429	435
combat:	283	281	277	277	280
support:	156	156	152	152	155
of which Long Range					
combat:	179	177	177	177	180
support:	102	102	102	102	105
of which MRBM/IRBM					
combat:	104	104	100	100	100
support:	54	54	50	50	50
Ground Forces	2840	2930	3020	3020	3030
combat:	1812	1900	1990	1990	2000
support:	1028	1030	1030	1030	1030
Air Defense	494	494	494	494	520
combat:	386	386	386	386	420
support:	108	108	108	108	100
Air Force	431	431	433	454	454
combat:	352	352	354	371	371
support:	79	79	79	83	83
Navy	432	444	452	479	479
combat:	312	323	324	348	348
support:	120	121	128	131	131
Border Troops	215	215	215	215	215
combat:	180	180	180	180	180
support:	35	35	35	35	35
Internal Troops	304	304	345	345	345
combat:	264	264	305	305	305
support:	40	40	40	40	40
TOTALS:					
Command, Support	1566	1569	1572	1579	1574
Total Combat	3589	3686	3816	3857	3904
Total, est.	5155	5255	5388	5436	5478

Appendix B

DERIVATION OF THE CONSCRIPT SHORTFALL MODEL

The number of conscripts required by the military each year is given by the following series of equations:

$$C_{D_t} = k_c \times MIL_t \times 12/\tau \quad \text{(B.1)}$$

$$k_c = 1 - k_o - k_l \quad \text{(B.2)}$$

$$\tau = 24 \times \varphi_2 + 36 \times \varphi_3 \quad \text{(B.3)}$$

and

$$\varphi_2 + \varphi_3 = 1 \quad \text{(B.4)}$$

where

C_{D_t} = the number of conscripts demanded in year t
MIL_t = the total number of men in the military in year t
k_c = the fraction of MIL_t that must be conscripts
k_o = the fraction of MIL_t who are officers and cadets
k_l = the fraction of MIL_t who are long-term enlisted personnel
τ = the average term of service in months of a conscript
φ_2 = the fraction of conscripts whose term is two years
and φ_3 = the fraction of conscripts whose term is three years.

The actual shortfall (if negative) or surplus (if positive) of potential conscripts to meet the conscript demand stated in Eq. (B.1) is given by:

$$\zeta_t = POOL_{18_t} \times r_{18} + POOL_{19_t} \times r_{19} + POOL_{20_t} \times r_{20} - C_{D_t} \quad \text{(B.5)}$$

where

ζ_t = the shortage (surplus) of eligible males to fill the conscript slots demanded in year t
$POOL_{i_t}$ = the pool of all males of age i in year t
and r_i = the rate at which males of age i are available for conscription

The size of the various age pools for each year t is determined as follows.

If $C_{D_{t-1}} \leq POOL_{18_{t-1}} \times r_{18}$ (B.6.1)

then, $POOL_{19_t} = POOL_{18_{t-1}} (1 - m_{18}) - C_{D_{t-1}}$ (B.6.2)

where

m_{18} = the mortality rate for 18-year-olds.

Otherwise, the size of the 19-year-old pool is given by

$$POOL_{19_t} = POOL_{18_{t-1}} (1 - m_{18}) (1 - r_{18}) \quad \text{(B.6.3)}$$

Similarly, the pool of 20-year-olds is determined as follows.

If $C_{D_{t-1}} \leq POOL_{18_{t-1}} \times r_{18} + POOL_{19_{t-1}} \times r_{19}$ (B.7.1)

then, $POOL_{20_t} = POOL_{19_{t-1}} (1 - m_{19}) -$ (B.7.2)

$(C_{D_{t-1}} - POOL_{18_{t-1}} \times r_{18})$

Otherwise, the size of the 20-year-old pool is given by

$$POOL_{20_t} = POOL_{19_{t-1}} (1 - m_{19}) (1 - r_{19}) \quad \text{(B.7.3)}$$

Finally, the fraction of the conscript requirement that is not met in any year t, leading to a shortfall, is given by

$$\psi_t = \zeta_t / C_{D_t} \quad \text{(B.8)}$$

where

ψ_t = the fraction of the conscript requirement not met (if negative) by the pool of available males.

Appendix C

DERIVATION OF THE MODEL OF THE SOVIET ECONOMY

THE MODEL

In the model, GNP in year t is generated from six sectors as defined in Eq. (A.1).

$$GNP_t = INDOUT_t + AGR_t + TRAD/SER_t + CONSTR_t + TRAN/COM_t + OTHERSO_t \quad \text{(C.1)}$$

where

$INDOUT_t$ – value added in industry in year t
AGR_t – value added in agriculture in year t
$TRAD/SER_t$ – value added in trade and services in year t
$CONSTR_t$ – value added in construction in year t
$TRAN/COM_t$ – value added in transportation and communication in year t
and $OTHERSO_t$ – indicate other sources of value added in year t.

