East Germany's Military: Forces and Expenditures

Keith Crane

October 1989

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PREFACE

This study is the first task of an exploratory project on the Warsaw Pact in the Policy and Strategy Studies Program of RAND's Arroyo Center. The study assesses the German Democratic Republic's (GDR) contribution to the Warsaw Pact. It is designed for officers and individuals involved in threat assessments and force planning for NATO and the United States and should be of particular interest to analysts who assess the East German military.

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SUMMARY

Since the late 1970s, NATO has postulated that a likely scenario for a Warsaw Pact assault on the Federal Republic of Germany (FRG) would consist of in-place, unreinforced troops attacking with little tactical warning. This scenario would be possible only with the participation of East European forces, including those of the GDR. The continued feasibility of this scenario depends on the ability of these forces to effectively participate in such an attack.

In the 1980s, reported Czechoslovak and Polish military expenditures have grown at about 1 percent per year in real terms. Readiness levels have fallen. In contrast, the GDR has reported increases in its military expenditures of over 6 percent per year, and modernization has continued. Thus, if non-Soviet forces continue to play an important role in Soviet military planning, the Soviets may be increasing their reliance on the GDR.

This study is designed to assess the military role of these East German forces, past and present, within the Warsaw Pact. The study is not a military analysis of the strengths and weaknesses of the East German army, the National Volksarmee (NVA) as a fighting force. Rather, it attempts to size the military effort of the GDR in terms of force structure and expenditures to assess whether the GDR has been playing an expanded military role in the Warsaw Pact or will be capable of doing so.

The study first assesses the validity of the reported East German defense budgets. In contrast to the Soviet budget, which deliberately underreports budgeted military expenditures, the East German budgets may encompass almost all actual spending, including expenditures on personnel, operations and maintenance, and procurement.

The study then assesses East German military and security expenditures in terms of their size and growth. The military is absorbing a large and increasing portion of East German utilized national income (UNI), goods available for consumption or investment. **Military and security expenditures have risen from 3.7 percent of UNI in 1962 to 9.2 percent in 1986.** This is a very large share, much higher than in any other country in the Pact with the exception of the Soviet Union. The military budget alone takes almost double the shares of the Polish and Hungarian budgets. Military and security expenditures have grown at 6.4 percent per year in nominal terms over the past decade. **However, much of these increases consists of**

hidden inflation. When deflated by Western estimates of East German inflation, since 1977 real increases in military and security spending have averaged a more moderate 3.3 percent per year.

Reconstructions of the composition of military spending indicate that most of these monies are spent on military construction and procurement, a great deal of the latter imported from Czechoslovakia, Poland, and the Soviet Union. Tentative estimates of military imports place an upper bound on them of 8–10 percent of total imports from the Soviet Union, the GDR's largest trading partner, 10–20 percent of machinery imports from Czechoslovakia, and 34–41 percent of machinery imports from Poland, two of the GDR's top five trading partners.

What has the GDR purchased with these expenditures? The study attempts to answer this question by examining the forces fielded and assessing East German military modernization. Present force levels are compared with the Group of Soviet Forces—Germany (GSFG) and with Czech and Polish forces to assess relative strengths in terms of numbers of men and equipment.

Despite the more rapid rate of increase in its military budget, the GDR has not modernized its ground forces more rapidly than Czechoslovakia, or even Poland, both of which have more T-72 tanks in their inventories. The GDR does appear to have modernized its air force slightly faster than either of these two countries. The only service to exhibit substantially greater modernization is the East German navy. Soviet ground and air forces in the GDR appear to continue to be considerably more modern and powerful.

The study also assesses potential manpower constraints on the East German military because the numbers of East German 18-year-olds have fallen. The GDR will have great difficulty in sustaining current force levels over the next decade. Conservative estimates of the numbers of draftable men show shortfalls of over a division in 1992 and 1993. The recent announcement of plans to cut 10,000 men from the NVA was due to shortages of draft age males as well as political reasons. **Further reductions of at least 6000 men are to be expected in the next three years.**

The East German government has already introduced measures to mitigate this problem. More women are being permitted to serve in administrative jobs. The government is attempting to increase the number of career soldiers through earlier recruitment and expanding the number of slots. It is also trying to reduce employment possibilities for young males elsewhere in the economy. It may try to increase the conscription period for army draftees from 18 to 24 months. However, none of these measures appears capable of eliminating

constraints on manning levels stemming from the decline in 18-year-olds.

The study concludes with an assessment of the sustainability of current military expenditure levels. Prospects for maintaining these levels are mixed. A small model of the East German economy constructed with East German data indicates that growth could remain strong enough to support substantial annual increases in military spending over the next decade. However, East German data are not the most reliable. Other indicators point to slower economic growth and declines in the rate of increase in military spending. East German trade and investment performance has been poor, and the 1980s were characterized by a severe recession during which military expenditures continued to increase. Although expenditure levels are very high both in absolute terms and as a percentage of UNI, government and military officials have begun to ascribe high priority to economizing on military expenditures. The 1988 and 1989 defense budgets were increased by only 3.4 percent, roughly half the average rate of the previous decade. Thus the announcement of a 10 percent reduction in the military budget in 1990 was motivated by economic as well as political reasons.

Increasing military spending is likely to become more difficult. Increased domestic pressure for improved living standards and better product quality coupled with Soviet pressures to improve exports imply a need for more investment and, more specifically, more investment in Western machinery. In fact, in both 1987 and 1988 East German investment and imports of Western machinery boomed. Increased Western imports of investment and intermediate goods and materials unavailable in the GDR or from the rest of the Soviet Bloc implies expanded trade with the West. It is unlikely that the military budget will be spared, if the GDR attempts to increase investment and hard currency exports (needed to pay for hard currency imports) to achieve the improvements in product quality that consumers demand.

Simultaneously, the East German leadership faces increasing religious and social opposition to the militarization of society. During a period of increased contacts between the GDR and the Federal Republic of Germany and in the context of Gorbachev's promise to reduce Soviet troops in the country the political difficulties of maintaining today's high level of military spending will increase.

How will the declines in conscript-age youth and the pressures on military expenditures show up in force levels and readiness? Although the answer to this question is speculative, intelligence

analysts should concentrate on detecting the following changes in the next few years:

- Possible restructuring from divisions to brigades in the manner of the Hungarians or, more likely, substantial reductions in manning in some divisions, even if tours of duty are extended. In particular, analysis should determine whether and how announced cuts have been implemented.
- Changes in the composition and tempo of force modernization. Given current economic stringencies and the planned reduction of the defense budget, it is highly unlikely that the East Germans will attempt to modernize their ground forces rapidly in coming years. Planned reductions of one tank regiment per division will render the NVA a much less potent fighting force. Despite the larger reduction in Soviet forces and equipment in the GSFG, disparities between the GSFG and the NVA will remain large because the GSFG fields more modern tanks and more artillery.

In light of the severe manpower constraints and pressure to restrain military spending, the East German government should find a further reduction in its forces either unilaterally or under a conventional arms control agreement an attractive solution to its problems. A Warsaw Pact proposal to disband an East German division would not be surprising. Negotiators must be aware, however, that the equipment of East German divisions will still be substantially less modern than that of the GSFG. Furthermore, the East Germans are likely to be forced into further reductions in manning levels for demographic reasons even without a conventional arms control agreement.

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CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS ix

TABLES xiii

Section

I. INTRODUCTION 1
- Objective 2
- Approach 2

II. THE GDR'S MILITARY CONTRIBUTION: EXPENDITURES 5
- Reported Military Expenditures 5
- The Veracity of Reported Expenditures 9
- Estimating Expenditures by Category 14
- Military Spending Trends 29

III. THE GDR'S MILITARY CONTRIBUTION: FORCES 34
- Total Forces 34
- The Army 35
- The Air Force 38
- The Navy 38
- Border Troops 40
- Summing Up 40

IV. DEMOGRAPHIC CONSTRAINTS ON THE EAST GERMAN MILITARY 42
- The Declining Conscript Pool 42
- Policy Changes to Cope with the Crunch 45
- Emigration 48

V. ECONOMIC CONSTRAINTS ON THE EAST GERMAN MILITARY 51
- Increases in Output 51
- Labor 52
- Capital 53
- Factor Productivity 54
- International Competitiveness 58

Overall Assessment 63
Implications of Economic Trends for Military Spending . 64

VI. CONCLUSIONS 66
Expenditures 66
Forces 67
Manpower 67
Sustainability of Expenditures 68
Potential Changes in Forces 70

Appendix
A. ESTIMATING UTILIZED NATIONAL INCOME 73
B. MODELING THE EAST GERMAN ECONOMY 75
C. FACTOR PRODUCTIVITY MEASURES 76

BIBLIOGRAPHY 77

TABLES

1. East German military expenditures 6
2. Decomposition of East German military expenditures 10
3. Alton personnel cost estimates as a percent of RAND estimates 15
4. Extrabudgetary personnel costs 16
5. Estimating military construction and procurement 19
6. Estimates of East German imports of arms 23
7. East German exports of arms 24
8. Estimated East German military R&D costs 26
9. Potential subsistence costs for the GSFG 28
10. Composition of the NVA 36
11. Number of tanks of the GSFG, the GDR, Czechoslovakia and Poland 37
12. Air forces of the GSFG, the GDR, Czechoslovakia and Poland 39
13. Percentages of 18-year-old males needed to maintain current force levels 43
14. Projections of NMP, UNI, and military spending 52
15. The population of the GDR 53
16. Comparative productivity growth in Eastern Europe, 1968–85 54
17. Gross value-added in industry per unit of primary energy consumed 56
18. Changes in energy and materials usage per unit of output . 58
19. European CMEA shares in OECD imports 59
20. European CMEA shares in OECD imports of manufactures 61

I. INTRODUCTION

Since the late 1970s, NATO has postulated that a likely scenario for a Warsaw Pact assault on the Federal Republic of Germany (FRG) would consist of in-place, unreinforced troops attacking with little tactical warning.[1] This scenario assumes that 20–40 percent of the attacking forces would be Czechoslovak, East German, and Polish,[2] and 60 percent of the tactical aircraft participating in such an event would be provided by non-Soviet Warsaw Pact (NSWP) forces.[3] The continued feasibility of this scenario depends on the ability of these Northern Tier forces to participate effectively in such an attack.[4]

The contribution of Czechoslovak and Polish forces to the Warsaw Pact has almost stagnated in the 1980s. After inflation is accounted for, their reported military expenditures have grown at about 1 percent per year. Slow rates of military modernization and numerous reports of military belt tightening indicate that Poland and Czechoslovakia have economized on their militaries. Poland's continued economic difficulties and Czechoslovakia's stagnating economy have provided little basis for large increases in military spending. As the Soviets have continued to modernize their own forces in the region, the Poles and Czechoslovaks appear to be falling further and further behind.

In contrast, the German Democratic Republic (GDR) has reported increases in its military expenditures of over 6 percent per year since 1979; in 1987 nominal military expenditures were over 80 percent higher than in 1978. Because reported price inflation is so low in the GDR, these figures superficially indicate that spending in constant prices increased at roughly the same rate.

The differences in reported increases in military expenditures between the GDR and Poland plus Czechoslovakia are so great that they would imply that the GDR has gained a new role for itself within the Warsaw Pact. Increased expenditures should have led to more rapid modernization and higher training and readiness levels than in

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[1]Secretary of Defense Harold Brown, *Annual Defense Department Report for Fiscal Year 1980*, Department of Defense Press release, p. 119.

[2]Johnson, Dean, and Alexiev, 1982, p. 2; Johnson, 1987, p. 1.

[3]Martin, 1986, p. 211.

[4]The Northern Tier is composed of Czechoslovakia, the German Democratic Republic, and Poland. After the Soviet Union, they are militarily the most important members of the Pact.

Czechoslovakia and Poland. Soviet military planners may be relying more heavily on East German forces, while downgrading the role of the Czech and Polish militaries.

Political factors may also be singling out the GDR as the preeminent Soviet ally in the Warsaw Pact, a place previously occupied by Poland. The National Volksarmee (NVA) is the most modern, efficient army in the NSWP; it has served Soviet foreign interests in Africa and participated in the 1968 invasion of Czechoslovakia. If Gorbachev keeps his promises to withdraw six tank divisions, 5,000 tanks, and 50,000 men from Eastern Europe, the relative importance of the NVA in Warsaw Pact planning will grow.[5]

OBJECTIVE

The first objective of this report is to determine whether the GDR's role in the Warsaw Pact has changed relative to Soviet forces in the region, or to that of Czechoslovakia and Poland. In particular, it attempts to determine whether reported expenditures have been converted into a substantially more modern military force. The second objective is to assess the sustainability of a further East German military buildup in light of probable demographic and economic trends in the GDR. Shortages of draft-age East German males and economic stringencies are likely to severely constrain the expansion of the NVA. The analysis is designed to quantify and assess these demographic shortfalls and economic constraints.

APPROACH

Western analysts of the East German military have a curious mixture of information to draw on. Aerial and satellite surveillance; East German defectors; and U.S., British, and French military observers provide information on the size, composition, and organization of East German and Soviet forces. Policy statements and articles in the East German military press give some sense of the concerns and priorities of the military leadership. Economic, budgetary, and demographic data provide a basis for sizing the military in terms of its draw on economic and human resources.

All of these measures contain flaws. Marginal changes in force levels, especially personnel, would be very hard to detect from photo-

[5]Herspring, 1988, p. 101.

graphs. Policy statements are often misleading. East German economic and budgetary data are often faulty or incomplete.

To guard against false conclusions, this report uses several different sources of information. Conclusions based on various sets of data are compared to construct a composite picture of the past role and probable future of the NVA in the Warsaw Pact.

The report first charts the size and increases in East German military expenditures. It examines the veracity of reported military budgets by comparing them with building block estimates and reconstructions of the military budget computed from East German economic data. The reported expenditures are then used to size East German military expenditures in terms of the drain they place on the East German economy and compare these expenditures with those of other Pact members.

An attempt is made to decompose military expenditures into personnel, procurement, and operations and maintenance costs, and to estimate imports of military equipment. This exercise is designed to measure military expenditure levels and determine whether the rapid increases in the budget are reflected in increased expenditures, especially procurement. Potential support costs of the Group of Soviet Forces—Germany (GSFG) are also estimated to determine whether these could be covered out of the East German military budget. These estimates should shed light on the potential importance of East German military spending in relations between that country and the Soviet Union.

Section III assesses the value of the East German contribution to the Warsaw Pact in terms of the forces fielded. Present force levels are compared with the Czech and Polish armies and with the GSFG to assess their relative strengths. Changes in NVA forces relative to those of Poland, Czechoslovakia, and the GSFG are charted over time. The section also compares changes in military equipment holdings with reported budgets to assess the extent to which expenditures have been converted into capabilities.

Section IV assesses manpower constraints on the East German military over the next decade stemming from declines in the numbers of East German 18-year-olds. It examines the measures the East German government may take or has taken to mitigate the results of the decline in draft-age males and discusses the implications of social changes and relaxation of travel and emigration restrictions for sustaining conscription levels.

Section V assesses the sustainability of current military expenditure levels. A small model of the East German economy projects a likely growth path, which is used to assess whether the GDR will be

able to support substantial increases in military expenditures in the coming years or will face economic pressures to reduce the current rate of military expenditure increases. The section also assesses the probable constraints on economic growth that the GDR may experience in the years ahead, such as labor shortages, inefficient use of capital, and slower factor productivity growth.

The report concludes with an assessment of how the GDR's military contribution to the Warsaw Pact has changed and how it is likely to change over the next decade. It examines why the East German government has devoted so many resources to the military and discusses the implications of Soviet and East German promises of troop reductions for the role of the NVA.

II. THE GDR'S MILITARY CONTRIBUTION: EXPENDITURES

One measure of the GDR's contribution to the Warsaw Pact is military expenditures. Military expenditures are a very indirect mirror of military capability. Strategy, morale, leadership, and training are crucial factors in determining battle outcomes, none of which are directly related to expenditures. Monies can be wasted on buying equipment inappropriate for the eventual mission or on improper training. Nonetheless, equipment must be purchased, soldiers paid, and supplies bought. Total military expenditures reflect a country's investment in its military.

Military budgets and expenditures are frequently the form in which the political leadership grapples with the issue of national security. It is political leaders, not generals, who must make the decision to hold down expenditures on health while increasing expenditures on border guards. They are the ones who determine the rate of modernization and the composition of spending. Changes in the levels and composition of military expenditures reflect the preferences of the leadership concerning the role and importance of the armed forces.

Military expenditure estimates are also necessary for measuring the military burden—the share of total output or utilized national income (UNI) taken by defense.[1] Military burden estimates permit one to assess the tradeoffs between increasing expenditures on the military or on alternative expenditure categories. They also permit evaluation of the drain on the country of maintaining or increasing future expenditure levels in light of potential economic growth. However, to make this assessment, one needs to have accurate measures of how much is being spent and how much is available for expenditures.

REPORTED MILITARY EXPENDITURES

The information provided by the GDR on military spending is minimal (Table 1). No figures on defense spending were given until 1960 when the percentage of the national budget allocated to defense

[1]UNI is the material goods available for consumption or net investment.

Table 1

EAST GERMAN MILITARY EXPENDITURES
(Millions of Eastmarks)

Year	Reported Military & Security Expenditures	Reported Military Expenditures	Reported Security Expenditures	Military & Security Expenditures (constant prices) NMP Deflator 1970=100	Military & Security Expenditures (constant prices) Keren Deflator 1970=100	Reported Military & Security Expenditures % NMP	Reported Military & Security Expenditures % UNI	Military Expenditures % NMP
1960	1,000	NA	NA	14.9	14.9	1.4	1.5	NA
1961	1,000	NA	NA	14.7	14.9	1.4	1.4	NA
1962	2,700	NA	NA	39.8	40.3	3.6	3.7	NA
1963	2,800	NA	NA	41.5	41.7	3.6	3.8	NA
1964	2,900	NA	NA	43.0	43.2	3.6	3.8	NA
1965	3,100	NA	NA	46.7	46.2	3.7	3.8	NA
1966	3,200	NA	NA	48.4	47.7	3.7	3.7	NA
1967	3,600	NA	NA	53.4	53.7	3.9	3.8	NA
1968	5,787	NA	NA	85.8	86.3	5.9	6.0	NA
1969	6,350	NA	NA	94.1	94.7	6.2	6.1	NA
1970	6,747	NA	NA	100.0	100.0	6.2	6.0	NA
1971	7,200	NA	NA	106.7	106.0	6.3	6.2	NA
1972	7,625	NA	NA	113.0	111.6	6.3	6.3	NA
1973	8,328	NA	NA	123.4	121.1	6.6	6.4	NA
1974	8,938	NA	NA	132.5	125.8	6.6	6.5	NA
1975	9,564	NA	NA	141.0	130.5	6.7	6.7	NA
1976	10,233	NA	NA	150.9	135.3	6.9	6.8	NA
1977	11,023	7,868	3,155	162.6	141.2	7.1	7.0	5.07
1978	11,573	8,261	3,312	170.7	144.3	7.2	7.2	5.14
1979	12,148	8,674	3,474	179.2	147.4	7.3	7.5	5.20

Table 1—continued

Year	Reported Military & Security Expenditures	Reported Military Expenditures	Reported Security Expenditures	Military & Security Expenditures (constant prices) NMP Deflator 1970=100	Military & Security Expenditures (constant prices) Keren Deflator 1970=100	Reported Military & Security Expenditures % NMP	Reported Military & Security Expenditures % UNI	Military Expenditures % NMP
1980	13,086	9,403	3,683	179.4	154.1	7.0	7.2	5.03
1981	14,045.3	10,144.9	3,900.4	192.5	161.0	7.2	7.6	5.17
1982	14,954.4	10,776.4	4,178	205.0	167.3	7.4	8.3	5.36
1983	15,851	11,401.4	4,449.6	217.3	172.5	7.5	8.8	5.42
1984	16,991.1	12,222.3	4,768.8	232.9	NA	7.7	9.2	5.50
1985	18,069.1	13,041.2	5,027.9	239.2	NA	7.5	9.0	5.39
1986	19,430.3	14,045.4	5,384.9	257.3	NA	7.7	9.2	5.57
1987	20,898	15,141	5,757	NA	NA	NA	NA	NA
1988	21,700	15,700	6,000	NA	NA	NA	NA	NA
Average Annual Rate of Increase								
1962–86	8.2%	NA	NA	7.8%	NA			
1970–77	7.0%	NA	NA	6.9%	4.9%			
1977–86	6.3%	6.4%	5.9%	5.1%	NA			
1977–83	6.1%	6.2%	5.7%	4.8%	3.3%			

SOURCES: 1962–1977—Alton et al., 1980; 1978–1988—Statistical Yearbooks, various years; since 1978 budget expenditures have been published in the statistical yearbook. However, only in 1981 did the ex post figure in the yearbook differ from the ex ante figure published in the budget. Consequently, it is not clear whether these are budgetary figures or the GDR pretends it is able to precisely match actual expenditures with the budget.

and security was published.[2] Budgetary totals for defense and security have been published since 1968; this figure has been split into "Outlays for National Defense" and "Outlays for Public Security, Legal Affairs, and Border Security" only since 1977. Since 1978 a figure for expenditures for both categories has been given in the statistical yearbooks. However, expenditures have equalled budgeted outlays in all years except 1981. This has not been true of the rest of the budget for which, on average, actual expenditures have exceeded budgeted expenditures by 2.4 percent per year between 1976 and the present. It is not clear whether the figures in the yearbook are really expenditures or just reprints of the budgeted figures. This said, I will refer below to these figures as expenditures rather than budgets.

The division of the budget between national defense and security in 1977 occurred at about the same time as a reorganization in the Ministry of Defense. The Border Troops were separated from the NVA on January 1, 1976, although they still fall under the administration of the Ministry of Defense.[3] Up until 1961 they fell under the purview of the Ministry of State Security. The Ministry of Defense apparently receives at least part of its funding through the category on "Outlays for Public Security, Legal Affairs, and Border Security." Some have argued that the reorganization was a subterfuge designed to prevent the inclusion of the Border Troops in the Mutual Balanced Force Reduction talks, which were beginning at that time. Be that as it may, the Border Troops appear to take a substantial share of the budget for state security (Table 2). Because the East Germans combined military and security spending until 1977 and the border troops, although lightly armed, fall under the Ministry of Defense, the analysis below concentrates on the combined security and military budgets, thereby permitting a more accurate examination of trends in spending and the burden of defense.

The figures in Table 1 are for budgeted expenditures on defense and security for years before 1977. The figures from 1960 to 1967 were taken from Alton et al. (1980) and were derived by multiplying the percentage of the budget devoted to these items (announced by the Ministry of Finance) by the total budget. The budgets themselves are given for 1977 and officially reported expenditures for subsequent years.

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[2]Alton et al., 1980, p. 27.

[3]Forster, 1980, pp. 124, 129.

THE VERACITY OF REPORTED EXPENDITURES

The Soviets themselves have stated that their reported expenditures exclude many expenditure categories; these are financed under other headings in the budget.[4] The East Germans may do the same. Therefore, before examining the behavior of reported expenditures over the past years, I have attempted to test the veracity of the figures.

The Behavior of Reported Expenditures

One piece of evidence is the behavior of expenditures. In contrast to reported Soviet expenditures, which have declined or stagnated over the past decade and a half, East German expenditures have increased steadily in nominal terms over this period. They have also increased sharply as a percentage of net material product (NMP) and UNI.

If East German leaders wished to understate the amount of resources spent on the military to mislead the population concerning the size of the military, one would have expected them to report small or no increases in military spending. After all, they have rigidly claimed that there has been no consumer price inflation for decades despite Western studies proving the contrary.[5] But such has not been the case. The alternative hypothesis, that the leadership would exaggerate expenditure levels, is incredible; there is no good reason why they would wish to do so. The changes in expenditures over time therefore provide some indication reported expenditures reflect actual outlays.

Building Block Estimates

Thomas Clements of the Defense Intelligence Agency has constructed military expenditures series for the GDR and other East European countries using the building block method.[6] Clements listed all the physical components of the East German armed forces for which he could obtain information and then multiplied these quantities by East German domestic prices or U.S. prices converted at purchasing power parity exchange rates. The sum of these values should equal total military expenditures. Clements found reported East

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[4]"More on Petrovoskiy Speech," *Izvestiya*, Moscow edition, August 27, 1987, p. 4, as translated in FBIS-SOV-87-169, September 1, 1987, p. 2.

[5]See Keren, 1987, for a discussion of GDR inflation.

[6]Clements, 1985, p. 463.

Table 2

DECOMPOSITION OF EAST GERMAN MILITARY EXPENDITURES

Year	Reported Military & Security Budget	Estimated Expenditures (Personnel, O & M, Procurement, Construction)	Estimated Expenditures as a % of Official Expenditures	Estimated Personnel Costs	Estimated Operations & Maintenance Costs	Estimated Procurement Construction Costs	Security Forces Personnel Costs	Security Forces Personnel Costs % of Budget
1960	1,000	NA	NA	NA	NA	NA	NA	NA
1961	1,000	NA	NA	NA	NA	NA	NA	NA
1962	2,700	3,120	115.6	960	960	1,200	530	NA
1963	2,800	3,700	132.1	1,130	1,130	1,440	540	NA
1964	2,900	3,840	132.4	1,200	1,200	1,430	640	NA
1965	3,100	4,460	143.9	1,270	1,270	1,910	670	NA
1966	3,200	4,890	152.8	1,370	1,370	2,140	690	NA
1967	3,600	5,380	149.4	1,420	1,420	2,540	700	NA
1968	5,787	5,790	100.1	1,470	1,470	2,840	730	NA
1969	6,350	6,430	101.3	1,670	1,670	3,080	830	NA
1970	6,747	6,550	97.1	1,640	1,640	3,260	820	NA
1971	7,200	6,350	88.2	1,600	1,600	3,140	770	NA
1972	7,625	6,700	87.9	1,620	1,620	3,470	720	NA
1973	8,328	7,670	92.1	1,820	1,820	4,030	870	NA
1974	8,938	8,780	98.2	1,970	1,970	4,840	900	NA

Table 2—continued

Year	Reported Military & Security Budget	Estimated Expenditures (Personnel, O & M, Procurement, Construction)	Estimated Expenditures as a % of Official Expenditures	Estimated Personnel Costs	Estimated Operations & Maintenance Costs	Estimated Procurement Construction Costs	Security Forces Personnel Costs	Security Forces Personnel Costs % of Budget
1975	9,564	8,960	93.7	2,030	2,030	4,900	950	NA
1976	10,233	9,560	93.4	2,200	2,200	5,150	960	NA
1977	11,023	9,920	90.0	2,330	2,330	5,260	1,050	33.3
1978	11,573	10,280	88.8	2,370	2,370	5,530	1,060	32.0
1979	12,148	NA	NA	2,450	2,450	NA	1,080	31.1
1980	13,086	NA	NA	2,530	2,530	NA	1,100	29.9
1981	14,045.3	NA	NA	2,650	2,650	NA	1,100	28.2
1982	14,954.4	NA	NA	2,710	2,710	NA	1,150	27.5
1983	15,851	NA	NA	2,780	2,780	NA	1,200	27.0
1984	16,991.1	NA	NA	2,920	2,920	NA	1,250	26.2
1985	18,069.1	NA	NA	3,070	3,070	NA	1,340	26.7
1986	19,430.3	NA	NA	3,190	3,190	NA	1,300	24.1
Average			109.2					
Standard Deviation			22.6					

German expenditures exceeded his estimates by a large amount for 1981.[7] He speculates that the difference might be used to support Soviet troops. My own estimates of procurement and military construction, personnel and operating and support costs averaged 109 percent of reported spending on the military and security between 1962 and 1979 (Table 2). Although I use very different techniques, the major difference between my work and Clements's may be in the estimates of military procurement and construction. Since so much of military procurement is imported and we know little about these trade prices, it is possible that Clements underestimates the cost of military durables to the East Germans.