The heart of the model is the Cobb-Douglas production function (C.2) that determines the output of the industrial sector.

$$INDOUT_t = \alpha_t \, INDCAP_t^{1-\beta} \, INDLAB_t^{\beta} \quad \text{(C.2)}$$

where

$INDCAP_t$ – the value of the capital stock in industry in year t
$INDLAB_t$ – the number of workers in industry in year t

and α_t and β are fixed positive parameters representing total factor productivity and the output elasticity of labor, respectively. (The value for the output elasticity of capital, $1 - \beta$, follows naturally from the assumption of constant returns to scale.)

Values for β utilized in the model were chosen, as discussed in the text, rather than derived by regression. As a result, even though the

term α can be independently modeled quite satisfactorily as $\alpha_t = f(t)$, where $f(t)$ is a cubic function in time, the model uses the α_t that fit the historical data, because once the β parameter is chosen arbitrarily it constrains the possible values of α_t.

The value of the industrial capital stock is derived from Eq. (C.3).

$$INDCAP_t = INDCAP_{t-1} \times (1 - \rho) + INDINV_{t-1} \qquad \text{(C.3)}$$

where

$INDINV_{t-1}$ = capital investment in industry, lagged one year

and ρ is the average retirement rate of capital stock in Soviet industry.

The level of investment in industrial capital is determined, in turn, by Eq. (C.4).

$$INDINV_{t-1} = \sigma \times [GNP_{t-1} \times (1 - (KREP/GNP)_{t-1}) - CONSUM_{t-1} - DEF_{t-1} - COMUD_{t-1} - OTHERUS_{t-1}] \qquad \text{(C.4)}$$

where

$KREP/GNP_{t-1}$ = the historical value of capital repair expenditure per ruble GNP in the year $t-1$

$CONSUM_{t-1}$ = consumption in the year $t-1$

DEF_{t-1} = the level of defense expenditures in year $t-1$

$COMUD_{t-1}$ = the value of dual use durable produced in year $t-1$

$OTHERUS_{t-1}$ = other end uses of GNP in year $t-1$ (which would include net exports)

and σ = the historical share of industry in total new fixed investment.

Value added in the six sectors was calculated as follows. For the variable on agricultural value added, it was assumed that

$$AGR_t = AGR_{t(hist)} \qquad \text{(C.5)}$$

that is, the historical series of value added in agriculture was used. Since output in this sector depends greatly on exogenous factors such as weather, it was deemed best to leave it exogenous in the formal model specification. All other variables in the GNP origin equation (C.1) were endogenized as follows:

$$TRAD/SER_t = a_1 + b_1 \times CONSUM_t \quad \text{(C.6)}$$

$$CONST_t = a_2 + b_2 \times INDOUT_t \quad \text{(C.7)}$$

$$TRAN/COM_t = a_3 + b_3 \times INDOUT_t \quad \text{(C.8)}$$

$$OTHERSO_t = a_4 + b_4 \times GNP_{t-1} \quad \text{(C.9)}$$

The values of the parameters a_i and b_i were determined through ordinary least squares regressions performed on historical data from 1970–1985. Their values are represented in Table C.1.

The derivation of the variables for defense expenditure (DEF) and civilian consumption (CONSUM) are discussed in the main text.

DATA SOURCES

The historical series for GNP and value added in the sectors of Construction, Trade and Services, Industry, Transportation and Communication, and Agriculture were derived from JEC (1982) through 1980 and updated by CIA/DIA (1987) through 1985. The series on capital repair (KREP) expenditures was calculated from data in JEC (1982).

Table C.1

VALUES OF PARAMETERS IN SECTORAL VALUE ADDED EQUATIONS
(Standard errors in parentheses)

TERM	a_i	b_i[a]	R^2
$TRAD/SER_t$	– 84.7269	0.848909 (0.057433)	.936
$CONST_t$	2.149139	0.211557 (0.006364)	.987
$TRAN/COM_t$	– 6.99752	0.353512 (0.006182)	.995
$OTHERSO_t$	5.577997	0.007824 (0.000283)	.983

[a]All b_i significant to the .99 level.

The series on defense expenditures was obtained by taking the midpoint of the upper and lower bound estimates reported in JEC (1982) and updated beyond 1980 through the use of growth figures obtained from JEC volumes on *The Allocation of Resources in the Soviet Union and China*, various years.

The historical series on stocks of fixed capital in industry was obtained from CIA, 1982. Labor force data, broken down by sector, were obtained from Rapawy, 1987.

Data on the size of Soviet military forces were obtained from Collins, 1980, 1985; Collins and Victory, 1987.

Estimates for the average annual rate of retirement of Soviet industrial capital stock (ρ), and for the historical share of industrial investment in total new fixed investment (σ) were obtained by interpolation from data found in Leggett, 1987.

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