Clements conducts a similar exercise with U.S. dollar prices to compare spending with that of NATO countries. This second exercise indicates that other non-Soviet members of the Warsaw Pact increased military outlays by 1–2 percent per annum in real terms during the 1970s; East German expenditures grew at the fastest rate, about 4 percent per year.[8] To the extent that increases in building block estimates in dollars reflect expenditures in Eastmarks, they provide no evidence of annual real increases in military outlays in the range of 6 (or more) percent per year.[9] East German military spending has probably been subject to hidden inflation.

Are Military Expenditures Hidden in Other Categories?

Military expenditures may be deliberately underreported; some could be hidden under other expenditure categories. Because the East Germans use the *khozraschet* system,[10] unreported military expenditures must sooner or later crop up in the national budget, either as payments to enterprises that are subsidizing the military by producing military goods at a loss or as allocations to the military hidden within a nondefense category. Consequently, it may be possible to spot military appropriations in other components of the budget, if they are hidden there.

Unidentified Budgetary Expenditures. One possible category concealing military spending is the unspecified residual in the East German budget. After all identified expenditures in the budget between 1979 and 1985 were summed, a fairly constant residual

[7]Ibid.

[8]Ibid., p. 470.

[9]Personal communication.

[10]*Khosraschet* means enterprises are independent accounting units and are expected to produce an operating profit.

averaging 22.8 percent of the total remained. It is unclear what this residual is spent on. Part may be devoted to foreign trade subsidies, but these could also be located in the category of government expenditures on industry. The increases recorded in the latter category over the past five years are more consistent with the decline in the profitability of GDR exports and the concomitant need for the state to subsidize exports. It could also be used to subsidize industrial production or investment, cover other expenses, or go toward military spending. If the last is the case this category could provide an increment of four times reported military expenditures.[11]

Enterprise Subsidies. Spending on the procurement of military durables could be hidden within allocations for the subsidization of enterprises. The GDR designates about one-quarter of its budget toward subsidization of enterprises and investments. Part of these expenditures can be disaggregated by product or industry by comparing government expenditures recorded in the statistical yearbook with the initial budgets. Even after disaggregation, over half of these expenditures go unexplained. This remainder generally runs more than twice the size of reported military expenditures.

Centrally Funded Investments. The Hungarians note that central stockpiles are funded from the budgetary category for centrally funded investments.[12] This category may also cover strategic stockpiles. If this is the case, these expenditures constitute a direct subsidy from the budget to the Ministry of Defense. This category may cover increases in strategic stockpiles for the GDR as well. It is certainly large enough, running 10 percent of the GDR's total budget.

Conclusions

The evidence given above concerning the veracity of the budgets is inconclusive. Clements's work indicates that actual expenditures could be less than reported expenditures. However, the budgetary breakdowns are so aggregate and incomplete that large additional military expenditures could be hidden under several categories so actual expenditures could be more than reported. However, the behavior of expenditures over time, the large annual increases, and the increases in the share of UNI that they absorb belie a policy of minimizing reported budgetary expenditures on security and defense.

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[11]Between 1979 and 1986 the residual averaged 390 percent of reported military spending.

[12]*Magyar Koezloeny*, December 21, 1981, p. 1280.

ESTIMATING EXPENDITURES BY CATEGORY

Because the evidence cited above is inconclusive, I have constructed an alternative test of the veracity of reported expenditures. Below I independently estimate military expenditure components and compare their sum with the reported figures. If the sum of components is of roughly the same size as reported expenditures, reported expenditures could reflect actual allocations.

Personnel Costs

A technique suggested by Alton et al. (1981) was used to calculate personnel costs. Estimates of the numbers of military and security personnel[13] were multiplied by data on per capita expenditures on food and clothing to calculate nonsalary personnel costs. Officers' and enlisted men's salary costs were calculated by multiplying nonconscript force estimates by the average wage level.[14] Conscript salary costs were calculated by multiplying 7 percent of average military wages by estimates of total conscripts.[15] The two products were summed to calculate total military salary costs. Total personnel costs equal salary costs plus nonsalary personnel costs (Table 2).

These figures are the "hardest" of the estimates made here. The actual salaries and costs of feeding and clothing military personnel must lie within a small margin of these estimates. The greatest margin of error stems from the estimates of personnel numbers, not the salary or per capita consumption cost estimates. In some cases changes in figures from one year to another may be due to better intelligence rather than to actual changes in force levels.

Table 2 also provides a breakout of estimates of personnel costs (calculated in the same manner) for security personnel, primarily border troops. As can be seen, the reported expenditures on internal security are large compared with total estimated personnel costs, which run about one-fourth to one-third of the reported budget. Thus, there is substantial room in the reported budget to cover costs of procuring equipment for the border troops and to cover construction of border installations, including the Berlin Wall.

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[13]Military personnel figures were derived by summing personnel estimates from *The Military Balance* for "Total Regular Forces" and "Border Troops."

[14]Numbers of enlisted men and officers in the armed forces after 1974 were calculated by subtracting the number of conscripts from total force levels; pre-1975 figures were estimated by multiplying the average proportion of nonconscripts in total forces after 1974 by figures for total personnel. All figures were taken from *The Military Balance*, various years.

[15]L. W. International found conscript wages run at about this level (Gregor Lazarczik, private communication).

Table 3 compares my estimates, excluding security personnel, with those of Alton et al., which are about 5 percent lower. The two series differ because we used different salary schedules, and my coverage of nonsalary personnel costs is probably somewhat narrower.

Extrabudgetary Personnel Costs

Alton et al. (1980) have shown that certain military expenditures on personnel are included in budgetary categories other than defense spending (Table 4). Transportation of soldiers to their first tour of duty and during leave is at least partly paid by the national railroad or bus services, which in turn usually receive government subsidies

Table 3

ALTON PERSONNEL COST ESTIMATES AS A PERCENT OF RAND ESTIMATES

Year	Alton/RAND Total Personnel Costs	Alton/RAND Wage Costs	Alton/RAND Subsistence Costs
1965	103.6	82.4	145.5
1966	98.7	80.0	133.7
1967	99.3	78.8	139.3
1968	109.0	87.6	151.4
1969	100.9	80.4	142.0
1970	102.4	84.4	139.6
1971	100.6	85.4	131.8
1972	96.1	82.2	124.8
1973	98.6	82.9	128.7
1974	89.9	74.9	119.6
1975	98.3	85.1	120.0
1976	87.3	73.9	111.4
1977	88.0	74.7	111.5
1978	90.5	77.0	114.7
1979	89.4	74.8	116.9
1980	89.6	73.1	121.6
1981	85.6	69.2	118.9
1982	86.5	70.3	118.5
Average	95.2	78.7	127.2
Standard Deviation	6.8	5.3	11.9

SOURCE: Alton et al., 1985, and my calculations.

Table 4

EXTRABUDGETARY PERSONNEL COSTS
(Millions of Eastmarks)

Year	Pensions	Family Aid, Conscription Costs, etc.	Total	Percent Reported Expenditures
1962	354.5	381.6	736.1	27.26
1963	360	470.3	830.3	29.65
1964	371.5	485.4	856.9	29.55
1965	385.5	520.8	906.3	29.24
1966	392.8	559.8	952.6	29.77
1967	402.5	588.6	991.1	27.53
1968	421.3	675.5	1096.8	22.78
1969	439.5	698.2	1137.7	21.76
1970	458.9	688.2	1147.1	20.08
1971	476.5	679.0	1155.5	19.20
1972	492.3	698.0	1190.3	19.15
1973	507.5	761.0	1268.5	19.30
1974	526.3	789.2	1315.5	19.50
1975	544.5	901.4	1445.9	20.21
1976	562.7	919.0	1481.7	19.46
1977	579.1	954.4	1533.5	19.49
1978	597.9	1,012.0	1609.9	19.49
1979	618.6	1,058.4	1677.0	19.33
Average				22.93

SOURCE: Alton et al., 1980.

for operating costs.[16] The national health service pays for pre-entry physicals. Enterprises pick up the wage bill for reservists on maneuvers. The national pension and welfare offices pay the pensions of retired military officers, plus disability insurance and child support allowances for all military personnel.

According to Alton et al. these expenditures would add a substantial increment to the reported military budget, averaging 23 percent of the reported budget (Table 4).

[16]Military personnel receive concessionary prices on railroad and bus tickets in these countries.

Operations and Maintenance

Operations and maintenance costs are notoriously difficult to estimate. Much depends on the reliability and age of the equipment and the intensity and level of operations. As a general rule, operations and maintenance costs run from 50 to 100 percent of personnel costs.[17] Because pay scales are low in the Warsaw Pact relative to those in NATO, I adopted the higher of these two ratios. These estimates are, of course, very ad hoc and should be viewed accordingly. Unfortunately, I was unable to find a more accurate means of estimating these costs.

Military Construction and Procurement

The East Germans publish no information on the costs of procurement. However, procurement of military durables should take an appreciable amount of machinery consumption. Analysis of the national income accounts and other economic data should make it possible to estimate expenditures on military procurement.

To accomplish this it is necessary to locate procurement in the accounts. The East German statistical authorities use the Marxist system of national income accounting in which output is measured in terms of net material product—the output of material goods (NMP excludes services) minus material inputs and depreciation. The stock of material goods available for net investment and consumption is UNI and is calculated by subtracting losses and net exports from NMP. In this system, UNI is divided into consumption and accumulation. Consumption, in turn, is divided into personal and collective consumption. Accumulation is divided into changes in reserves, net investment in material branches, and gross investment in nonmaterial branches (because investment in nonmaterial sectors is not depreciated in the NMP accounts).

Conventional wisdom places Soviet expenditures on the procurement of military durables under accumulation, probably under changes in reserves.[18] This is consistent with the Chinese practice of placing capital expenditures on equipment and construction by the military within accumulation.[19] Increases in state stockpiles for military reasons are also included in accumulation, under increases in state reserves.[20]

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[17]Becker, 1964.

[18]Gallik et al., 1979, p. 427; Becker, 1964.

[19]World Bank, 1981, p. 27.

[20]Statistical Office of the United Nations, 1971, p. 20.

Both the Czechs and the Poles state that consumption of material goods, including military durables, by organizations that provide for national defense is recorded under "Other Consumption of a General Social Character,"[21] within collective consumption. This categorization is consistent with the *Basic Principles of the System of Balances of the National Economy*, which states that this category includes "the consumption of material goods by institutions meeting the collective needs of the community."[22] Wiles (1987) argues that the Hungarians also place military procurement under collective consumption. The results of Crane (1987) support this argument. Military construction, however, appears to be recorded under nonproductive investment in Poland.[23]

I have found no written evidence concerning the location of military construction and the procurement of military durables in the East German national income accounts. The figures given here are computed under the assumption that the GDR, like the Soviets and the Chinese, records procurement of military durables under accumulation, and unlike the other East Europeans, who record it under collective consumption. This could possibly stem from differences in timing. The Czech, Hungarian, and Polish military establishments were reorganized in the 1940s, under the Soviet accounting practices of that time. The formative period of the NVA was the mid to late 1950s. Wiles (1987) argues that the Soviets changed their categorization of military procurement in the late 1950s, before the buildup of East German forces. The East Germans may have adopted bookkeeping practices corresponding with the Soviet practices prevailing at that time.

One reason for believing that East Germans record military procurement under accumulation is that the East German authorities stopped publishing the percentage of UNI devoted to gross investment in nonproductive sectors in 1978, lumping it into net investment. Because the East German government is secretive, the elimination of this category is suggestive.

Another reason is that the East German figures on collective consumption seem too low to cover military procurement. GDR military budgets averaged 46 percent of collective consumption between 1979 and 1985. Similar figures for Czechoslovakia and Poland were 27.1 and 30.1 percent, respectively. Assuming procurement takes a similar share of each country's defense budget, either the East

[21]Jilek, 1960, p. 277; *Rocznik Statystyczny*, 1985, p. 75.

[22]Statistical Office of the United Nations, 1971, p. 55.

[23]Crane, 1987, p. 84.

German figures take a substantially higher share of collective consumption than the Czech or Polish military expenditures, or the East Germans do not record material consumption by the military in this category.

My estimates of East German military construction and procurement (Table 5) stem from an anomaly in East German statistics first noted by Collier (1985). The East Germans record investment flows to productive and nonproductive (education, health, etc.) branches of the economy. Gross investment in nonproductive uses is shown in Table 5. They also record the percentage of UNI used for various purposes, although they have never published value figures for UNI.

Table 5

ESTIMATING MILITARY CONSTRUCTION AND PROCUREMENT

Year	NMP Current Prices	UNI Current Prices	Nonproductive Investment Percent UNI	Estimated Nonproductive Investment[a]	Nonproductive Investment[a]	Possible Military Procurement[a]
1962	74,448	73,300	5.9	4,502	3,295	1,207
1963	76,749	73,300	6.2	4,731	3,282	1,449
1964	80,447	76,900	6.1	4,860	3,416	1,444
1965	82,802	81,600	.6	5,050	3,091	1,959
1966	86,478	86,300	6.2	5,566	3,367	2,199
1967	93,043	94,000	6.8	6,410	3,851	2,559
1968	97,830	96,200	7.8	7,527	4,664	2,863
1969	102,947	104,100	8.6	9,020	5,897	3,123
1970	108,720	111,900	8.1	9,135	5,834	3,301
1971	113,562	115,300	.8	9,293	6,110	3,183
1972	120,090	122,000	8.3	10,203	6,686	3,517
1973	126,840	129,800	8.7	11,381	7,297	4,084
1974	135,005	137,700	9.2	12,762	7,859	4,903
1975	142,370	141,700	9.3	13,215	8,277	4,938
1976	147,520	149,600	9.3	13,949	8,762	5,187
1977	155,210	157,500	9.4	14,841	9,546	5,295
1978	160,760	159,700	9.6	15,374	9,800	5,574
1979	166,900	162,000	NA	NA	NA	NA
1980	187,060	182,700	NA	NA	NA	NA
1981	196,070	185,100	NA	NA	NA	NA
1982	201,140	179,100	NA	NA	NA	NA
1983	210,430	180,300	NA	NA	NA	NA
1984	222,100	185,100	NA	NA	NA	NA
1985	241,863	201,700	NA	NA	NA	NA
1986	252,210	210,500	NA	NA	NA	NA

[a]Figures before 1970 are in constant 1967 prices; figures after 1969 are in 1970 prices.

Before 1979 percentages were given for net investment in productive sectors, investment (gross, not net) in nonproductive sectors, inventory investment, and personal and collective consumption. Multiplying the percentage of gross investment in nonproductive sectors by plausible estimates of UNI[24] causes a large discrepancy to appear. The resulting figures are roughly one-third more than recorded flows. These figures should have been equal.

One possible explanation for the discrepancy is military construction and procurement, including construction and procurement by the security forces. These investment flows may be included in the national income accounting statistics, but not in the gross investment statistics. If that is the case, the difference between the estimates for nonproductive investment based on national income accounting data and the figures for nonproductive investment in the investment section of the statistical yearbook put an upper bound on military construction and procurement. These are the figures given in Tables 2 and 5. Although it is merely a hypothesis, this residual almost tripled between 1962 and 1970, when the Berlin Wall was being constructed and strengthened and when the NVA was being rapidly expanded and modernized.

Although Collier notes that this residual could contain military construction and procurement, he also adds that the discrepancies between the investment figure in the national income accounts and the investment accounts could be due to very heavy subsidy of investment in the nonmaterial sphere. Investment in the nonmaterial sphere includes schools, state administration, hospitals, and housing. Of these, only housing could rival military spending as an explanation for the residual, especially as it has been heavily subsidized.

To test this alternative hypothesis I compared expenditures on housing in producers' prices with total estimated investment in nonproductive capital and with the residual. Housing averaged 43 percent of total nonproductive investment; the sum of housing and the residual averaged 77 percent. In no year did the sum of the two categories exceed 85 percent of total nonproductive investment. Thus, because the value of other components of nonproductive investment (schools, hospitals, etc.) are small in relation to housing, and housing takes less than half of total nonproductive investment, it is plausible that military construction and procurement fall into this category. Moreover, the number of units built and East German investment in housing fell or increased very slowly during the late

[24]See App. A for a description of various measures of UNI.

1960s, years when the residual more than doubled in size, making it implausible that housing accounts for the residual.

Because the residual is almost the same size as total GDR investment in housing, it must contain more than military construction, if it contains military expenditures. Despite the costs of building the Berlin Wall and other border installations, military construction costs cannot equal the entire cost of the East German housing program, so if the residual does hide military expenditures on construction, it probably hides procurement as well.

The residual averaged 52 percent of the reported military budget and grew 4.6 times between 1962 and 1978. It more than doubled between 1962 and 1967, a time of rapid buildup of the NVA.

Arms Production

The GDR is not a major arms producer. After World War II the Soviets dismantled arms plants and carted them east. No domestic demand for arms existed until 1956 when the NVA was formed, but wide-scale modernization did not take off until 1962 so there was little call for the reconstruction of the East German arms industry. The Soviets have apparently vetoed the creation of an East German arms industry for political and historical reasons.[25] Consequently, most arms are imported.

Western observers have identified 106 industrial enterprises that produce arms.[26] Production appears to be confined to munitions (two munitions factories and three factories for the production of explosives) and light weapons,[27] although the Industrial Association for Motor Vehicle Construction (IFA) plant in Chemnitz-Hainichem produces some military vehicles. The GDR also produces naval vessels, most notably Parchim class corvettes. Sixty percent of the output of the Carl Zeiss plant in Jena is for military purposes. It produces infrared binoculars, night vision equipment, bombsights, and tank and artillery optical systems.[28] All armaments plants are consolidated under the VVB (Association of State Enterprises) for Iron, Sheet Metal and Metal, in Chemnitz, which falls under the direct control of the Engineering and Technical Administration of the GDR National Defense Ministry.

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[25]Johnson, Dean and Alexiev, 1982, p. 70.

[26]Bensch, 1983, p. 4.

[27]The Ernst Thalmann Works in Suhl makes AK-77 submachine guns and the Makarov pistol, both Soviet designs (Bensch, 1983).

[28]Bensch, 1983, p. 4, as translated in JPRS 84627, October 27, 1983, p. 17.

Arms Trade

Official East German data on arms trade are nonexistent. However, trade residuals (uncategorized trade flows) provide one method of identifying arms flows.[29] Intelligence estimates provide another. Vanous's and my figures in Table 6 are based on the residual method; the ACDA figures are provided by the U.S. government. Because residuals are just that, residuals, they should be used with caution, but the figures are at least interesting.

Below I have attempted to calculate East German arms imports from three countries: Czechoslovakia, Poland, and the Soviet Union. These three are probably the GDR's primary suppliers of arms. After the Soviet Union, Poland and Czechoslovakia are the two major arms producers in the Warsaw Pact and both are active exporters. Both produce T-72 tanks under license from the Soviets. Czechoslovakia produces jet trainers and Poland produces military helicopters.[30]

Czech arms exports to the GDR were calculated using a methodology suggested by Vanous (1985). He claims Czech arms exports were located within Standard International Trade Classification (SITC) Revision 2 category 718 (other special machinery).[31] Czech arms exports were calculated by subtracting exports identified in this category from the total figure.[32] The residual was assumed to equal arms exports. These estimates are upper bounds; part of this residual is patently not arms. These data were recorded in dollars, and they were converted to transferable rubles by multiplying them by the official Soviet ruble-dollar exchange rate.

Polish arms exports were calculated by subtracting all identified machinery exports to the GDR from total machinery exports.[33] As can be seen, this residual runs about 35–40 percent of Polish machinery exports to the GDR. Arms exports by the GDR were calculated in the same manner (Table 7). The lesser importance of arms production for the GDR is possibly reflected in the lower share of unidentified machinery in the residual.

The post-1970 figures for the Soviet Union were taken from Vanous (1987). He uses the unaccounted residual for Soviet trade with the

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[29]This method was developed by Montias, 1974.

[30]Deutch, 1989.

[31]This is according to the pre-1982 SITC classification system. Vanous argues that in the revised classification system arms trade falls into SITC 728 (other equipment specialized for particular industries), 745 (other nonelectrical machinery, tools, and parts, n.e.s.) and 784 (motor vehicle parts and accessories, n.e.s.) since 1982. He also places unidentified machinery sales into the arms category (Vanous, 1985).

[32]Data taken from Economic Commission for Europe, various years.

[33]Glowny Urzad Statystyczny, various years.

Table 6

ESTIMATES OF EAST GERMAN IMPORTS OF ARMS
(Millions of transferable rubles)

Year	Czecho-slovakia[a]	Percent Machinery Imports	Poland[a]	Percent Machinery Imports	Soviet Union[b]	Percent Total Imports	Total Arms (ACDA)[c]
1960	NA	NA	NA	NA	85	9.0	NA
1961	NA	NA	NA	NA	125	11.5	NA
1962	NA	NA	NA	NA	115	9.3	NA
1963	NA	NA	NA	NA	128	10.0	NA
1964	NA	NA	NA	NA	157	12.6	NA
1965	17.7	15.6	NA	NA	NA	11.7	NA
1966	33.4	25.8	NA	NA	NA	NA	150
1967	33.8	23.7	NA	NA	NA	NA	130
1968	NA	NA	NA	NA	NA	NA	110
1969	47.7	24.8	NA	NA	NA	NA	110
1970	77.6	29.5	NA	NA	NA	NA	110
1971	NA	NA	NA	NA	NA	NA	110
1972	36.4	14.3	NA	NA	NA	NA	280
1973	NA	NA	NA	NA	NA	NA	360
1974	NA	NA	NA	NA	NA	NA	370
1975	68.8	16.9	NA	NA	NA	NA	320
1976	58.1	12.2	NA	NA	NA	NA	410
1977	94.3	18.4	NA	NA	NA	NA	390
1978	106.7	20.4	NA	NA	NA	NA	240
1979	59.3	12.2	NA	NA	NA	NA	160
1980	62.3	11.7	149	36.4	460	9.4	270
1981	90.7	13.2	167	40.4	500	9.0	430
1982	101.4	17.6	131	36.0	600	9.3	350
1983	NA	NA	164	39.0	530	7.8	630
1984	NA	NA	184	36.8	600	8.0	590
1985	NA	NA	219	35.8	650	8.5	690
1986	NA	NA	234	34.6	680	8.6	370

[a]Author's estimates.
[b]Vanous, 1987.
[c]Arms Control and Disarmament Agency, various years.

CMEA to calculate total Soviet CMEA arms and then allocates this residual on the basis of Soviet machinery trade with the individual countries including the GDR.

Pre-1970 Soviet arms trade figures were estimated from an anomaly in East German and Soviet statistics. The GDR stopped publishing import and export figures by country in 1975. Before that date the country balances with the Soviet Union were very peculiar. Soviet exports to the GDR as recorded by the Soviets and GDR

Table 7

EAST GERMAN EXPORTS OF ARMS
(Millions of transferable rubles)

Year	Poland[a]	Percent Machinery Imports	Soviet Union[b]	Percent Total Imports	Total[c]
1966	NA	NA	NA	NA	5
1967	NA	NA	NA	NA	5
1968	NA	NA	NA	NA	5
1969	NA	NA	NA	NA	5
1970	NA	NA	NA	NA	5
1971	NA	NA	NA	NA	5
1972	NA	NA	NA	NA	40
1973	NA	NA	NA	NA	40
1974	NA	NA	NA	NA	30
1975	NA	NA	NA	NA	40
1976	NA	NA	NA	NA	20
1977	NA	NA	NA	NA	70
1978	NA	NA	NA	NA	50
1979	NA	NA	NA	NA	50
1980	100	15.2	170	3.9	120
1981	80	17.3	220	4.3	100
1982	91	15.2	280	4.8	120
1983	92	20.0	350	5.3	160
1984	134	21.0	420	5.7	320
1985	155	21.3	370	4.9	460
1986	176	18.1	360	5.1	150

[a]My estimates.
[b]Vanous, 1987.
[c]ACDA, 1988.

imports from the Soviet Union as recorded by the East Germans differed by 753 million rubles between 1960 and 1965. After 1965, the differences became very small. These differences could stem from the Soviets' recording arms exports in total trade figures, and the East Germans' not recording them. The differences could also stem from a statistical fluke. In any event they are puzzling and do not occur to the same extent in East German or Soviet trade with other East European countries. Because the 1960–65 period was a period of rapid buildup of the NVA, the size of these residuals seems credible, although the figures should be used tentatively.

To put much credence in these figures, they have to be compared with other sorts of data. They are consistent with the reported

military budget. The sum of these estimates of Czech, Polish, and Soviet arms exports to the GDR ran from 40–50 percent of the combined military and security budgets after converting them from deviza marks to domestic marks using a rate of exchange of 1.7 domestic marks per deviza mark (Collier, 1985). The pre-1970 estimates of Soviet arms exports ran 33–43 percent of reported budgets. Thus, the estimates are not inconsistent with the published budgets. However they are high when compared with my procurement estimates. Both the Polish and Soviet numbers are probably inflated.

The size of the figures in terms of imports from the countries is also interesting. The estimates imply that 8–10 percent of total imports from the Soviet Union, the GDR's largest trading partner; 10–20 percent of machinery imports from Czechoslovakia; and 34–41 percent of machinery imports from Poland consist of arms.

Military Research and Development

Alton et al. have estimated military R&D expenditures for the GDR by assuming that the GDR spends 5 percent of its total R&D budget on military research.[34] Lack of data caused Alton et al. (1985) to choose these percentages on the basis of their best judgment.

I have explored two alternative avenues to narrow the range of feasible estimates of military R&D. The first involved decomposing nationally funded research expenditures. The GDR provides a breakdown of R&D expenditures by institution or industry. Some of these categories can reasonably be excluded from military R&D, notably agricultural research, research at universities, and, less probably, research at the Academy of Sciences. This still leaves an extreme upper bound of over one-half of total R&D expenditures for military R&D, equivalent to roughly 15 percent of reported military expenditures (Table 8).

The second approach involved using West European percentages of military R&D in total R&D to obtain ranges for R&D expenditures. West European countries tend to fall into three groups: members of the nuclear club, such as France and the United Kingdom, which devote about one-quarter of their total R&D to the military; armed neutrals, such as Sweden and Switzerland, which fall into an intermediate range; and nonnuclear members of NATO, such as Italy and the FRG, which devote about 4 percent of their R&D to military work.[35] Because of the large disparities in R&D expenditures by nuclear and nonnuclear states, the FRG was chosen as an analogue for the GDR.

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[34]Personal communication with Gregor Lazarczik.

[35]SIPRI, 1984, pp. 288–289.

Table 8

ESTIMATED EAST GERMAN MILITARY R&D COSTS[a]

Year	Potential Military R&D (Eastmarks)	Percent Total R&D	FRG Analogue (Eastmarks)	Percent Reported Military Expenditures
1971	764	NA	210	3.49
1972	812	NA	220	3.54
1973	834	NA	230	3.50
1974	842	NA	230	3.41
1975	867	NA	240	3.35
1976	923	NA	250	3.28
1977	1002	NA	270	3.43
1978	1076	NA	290	3.51
1979	1112.3	48.23	310	3.57
1980	1185	49.14	330	3.51
1981	1306.3	50.20	360	3.55
1982	1378.3	50.02	370	3.43
1983	1361.4	49.70	370	3.25
1984	1220	45.34	390	3.19
1985	1654.2	51.73	430	3.30
1986	1866.1	67.90	470	3.35

[a]Author's estimates.

Estimates were made by multiplying the average share of military R&D in total R&D in the FRG by total R&D expenditures in East Germany. The resulting estimates seem plausible as shown by their size relative to the reported military expenditures (Table 8). Military R&D as a percentage of total military spending in Sweden and the FRG averaged 6.5 and 3.0 percent, respectively between 1981 and 1984.[36] These estimates fall in that range. They also appear reasonable when compared with estimates of maximum feasible military R&D expenditures. The estimates may suffer from an upward bias; the GDR, with its small arms industry, may spend less on military R&D than implied by these figures.

Payments for the Support of Soviet Troops Based in the NSWP

The question of who pays for Soviet troops stationed in the GDR is a cloudy one. The initial legal right for the Soviets to base troops in

[36]Ibid.

the GDR resulted from the 1945 Potsdam Conference. The actual terms for stationing troops were spelled out in a series of agreements concluded between the Soviet Union and the GDR in the 1950s. The first GDR-USSR treaty on relations was signed in 1955; it included a section on the *temporary stationing* of Soviet troops in the GDR.[37] The terms of the agreement were substantially altered in 1957, the year after the Hungarian uprising and the 1956 Polish crisis.

Currently, the GDR does not appear to pay the support costs of the Soviet troops in the country. Khrushchev announced at the Fifth Party Congress of the East German Communist Party (SED) that from January 1, 1959, the GDR would no longer have to pay for Soviet troops.[38] Subsequently, he complained in his memoirs that Soviet troops cost twice as much to station in Eastern Europe as in the Soviet Union.[39] The Czech Basing Agreement, although different from that of the GDR, appears similar in terms of stationing costs. It states that Soviet trade establishments are to purchase goods and services from their Czech counterparts for sale to Soviet troops at state retail prices minus the wholesale discount. The Soviets pay in transferable rubles converted into koruna at a ratio determined by the ratio of domestic Czech prices to foreign trade prices.[40] In other words, the Soviets cover support costs.

Declaratory policy is not always actual policy. I have made rough estimates in Eastmarks of the potential costs to the GDR of providing subsistence to Soviet forces employing the same methodology used to compute NVA subsistence costs (Table 9). The figures are so large that if the East Germans paid these costs, surely someone in emigration, or even at home, would have made public mention of them. I have no knowledge of their having done so.

I could find no definitive information concerning who pays for the costs of constructing and maintaining military facilities. The Czech stationing agreement, signed in October 1968, a decade after the Soviet-East German agreement, stipulates that the Soviet Union will cover maintenance costs but Czechoslovakia will provide barracks, housing, services, warehouses, airfields, and other services.

The facilities used by the Soviet forces in the GDR were occupied by the Soviets after World War II. In all probability the use of these facilities is provided gratis by the East Germans; it is very difficult to

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[37]"Soviet Forces in the GDR, Problems Below the Surface," *Radio Free Europe Background Report*, No. 83, August 21, 1985.

[38]Fricke, 1982, p. 271.

[39]Khrushchev, 1974, p. 221.

[40]Czech Status of Forces Agreement with the Soviet Union.

Table 9

POTENTIAL SUBSISTENCE COSTS FOR THE GSFG
(Millions of Eastmarks)

Year	Total	As a Percent of the Reported Expenditures
1962	350	13.0
1963	354	12.6
1964	364	12.5
1965	364	11.8
1966	394	12.3
1967	376	10.4
1968	386	8.0
1969	397	7.6
1970	392	6.9
1971	393	6.5
1972	439	7.1
1973	513	7.8
1974	531	7.9
1975	613	8.6
1976	610	8.0
1977	700	8.9
1978	717	8.7
1979	716	8.2
1980	748	8.0
1981	732	7.2
1982	1197	11.1
1983	1176	10.3
1984	1205	9.9
1985	1267	9.7
1986	1267	9.0

believe the Soviets pay rent for them. Who pays for current military construction is a cloudier issue. When short-range nuclear missiles were installed in the GDR in response to the deployment of Pershing IIs in Western Europe, reports from the GDR claimed the East Germans would bear part of the cost of installation.[41] Whether this is true is an open question. It is difficult to believe that the East Germans pay for Soviet military construction on present Soviet bases, if the work is performed by Soviet crews using Soviet materials.

[41]Radio Free Europe, *RAD Background Report*, No. 143, December 20, 1985.

Matters may be different for new installations, but there have been very few, if any, of these.

Conclusions

The above estimates are necessarily tentative and contain a substantial margin of error. Nonetheless, they are consistent with the hypothesis that reported East German military and security expenditures cover personnel, operations and maintenance, and procurement costs. Personnel costs, the hardest of the estimates, take less than 30 percent of reported expenditures. Independent estimates of procurement run about 50 percent of reported expenditures. Arms import estimates, although more tentative, are also consistent with the budget, although high in relation to the procurement estimates.

In sum, these various pieces of evidence provide no definitive answer to the question of the veracity of reported East German military expenditures. The building block results are puzzling because they are so much lower than reported expenditures; it is hard to imagine why the East German government would exaggerate them. The holes in the total budget do provide plenty of room to disguise military spending. However, both the behavior of expenditures over time and my reconstructions suggest reported expenditures may cover all East German spending on military and security forces with the exception of those personnel costs enumerated by Alton and, possibly, military research and development. On the basis of this evidence, I tentatively accept the veracity of the reported expenditures in the analysis below.

MILITARY SPENDING TRENDS

Increases in the Budget

The military and security budgets reported by the East Germans have increased rapidly in nominal terms, averaging 6.5 percent per year since 1978, when the Warsaw Pact made a commitment to accelerate military spending to match a NATO agreement.[42] However, it is difficult to separate the wheat from the chaff in these figures: How much of the increase has been due to inflation and how much has been due to actual increases in resources devoted to the military?

[42]In early 1978, NATO countries agreed to increase military expenditures by 3 percent per year in real terms.

East German price indices are very unreliable. They are reported for consumer goods and services with a breakdown given for goods only. According to this index, the prices of consumer goods declined slightly, but steadily, until 1980. Since then, inflation of .1 percent per year has been recorded, virtually zero.

There is a good bit of politicized wishful thinking in these figures. The citizens of the GDR compare their living standards with their brethren in the FRG. Consequently, the East German government has a vested interest in keeping reported inflation low. The German Institute of Economic Research (DIW) located in West Berlin has attempted to check these reported rates by conducting their own consumer price surveys. The DIW found inflation averaged roughly 4 percent per year between 1972 and 1983 assuming the East Germans purchased roughly the same market basket of goods as West Germans or 2.6 percent per year using an East German market basket.[43] Keren (1987) has modified these figures somewhat to derive his best estimate of East German inflation, 2.7–2.8 percent per year between 1973–83. Keren notes that West German scholars have argued that investment prices rise by roughly 1 percent more per year than consumer prices and uses this derived figure to deflate East German investment expenditures.

I have derived figures for military spending in constant prices using Keren's estimates of East German price increases. Although the market basket of goods purchased by the military is different from that purchased by either consumers or enterprises, I nonetheless assumed that price increases for goods purchased by the military corresponded to those in the economy as a whole. Consequently, I constructed a composite price index using Keren's figures for price drift in consumer and investment goods, weighted by the shares of consumption and accumulation in UNI. These deflated expenditures were shown in Table 1.

I also constructed an NMP price deflator using East German national income accounts. The East Germans publish time series data on NMP in base prices of specified years. I constructed a NMP deflator using these overlapping series, which I used to deflate reported military expenditures.

As can be seen from Table 1, the three different series (nominal budgets, budgets deflated by Keren's price deflator, and budgets deflated by the NMP deflator) provide dramatically different pictures of East German military efforts. While nominal expenditures increased at an annual average rate of 6.1 percent between 1977 and

[43]Keren, 1987, pp. 259–260.

1983, expenditures deflated by the NMP deflator imply a rate of only 4.8 percent. Expenditures deflated by Keren's deflators give an even lower figure of 3.3 percent, roughly half the nominal increases. In the first instance, the GDR would have reported the highest annual rate of increase in military spending of any country in the Warsaw Pact. If the third figure is correct, the East German military buildup has been more substantial than that of Czechoslovakia and Poland, but of about the same magnitude of the United Kingdom in this period (4 percent per year in real terms). Which of these estimates is more accurate radically alters one's interpretation of the role the GDR is playing, and planning on playing, within the Warsaw Pact. Under the assumption of zero inflation (that the official East German consumer price index reflects real changes in military costs), during the 1980s East German spending grew at over six times the rate of Polish or Czech spending in constant prices, implying a much more vigorous financial commitment to defense than the other two countries. If, however, Keren's inflation estimates are more accurate, the GDR increased expenditures three times more rapidly (3.3 percent per year rather than 1 percent for the other two countries). Although this is an appreciable difference, in my view it is not large enough to warrant the conclusion that the GDR is assuming a dramatically more important role than that of Poland and Czechoslovakia in the Warsaw Pact's military organization. If, however, the highest figure is correct, by 1986 the GDR ought to have had markedly more modern armed forces than the other two countries.

Military Spending as a Percent of UNI

An alternative way to size the reported budget is to measure it as a percent of output, in this case, net material product, or (UNI). Both measures are provided in Table 1.[44]

The ratio of military spending to UNI is the better of the two. Net material product is a measure of output; it has grown fairly steadily over the last two decades. UNI is a measure of material goods available for consumption, investment, or defense. UNI increased substantially in the 1970s as the GDR imported more than it exported, allowing it to consume more than it produced. The crunch came in the early 1980s when it had to generate a large hard currency trade surplus to service its debts and export more goods to purchase increasingly expensive Soviet oil. While NMP increased 3 percent in

[44]The GDR only provides NMP figures in constant prices and an index for UNI. The NMP figures were inflated using the NMP price deflator described above. The procedure used to calculate UNI is described in App. A.

1981, UNI fell by the same amount, reflecting sharp declines in consumption and investment occasioned by the export drive. Thus, the ratio of military expenditures to UNI better reflects the resource costs and tradeoffs facing the East German government than the ratio of expenditures to NMP.

As can be seen, the GDR has been allocating a steadily increasing share of NMP and UNI to the military. The large jump in 1968 was the result of a very large increase in the reported defense budget. The increase in the military's share of UNI in 1981–82 was a consequence of declines in UNI stemming from the GDR's drive to close its hard currency trade deficit. During this period, investment was sharply reduced, but the reported military budget continued to grow. By 1986 the military and security budget took an extraordinarily large share of UNI, 9.2 percent, and the defense budget alone absorbed 5.6 percent. By way of comparison the Polish military budget was 3.6 percent of UNI and the Czech military and security budget was 6.2 percent of UNI.[45] Thus comparable budgets for these two countries are roughly two-thirds of the East German levels. Part of the difference between the Czech and East German ratios is due to the GDR's very large security budget. At 3.6 percent of UNI it equals the ratio of Poland's *military* budget to UNI and exceeds Hungary's ratio.

One can use the ratio of military expenditures to UNI and NMP and indices of growth in these aggregates to calculate real increases in military expenditures. In 1962 military and security expenditures were 3.6 percent of NMP; in 1986 they were 7.7 percent, more than double. During the same period NMP increased over 3.14 times, implying military spending increased by 7.9 percent per year in real terms. This is an enormous rate of increase. As can be seen, a large share of it took place in the 1960s: Military spending grew by 11.4 percent per year between 1962 and 1970, the period when the NVA became a conscript army and was accepted as a full-fledged member of the Warsaw Pact.[46] UNI grew by only 4.7 percent per year during this period. Much of this increase in military expenditures was financed by slower growth in personal consumption, which lagged a full percentage point behind the increase in UNI.

Another measure of the burden of defense is the percentage of GNP absorbed by military expenditures. This is the measure traditionally employed in the West. Unfortunately, the GDR does not compute GNP figures. However, Collier (1985) estimated 1980 East German

[45]The Czech figures are for 1985.

[46]The NVA adopted conscription in 1962, the year after the Berlin Wall was built.

GNP. The reported defense budget was 4.3 percent of his figure, 219 billion Eastmarks; and the combined defense and security budgets, 6.0 percent. For sake of comparison, the United States spent 5.5 percent of its GNP on the military in 1980; the Federal Republic of Germany spent 3.3 percent. Thus, the combined defense and security budgets absorb a substantial share of GNP.

III. THE GDR'S MILITARY CONTRIBUTION: FORCES

What has the GDR purchased with these very large military expenditures? This section attempts to answer this question by describing East German forces and comparing them with Czech and Polish forces and the GSFG. It also measures the gap between the NVA and the GSFG in terms of numbers and type of military equipment and traces changes in relative force levels over time. The section also seeks to answer the question: How much has the NVA modernized and has modernization been sufficient to change the NVA's role with regard to the GSFG and Czech and Polish forces?

TOTAL FORCES

The East German armed forces, excluding border troops, numbered 176,000 in 1987. They are divided among the army, navy, and air force, with force levels numbering 120,000, 16,000, and 40,000, respectively. The army, navy, air force, and reserves fall under the Ministry of Defense. A large contingent of border troops, numbering 49,000, also under the Ministry of Defense, patrols the frontier and the Berlin Wall.[1] In addition, four motorized rifle divisions would be formed from reserves, if called up.[2]

The armed forces of Czechoslovakia and Poland, the other two members of the Northern Tier, are larger, numbering 197,000 and 406,000, respectively. The GDR places 10.4 men per 1000 of population in the regular armed forces while these two countries field 12.6 and 10.7, respectively. However, if one includes border troops, the GDR's ratio climbs to 13.2. The comparable figures for the Soviet Union are 17.9; including security forces, 19.8. By way of contrast, the Federal Republic of Germany fields only 8.0 men per thousand people.

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[1]All figures taken from *The Military Balance*, 1987.

[2]*Military Balance*, 1988, p. 45.

THE ARMY

Founded in 1956, the army of the German Democratic Republic has the reputation of providing a considerable contribution to the Warsaw Pact's central front. Several authors claim the NVA is a first-rate army, capable of fighting protracted, high intensity conflicts and conducting complex operations on a variety of fronts.[3]

In contrast to other NSWP forces, East German divisions are fully integrated with Soviet forces. The NVA is permanently assigned to the joint command of the Warsaw Pact. Johnson, Dean, and Alexiev (1982) argue that the precise form of authority the Joint Command of the Warsaw Pact exercises over the NVA is unclear. According to Martell (1983) the three divisions in Military District V fall under the direct control of the commander of the GSFG and the three divisions in Military District III fall under the control of the commander of the Soviet Northern Army (Table 10). There would be no East German front in the case of a NATO-Warsaw Pact war; East German divisions would fight alongside Soviet divisions.[5]

Despite the high marks the NVA receives for military prowess, it is small compared with the Polish and Czech forces, the other two forces forming the Northern Tier. It consists of only two tank and four motorized rifle divisions (Table 10), significantly smaller than the 15 divisions of the Polish army (five armored, eight mechanized, one airborne and one amphibious assault), or even the 11 divisions of the Czech Army (five armored, five mechanized, and one artillery), which draw on a smaller population.[6] However, in contrast to the Polish and Czech armies, the NVA is composed entirely of Category One divisions. Only ten of the Polish divisions are Category One, including the amphibious and airborne divisions, both of which are closer in size to brigades.[7] Czechoslovakia fields only four Category One divisions.

The differences in quality, especially with Polish forces, become apparent in comparisons of divisional equipment holdings among the three armies. Martin estimates that Poland fields about 43 percent of the artillery of a similar size Soviet force, Czechoslovakia fields 60 percent, and the GDR 70 percent.[8] Thus, taking weaponry into consideration the GDR fields the most potent fighting force of the three countries.

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[3]For example, Martell, 1983.

[4]Martell, 1983.

[5]Martin, 1986, p. 210.

[6]*The Military Balance*, 1988.

[7]Martin, 1986, p. 206.

[8]Martin, 1986, p. 211.

Table 10

COMPOSITION OF THE NVA

Northern Army Group (V Military District)

Headquarters—Neubrandenburg, but under the control of the commander of GSFG.

1st Motorized Rifle Division—Potsdam
8th Motorized Rifle Division—Schwerin
9th Armored Division—Eggesin

Artillery regiment—Torgelow
Artillery-locating regiment—Torgelow
Anti-tank battalion—Torgelow
NCO training regiment—Torgelow
Air defense regiment—Prenzlaw
Signals regiment—Neubrandenburg
Engineering battalion—Rasewalk
Transport battalion—Rasewalk
Nuclear-chemical company—Rasewalk

Southern Army Group (III Military District)

Headquarters—Leipzig, but under the control of the commander Soviet Northern Army Group.

4th Motorized Rifle Division—Erfurt
11th Motorized Rifle Division—Halle
7th Armored Division—Dresden

Artillery regiment—Leipzig
Artillery-locating regiment—Leipzig
Anti-tank battalion—Wolfen
Signals regiment—Leipzig
Air defense regiment—Leipzig
Engineering battalion—Gera
Transport battalion—Gottibius
NCO training regiment—Eilenberg
Nuclear-chemical company—Grossenburg

SOURCE: Artell, 1983.

The NVA does less well when compared with the GSFG. The Soviets have 20 divisions (ten tank, nine motorized rifle, and one artillery) stationed in the GDR, all Category One, over three times the size of the NVA.[9] As noted above, the GSFG fields substantially more artillery per unit than the NVA. It also fields more tanks and much more modern ones.

[9]*The Military Balance*, 1987, p. 42.

The relative weakness of the NVA stems in part from its outmoded equipment. Soviet divisions are outfitted with T-80s or T-62s and T-64s. Over 80 percent of the NVA is still equipped with T-54/55s; the rest are T-72s, although there are some World War II vintage T-34s in storage.[10] No units possess T-80s. The East German units also have less artillery and lack the helicopter wings attached to the Soviet divisions. Thus, although the NVA has more punch per division than the Polish and Czech armies, it is markedly inferior to the GSFG.

Also of interest is whether the effectiveness of the NVA has changed over time relative to the forces of Czechoslovakia and Poland. Table 11 contains numbers of tanks by model for the three countries over the last decade. Unfortunately, similar numbers were not available for the GSFG. Despite the limitations of the analysis, the even pace of modernization over time is striking. In spite of smaller rates of increases in military spending, Czechoslovakia and even Poland appear to have modernized about as rapidly as the NVA. T-72s constitute a higher percentage of the NVA's tank holdings

Table 11

NUMBER OF TANKS OF THE GSFG, THE GDR, CZECHOSLOVAKIA, AND POLAND

GSFG	GDR	Czechoslovakia	Poland
1976			
T-34	600	—	
T-55	2,400	3,300	3,400
T-62	some	some	
PT-76	115	—	375
1980			
T-34 (storage)	600	—	—
T-54/55	2,600	3,400	3,400
T-62	—	100	—
T-72	some	100	100
PT-76	60	—	100
1988			
T-34 (storage)	800		200
T-54/55	1,700	2,900	3,400
T-72	350	500	350

SOURCE: *Military Balance*, various years.

[10]*The Military Balance*, 1988.

than they do in the Czech or Polish armies, but in absolute terms, Czechoslovakia has added more T-72s than the East Germans.

THE AIR FORCE

There are roughly 400 combat aircraft in the East German air force. As shown in Table 12, the force has also undergone substantial modernization since the early 1960s. Personnel has expanded from 15,000 in the early 1960s to 40,000 in 1987.[11]

The GDR expanded its air force by 60 percent between 1970 and 1976 while the numbers of aircraft in the Czech air forces declined. Since 1976 the GDR appears to have modernized its air force slightly faster than Poland and Czechoslovakia. Between 1976 and 1987 Czechoslovakia added 40 MiG-23s to its inventory; Poland added 40 MiG-23s and 75 Su-22s. The GDR added a net 70 MiG-23s and 35 Su-22s (Table 12).

The Soviets have stationed an Air Army in the GDR that provides front line aviation for the central front. This is a very powerful force, equipped with top-of-the-line Soviet aircraft. It continues to field more modern aircraft than the GDR.

This modernization program must have been fairly expensive. The new Soviet aircraft are more costly than their predecessors, containing more advanced avionics. In view of the numbers of new planes purchased, a substantial share of East German military expenditures must have gone into the air force in recent years.

THE NAVY

East Germany has a small navy, principally designed for coastal defense with about 160 ships, of which 30 are patrol craft and 70 auxiliary and miscellaneous vessels.[12] Three Koni-class frigates (2000 tons) are the largest vessels in the fleet, all purchased in the last decade.[13] Peene Shipyard in Wolfgast, the naval shipyard, has been constructing a number of Parchim-class corvettes in recent years. In the past it has constructed minesweepers, antisubmarine craft, and some landing craft. The East German navy contains no submarines. In the early 1950s there were reportedly some preparatory measures for procuring submarines, but these were halted after the 1953 riots in East Berlin, possibly because the Soviets may have had second

[11] *The Military Balance*, various years.

[12] Vego, 1983.

[13] *The Military Balance*, various years.

Table 12

AIR FORCES OF THE GSFG, THE GDR, CZECHOSLOVAKIA, AND POLAND

	1970			1973		
	GDR	Cz	Po	GDR	Cz	Po
MiG-15		80	some		some	some
MiG-17	some	80	some	32	some	some
MiG-19	some	100	some		some	some
MiG-21	some	150	some	288	some	some
Il-28		60			some	~48
Su-7		150	some		some	some
TOTAL	275	620	750	320	504	696

	1976			1981			1987		
	GDR	Cz	Po	GDR	Cz	Po	GDR	Cz	Po
MiG-15		50	some						
MiG-17	36		300	35		150			
MiG-19			12						
MiG-21	360	~330	~410	~310	~320	~460	>225	270	360
MiG-23				>12	>12		70	40	40
LIM-6						15			70
Su-7		72	30		80	35		85	30
Su-20			10			35			50
Su-27							35	some	75
Su-25								40	
Il-28			38			5			
Il-29	45	some			30			15	
TOTAL	441	458	804	359	471	705	330	450	625

SOURCE: *The Military Balance*, various years.
NOTE: Cz = Czechoslovakia; Po = Poland.

thoughts about the reliability of East German forces after East German security forces failed to quell the riots.[14]

Despite the additions of the frigates and corvettes to the fleet, the overall stock of East German craft has gradually declined after the buildup of the mid to late 1960s. The number of sailors peaked at 17,000 in 1965 and has stagnated at 16,000 until 1988.[15] In contrast to the air force and the army, the East German navy would play a

[14]Breyer, 1984, pp. 36–41.

[15]*The Military Balance*, various years.

minor role in any East-West conflict. This role does not appear to have changed since the 1960s.

Nonetheless, the East German navy probably accounted for a large share of expenditures on procurement over the last decade. Aside from the three Koni-class frigates, 15 Parchim-class corvettes have been in procured in recent years.[16] During this period the Polish navy undertook little in the way of modernization. (Czechoslovakia, of course, has no navy.) Thus, this service branch may account for most of the differences in increases in military spending between the GDR and the other two countries. However, it is precisely this branch that would have the least importance in a NATO-Warsaw Pact conflict; aircraft and ground forces are much more important in terms of Warsaw Pact capabilities in the central region.

BORDER TROOPS

Since 1976 the Border Troops have become organizationally distinct from the NVA, although they still fall under the Ministry of Defense. Most are lightly armed. Their primary peacetime task is to keep East German citizens within the country.

SUMMING UP

These comparisons of force levels and equipment holdings between the GDR on the one hand, and the GSFG, Czechoslovakia, and Poland on the other, provide no indications that the GDR has achieved a substantially more prominent role in the Warsaw Pact than heretofore. Ground force modernization rates have been about the same as Czechoslovakia's. Soviet ground forces continue to be much more powerful. The GDR appears to have modernized its air force slightly faster than Czechoslovakia and Poland. Modernization in the navy has proceeded much more rapidly and extensively than elsewhere. Poland's navy has purchased no major vessels in the 1980s while the GDR has purchased at least 15 corvettes.

These different rates of modernization do not indicate that the GDR has been increasing military spending at rates six times faster than Poland or Czechoslovakia. Consequently, the increases in military spending in the GDR in real terms have been substantially less than the reported nominal increases. The real expenditure index constructed from Keren's price indices probably provides more accurate

[16]*The Military Balance*, various years.

estimates of real spending increases than the other series in Table 1, implying that the GDR has been increasing its military spending at a rate three, not six, times faster than rates in Poland and Czechoslovakia. Although this difference is large, it does not signify a dramatic change in the roles of these countries in the Warsaw Pact, unless it would be sustained for decades. Since the GDR reduced the nominal increase in its military budgets from 7.8 percent between 1986 and 1987 to 3.4 percent between 1987 and 1988 and between 1988 and 1989 these different rates of increase may already be converging.

IV. DEMOGRAPHIC CONSTRAINTS ON THE EAST GERMAN MILITARY

THE DECLINING CONSCRIPT POOL

Between 1956 and 1961 the NVA was an all-volunteer force. It became a conscript army in 1962, the year after the construction of the Berlin Wall.[1] Until recently, there was an adequate supply of conscript age males to staff the armed forces. However, now the GDR, like the Soviet Union and the Federal Republic of Germany, faces a decline in the numbers of draft-age males (Table 13). If current force levels are to be maintained, a greater proportion of 18-year-old males will have to be drafted reducing the supply of labor to the rest of the economy. The question is, "How large will this proportion have to be and is it supportable?"

To answer this question I calculated the annual intake of the East German armed services and Border Forces using total force figures from *The Military Balance*. Officers were assumed to serve 25 years; noncommissioned and warrant officers 12 years; enlisted men three years; navy and air force conscripts two years; and army conscripts 18 months.[2] These periods of enlistment coupled with *The Military Balance* figures and percentages of officers, warrant officers and enlisted men from Johnson, Dean, and Alexiev (1982) were used to calculate replenishment needs. I then divided this figure by projections of East German 18-year-old cohorts computed by the Center for International Research, Bureau of the Census.[3] The resulting percentages are given in Table 13.

A comparison of West German and East German percentages shows that initially the East German problem is much more severe

[1]McCausland, 1986, p. 139.

[2]These figures were derived from Lauterbach, 1983, pp. 403–405, as translated in JPRS 83918, July 18, 1983, pp. 7–13. Lauterbach states that the active service period for professional soldiers runs 10 years for noncommissioned officers and 15 for warrant officers. Because I had no breakdown for warrant and noncommissioned officers, but know noncommissioned officers are the more numerous, I chose a representative 12-year period for these two groups.

[3]Not all new recruits are drawn from among 18-year-olds; in the tightest years the NVA could draft older, previously deferred men. In fact, East German military representatives interviewed by A. Ross Johnson state that they have already resorted to this. However, conscription rates are so high for most of the period that this option cannot produce dramatic increases in personnel, so I adopted the simplifying assumption that all new entrants come from the cohort of 18-year-olds.

Table13

PERCENTAGES OF 18-YEAR-OLD MALES NEEDED TO MAINTAIN CURRENT FORCE LEVELS

	FRG			GDR				
Year	Draft-Age Males 18 Years Old Midyear	18-Month Enlistment	2-year Enlistment	Draft-Age Males 18 Years Old	18-Month Enlistment	% Draftable Males, 18-Month Enlistment	% Draftable Males, 2-year Enlistment	Shortfall in Military Manpower, Draftable Males
1983	555,000	41.80	31.35	140,051	64.3	76.6	63.0	27571
1984	544,083	42.64	31.98	133,489	67.5	80.3	66.1	22059
1985	530,625	43.72	32.79	126,051	71.5	85.1	70.0	15811
1986	511,553	45.35	34.01	121,735	74.0	88.1	72.4	12185
1987	485,205	47.81	35.86	118,781	75.2	89.5	73.6	10520
1988	441,674	52.53	39.40	117,554	76.6	91.2	75.0	8673
1989	441,686	52.53	39.39	116,482	77.3	92.1	75.7	7773
1990	375,048	61.86	46.39	99,846	83.8	99.7	82.0	268
1991	334,452	69.37	52.03	89,462	96.0	114.3	94.0	−11277
1992	311,367	74.51	55.88	88,142	102.2	121.7	100.0	−16033
1993	301,056	77.06	57.80	88,666	101.6	120.9	99.5	−15593
1994	298,283	77.78	58.33	92,624	97.2	115.8	95.2	−12268
1995	298,824	77.64	58.23	102,984	87.5	104.1	85.6	−3566
1996	295,841	78.42	58.82	112,483	80.1	95.3	78.4	4414
1997	295,201	78.59	58.94	115,592	77.9	92.8	76.3	7025
1998	304,668	76.15	57.11	118,799	75.8	90.3	74.2	9719
1999	314,630	73.74	55.30	117,300	75.9	90.4	74.3	9556
2000	315,368	73.56	55.17	118,054	76.3	90.8	74.7	9093

NOTE: The FRG is assumed to need 232,000 new entrants to the military annually. The FRG percentages understate the military's draw on West German 18 years olds. At the time this analysis was conducted, the West German government had decided to increase enlistments from 15 to 18 months. It has since reverted to 15 month periods. Consequently, the annual draw could be 40,000 men more. The GDR is assumed, to need 75,500 conscripts, 9587 enlisted men, 3646 noncommissioned officers, and 1340 officers per year. If the draft is increased from an 18-month period of enlistment for army and border guard draftees to a two-year period of enlistment for all draftees the number of conscripts needed annually would fall to 59,500. East German shortfalls and the number of potentially draftable men were calculated under the assumption that 16 percent of potential conscripts receive deferments for physical, mental, or academic reasons (Popper, 1988). This figure was derived from Soviet data and assumes a very low percentage of academic deferments (2 percent per cohort). The shortfalls in military manpower were derived by subtracting the number of needed new recruits from the potential pool.

(Table 13). Under current enlistment patterns the GDR would have to conscript all 18-year-old males in the early 1990s. However, the East German problem eases somewhat by the late 1990s while the FRG's continues to worsen until 1997. Even so, the GDR's problem will be more severe than the FRG's over the next decade.

Of course, not all draft age males can be conscripted. Some are not physically or mentally capable of military service. Between 1944 and 1945, the peak of the World War II draft, 14.0–17.1 percent of all 18–25-year-old males were considered physically unfit for duty (IV-F) in the United States. Between 1965 and 1968 IV-F deferments of 18-year-olds ran 25 percent in the United States.[4] Popper (1988) has estimated that at a minimum, 16 to 17 percent of Soviet youth must obtain deferments, of which roughly 2 percent might be for academic reasons. I have taken the very conservative lower bound of Popper's calculations to estimate the surplus or shortfall available for military service in the GDR.

The entire pool of draftable conscripts will be inadequate to maintain current inflows. Between 1991 and 1995 the GDR will experience shortfalls of up to 16,000 men, over a full division. Thus, it is possible that the GDR will try to increase the length of service.

If the GDR does increase terms of service to two years for the army and border troops, the standard term in Poland and Czechoslovakia, current force levels would still be difficult to sustain. The lengthier service term would mean that the entire pool of draftable 18-year-olds will be taken by the military in the early 1990s. Increasing tours of duty will be costly. At a time when the East German government stresses technological change, longer military service will postpone the time between graduation from secondary school and the entrance of college and technical school graduates to the job market. Increasing numbers of retirees also place pressure on the labor market, as more young workers are siphoned off by the draft. Last, the GDR is in perennial competition with the FRG for the loyalties of its citizens. At a time when the West German tour of duty remains 15 months and the Soviets are promising to withdraw six divisions from Eastern Europe, increasing the term of conscription would be very difficult politically. In fact, Asmus (1982) notes that in 1983, the year in which a new conscription law was passed in the GDR, the leadership debated the possibility of increasing the period of conscription to two years. They decided not to for political reasons.

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[4]Popper, 1988.

POLICY CHANGES TO COPE WITH THE CRUNCH

The East German leadership has begun to openly acknowledge the demographic crunch. Defense Minister Kessler has stated that demographic trends are negative until 1992 and will not get much better through 1996. Kessler noted that the GDR can maintain current manpower levels only "with great difficulty."[5] Demographic as much as political reasons probably motivated the recent decision to reduce the size of the NVA.

More Career Soldiers

One can already see attempts by the East German leadership to relieve the pressure. The military intends to increase the number of career and extended term soldiers to compensate for the declining number of potential draftees and has increased efforts to recruit people for longer periods of duty, which will lessen the number of conscripts needed to keep troops at a particular level. The East German government also appears to believe that more professional soldiers would increase the potency and combat readiness of its forces.[6] Representatives of the East German Youth League (FDJ) and military commanders frequently give talks in enterprises and schools to persuade young people to choose military careers. In fact, the FDJ passed a resolution in 1986 stating that it needs to attempt to increase voluntary long-term enlistments.[7] One naval captain stated that over 40 percent of those called up for the navy (a small percentage of total conscripts) have opted for a longer service period. By so doing, they can postpone their tour of duty to the next callup period. Those who do not volunteer for longer periods face greater uncertainty. In some instances they are called up immediately, in others they are called up as late as their 23rd birthday. Such a late callup can greatly inconvenience their civilian careers. Furthermore, those who have served as volunteers or officers in the military are awarded job classification levels or access to government or party positions that ensure them a substantial income (above and beyond their pensions) after leaving the armed forces.[8] Extended military service also facilitates access to higher education. People with less than a spotless military record may be penalized; they may be denied entry to a university and passed over for promotion.

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[5]*Die Zeit*, September 30, 1988, pp. 4–8, as translated in FBIS-EEU-88-192, October 4, 1988.

[6]Mara, 1984, p. 3.

[7]*Iwe Tagesdienst*, No. 68, May 2, 1986, pp. 1–2, as translated in JPRS-EER-86-164.

[8]Johnson, Dean, and Alexiev, 1982, p. 88.

Recruiters have begun to advocate military professions for boys at an early age. After completing vocational training in tenth grade, teenage boys are encouraged to apply for a one year officer training course.[9] If accepted, recruits are eligible for military college admissions. They are generally recruited as warrant officers. Moreover, noncommissioned officers receive master craftsman qualifications. These are very important in East Germany; holders receive substantially greater wages than ordinary craftsmen.

Military wages are very competitive with alternative occupations. In 1980 monthly wages were:

Squad leader, 1st year—815 marks
Deputy platoon leader, staff sergeant, 6 years—1025 marks
Platoon leader, 6 years—1155 marks
Master sergeant, 10 years, 1222 marks

Graduates of an officers' college:
Lieutenant, 4 years—1185 marks
Company commander, 9 years—1495 marks.[10]

The average gross income for a skilled worker in 1980 was 1018 marks per month.

Despite these recruitment attempts, many young East Germans do not consider the military an attractive career. For example, on a broadcast entitled "Do Soldiers and Peace Even Go Together?" a high school boy and girl who had recently decided to enter the military reported that many of their classmates had told them they must be insane to enter the military. East German military recruiters have had a difficult time.[11]

Female Soldiers

Another option is to increase the number of women in the military. One East German author has noted the growing number of women entering the armed forces.[12] Women constitute roughly one third of the personnel in civil defense formations and operational units. The number of women in active service in paramilitary combat groups is also growing. There are also more women in administration,

[9]"Schoolboys More Actively Recruited for Military Professions," Background Report by FRG Ministry for Inner-German Relations, *Informationen*, No. 15, July 1982, pp. 10–12, as translated in JPRS-82564, pp. 66–68.

[10]Ibid.

[11]Kersten, 1986, p. 3.

[12]Mara, 1983, p. 3.

communication centers, and medical services, the only areas in which they are currently permitted to serve in the regular forces. Some are serving as temporary or career noncommissioned officers, ensigns, and technicians at technical installations. More have taken staff service as career officers. Among the most important pools of women entering military service are the daughters of military officers.

Mara (1983) notes one reason for the rising number of women recruited by the military is the low number of young men of draft age because of the low birth rates of the 1960s. Another reason for recruiting more women has been the increased need for specialists willing to serve longer periods of enlistment stemming from the greater complexity of military operations and equipment.

Women in uniform are awarded special consideration. The military has modified uniforms to make them more attractive. Women who sign up while in secondary school receive priority for training and receive the higher basic pay of 300 marks a month as obligated career officer aspirants.

Women are also used to a greater extent as substitutes for men in traditionally male occupations such as technicians. East German publications are advocating technical careers for girls and military professions for boys. In some cases more apprenticeships have been reserved for women. As a consequence, more young men were planning on going into the military in 1982 than previously, because many apprenticeships had been reserved for young women.[13]

Opposition to increasing the numbers of women in the military has grown. Petitions opposing military service have been sent to the state agency in charge of recruitment. One petition sent to Erich Honecker, signed by 300 women, stated that army service for women was not an expression of their equality, but antithetical to their principles. They felt called on to protect life and doubted that as conscripts they would be able to act against war and for peace.

Greater Use of Reserves

Another alternative is to increase reliance on reserve units. Ostensibly, 400,000 men are enrolled in the reserves, double the size of active duty troops.[14] Some of these men would form the four reserve divisions of the NPA; the rest would provide support for the regular forces. Because the GDR already has such a large reserve, it is

[13]"Schoolboys More Actively Recruited for Military Professions," Background Report by FRG Ministry for Inner-German Relations, *Informationen*, No. 15, July 1982, pp. 10–12, as translated in JPRS-82564, pp. 66–68.

[14]Zulauf, 1986, pp. 14–15.

unlikely that it can expand these forces substantially. A large share of the potential pool is in the reserves already. Other citizens volunteer part of their time for paramilitary organizations such as the Workers' Militia. Thus, this potential solution has already been heavily exploited. If reservists were to increase the time currently spent training or engaging in other military activities, economic output could suffer because of the resulting disruptions. If reserves were expanded even more, Western military analysts would have to weigh the capabilities of these units carefully in determining the potential threat they present, especially if they are manned by older men using obsolete equipment.

EMIGRATION

Emigration, especially of draft age males, could pose an additional problem for the GDR in the coming decade. During the 1950s roughly 2.2 million people left the GDR for the West, 12 percent of the population in 1950. Some of these had earlier been refugees from East Prussia, Silesia, and other areas annexed by the Soviet Union and Poland.[15] This flow was stopped almost completely by the construction of the "Wall" in 1961. A very few people have escaped over the "Wall"; some have escaped to the West on vacations to Yugoslavia, some, especially the elderly, have been allowed to emigrate for reasons of family reunification, and a few dissidents have been expelled by the East German government.

In 1984, however, the East German government altered its emigration policies and began to permit larger flows of emigrants. In 1984, 40,000 people were given official permission to leave, .24 percent of the population. Never before had the GDR government given permission to emigrate on such a scale.[16] Emigration was the major factor in the decline of the population that year. However, less than .25 percent of the pool of 1985 conscripts left in 1984, so emigration has not been a major problem in terms of conscription. 20,000 people were given permission to legally emigrate in 1986 (more left through illegal means). In 1987 the total number of emigrants fell to 18,000, of which only 11,459 were legally permitted to leave. However, legal emigration has risen to almost 30,000 in 1988 and an additional

[15]Kosinski, 1977, p. 35.

[16]Donovan, 1988b.

10,000 left illegally.[17] Some of these people were tourists who decided not to return to the GDR. Young people constitute a large share of the nonreturners.

If East German emigration policies continue to be relaxed, emigration may create serious problems for the NVA. Three to four hundred thousand of the GDR's 16.6 million citizens, 1.8–2.4 percent of the population, may have applied to emigrate.[18] The exact figure is unknown but some sources argue the figure may be as high as one million.[19] More worrying for the East German government is that those who wish to emigrate tend to be of working age; 400,000 people is equivalent to 4 percent of the working population.[20] One out of four doctors reportedly wishes to leave.[21] Many of these potential emigres are of draft age.

The East German government is unlikely to let these men leave. It has, however, begun to permit more travel to the West. The West German government estimated that five million visitors arrived from the GDR in 1988.[22] Over half of them will have been in the Federal Republic for the first time and many are young.

To this point, the vast majority of tourists have returned. However, as these flows increase, especially among younger people of marriageable (and draft age), more of them are likely to stay. In this case, emigration may have a significant effect on the pool of potential conscripts.

The likely East German response to defections by travelers would be to limit travel again. However, the prohibitions on travel are considered the most onerous facet of life in the GDR by most East Germans. To have this privilege withdrawn so soon after it has been granted would undoubtedly lead to serious political dissatisfaction, creating new problems for the regime.

Travel is creating another problem for the East German military: morale, or more specifically, maintaining the motivation to fight. The East Germans have made great efforts to construct an image of

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[17]Kahl, 1988, p. 1; personal communication from Barbara Donovan; *Suddeutsche Zeitung*, December 6, 1988.

[18]Donovan, personal communication.

[19]Kahl, 1988b, p. 1.

[20]The prime emigration ages tend to be between 18 and the early 30s; the elderly are often reluctant to emigrate because they prefer to remain with family and friends. Young adults, however, tend to be more adventurous and more attracted to the economic opportunities available elsewhere. For these reasons, the working age population, especially the young, would be disproportionately represented, as they were in the 1950s, in open emigration from the GDR.

[21]Kahl, 1988b.

[22]Donovan, 1988a.

NATO forces as the "enemy." To some extent this effort has been successful. One East German officer who defected to the West said, "The notions of imperialism and class enemy are still a factor in the military, although Marxism has lost its appeal. But in foreign policy and military strategy, it still has some effect on the majority of officers."[23] Alexiev and Johnson conclude that in a short-warning attack against NATO, East German forces would generally be reliable. However, in 1988 the East German Defense Minister stated, "[I]t is more complicated to explain to young people the need to do their duty here, in this socialist army." He goes on to say detente, not perestroika or glasnost, has made it more difficult to motivate people for military service.[24] As East German youth travel to the FRG and establish contacts with their Western counterparts, the problems of maintaining an image of the enemy will multiply.

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[23]Alexiev and Johnson, 1986, p. 82.

[24]*Die Zeit*, September 30, 1988, pp. 4–8, as translated in FBIS-EEU-88–192, October 4, 1988.

V. ECONOMIC CONSTRAINTS ON THE EAST GERMAN MILITARY

INCREASES IN OUTPUT

As shown in Crane (1987) UNI is the most important determinant of military spending in the Northern Tier of the Warsaw Pact, including the GDR. Consequently, future increases in East German military expenditures will depend on the outlook for growth in economic output.

A simple way of looking at growth is to see it as a function of increases in capital and labor inputs and improvements in total factor productivity. Increased factor productivity is often traced to technological change. However, improvements in allocative efficiency, gains from trade or increasing levels of education (increases in human capital) are also important factors. Thus, the ability of the GDR to finance its military in the future depends on the labor, capital, and other resources it will have at its disposal and on improvements in the productivity of these factors.

I have constructed a small model of the East German economy to assess the potential of the economy to finance increased outlays on the military. The model, described in greater detail in App. B, projects output (NMP), the material resources available to the government to spend on defense (UNI), and average annual increases in military spending in constant prices, assuming the East German government continues to devote 7.0 percent of UNI to the military and 9.7 percent to the military and security, as it is estimated to do for 1988.

The model is, of course, only as good as the data from which it is constructed. As noted above, GDR growth statistics appear to have been greatly inflated in the past. For this reason, it is probably not surprising that the model generates continued growth in NMP of about 4 percent per year (Table 14). Because terms of trade are assumed no longer to deteriorate and the trade surplus to stagnate, UNI and military spending grow faster, at about 5 percent per year. Below a more detailed analysis of these components of economic growth suggests the actual course of the East Germany economy will be quite different from that indicated by this model constructed from official data. Continued increases in military spending will probably become difficult to sustain.

Table 14

PROJECTIONS OF NMP, UNI, AND MILITARY SPENDING

Year	NMP (1986 = 100)	UNI (1986 = 100)	Percent Increase in Military Spending	Percent Increase in Military and Security Spending
1988	109.2	111.0	3.0	3.8
1989	113.8	116.5	5.0	5.0
1990	118.7	122.3	5.0	5.0
1991	123.8	128.4	5.0	5.0
1992	129.3	135.0	5.1	5.1
1993	135.2	142.2	5.3	5.3
1994	141.5	149.7	5.3	5.3
1995	147.9	157.4	5.2	5.2
1996	154.5	165.4	5.1	5.1
1997	161.4	173.7	5.0	5.0
1998	168.7	182.4	5.0	5.0
1999	176.2	191.4	5.0	5.0
2000	183.9	200.6	4.8	4.8

LABOR

Increases in East Germany's labor force will not be a source of economic growth in the 1990s. The GDR has experienced more or less steady declines in population since its inception (Table 15). The total labor force will fall through 1990, after which it will increase slightly and then stagnate. Sharp declines will take place after the year 2000. This trend may make it difficult to maintain current output levels in the next century, although it should not be a problem in this one.

Although population declines per se can lead to improvements in per capita incomes as the existing capital stock services a smaller number of individuals, it does pose problems for military spending. If declines in the working age population lead to slower aggregate economic growth, the size of the pie to be spent on the military will be smaller than it otherwise would be. Thus, future declines in the population of the GDR may work to constrain military expenditures, even though they may be accompanied by increases in per capita incomes.

Table 15

THE POPULATION OF THE GDR

Year	Inhabitants	Working Age People
1946	18,488,316	11,660,166
1950	18,388,172	11,781,917
1955	17,832,232	11,402,495
1960	17,188,488	10,542,093
1965	17,039,717	9,916,271
1970	17,068,318	9,881,068
1975	16,820,249	10,046,449
1980	16,739,538	10,580,640
1983	16,709,067	10,757,828
1985	16,655,219	10,798,925
1986	16,639,877	10,809,682
1988	16,596,876	10,853,418
1990	16,577,912	10,810,832
1993	16,555,649	10,825,512
1995	16,541,711	10,872,224
1998	16,530,708	10,881,229
2000	16,538,949	10,857,901

SOURCE: Projections by the Center for International Research, U.S. Bureau of the Census.

CAPITAL

A second source of economic growth is increases in capital. Like its East Bloc neighbors, the GDR has traditionally devoted a substantial share of net output to investment, more than is usually the case in market economies. According to official figures, 24.6 percent of UNI was devoted to investment in 1970; investment averaged 22.0 percent of UNI between 1970 and 1986. By devoting such a large share of UNI to investment, the GDR has been able to rapidly increase the size of its capital stock. Investment fell to a low of 17.6 percent of UNI in 1985, however, before recovering slightly to 18.2 percent in 1986.

These sharp declines in this percentage since 1970 coupled with slow growth in UNI has meant that the capital stock has grown more slowly in the 1980s. Unless economic growth accelerates or the share of UNI devoted to investment increases, a slowdown in the growth of the capital stock may serve to brake economic growth in the coming decade.

FACTOR PRODUCTIVITY

This leaves improvements in factor productivity as the key to East German growth in the 1990s. By official measures, total factor productivity has increased steadily and rapidly in the GDR since the creation of the state. Since 1968, the GDR has increased total factor productivity more rapidly than Czechoslovakia and Poland (Table 16). By some measures, however, Hungary's performance has been superior to the GDR's since the implementation of its economic reform.

Table 16

COMPARATIVE PRODUCTIVITY GROWTH IN EASTERN EUROPE 1968–85
(Average annual figures in percent)

	Czechoslovakia	GDR	Poland	Hungary
NMP growth rates				
Official	4.0	4.7	3.3	3.8
Keren deflator[a]	—	2.4	—	—
Changes in capital productivity[b]	–1.42	–0.30	–2.16	–1.72
Changes in labor productivity[b]	3.54	4.54	3.26	5.35
Keren deflator[c]	—	1.77	—	—
Decreases in energy usage[d]	–1.73	–2.44	–.29	–0.26
Changes in total factor productivity[b] (East German weights)	2.23	3.26	2.01	3.47
Changes in total factor productivity[b] (Hungarian weights)	1.23	2.28	.80	2.04

[a]These figures were derived from Keren (1987). They are for 1968–83 only. His price deflators were employed to construct revised growth rates for 1981–83. These growth rates coupled with ones for earlier years provided by Keren were used to construct a revised NMP index in 1980 prices, which generated the figures in the table.

[b]These figures are for net industrial output only. In general, economy-wide performance would be lower. See App. C for details.

[c]These figures were constructed by deflating the official net industrial output index by Keren's estimates for price drift for NMP.

[a]Vanous, 1986. The figures for energy usage are per unit of total NMP, not per unit of NMP produced by industry.

The GDR has not done as well as Hungary in increasing labor productivity, but has done better than Czechoslovakia and Poland, according to the official statistics. East German figures show that the large investments of the 1970s have been accompanied by *declines* in the productivity of capital, each additional increment of capital has resulted in smaller and smaller increments to net output (Table 16). However, capital productivity in the GDR has declined less rapidly than in any of its neighbors.

Capital productivity has declined in part because of poor choices of investment. The GDR is a highly centralized economy. In 1985 the East German budget equalled 97 percent of NMP. In other words, almost the entire net value of economic production was reallocated by the central government through the budget. Under these conditions there is little or no room for markets to be used to make decisions on the allocation of investment. The success or failure of investment depends on the decisions of the central authorities.

Although the East German authorities have been fairly close-mouthed on the allocation of investment, they have increasingly emphasized energy, especially the mining of lignite, since the 1970s. According to Boot (1988), the share of fuels and energy in industrial investment rose from 24 percent in 1975 to 34 percent in 1980 to 40 percent in 1985. East Germany is not well-endowed with energy. It is one of the few countries in the world that mines massive quantities of lignite. Most other countries that mine lignite are also in the bloc; few other countries find it cost-effective to mine this high-polluting fuel. Because the GDR is fairly poorly endowed with energy, investing so much in this sector, especially lignite production, appears to be a misallocation of investment resources at a time when energy prices are falling or have fallen on both the CMEA and world markets. Other potential misallocations of investments include the push to develop an indigenous microchip industry at a time when the industry in the West is becoming more integrated.

The GDR also deserves mixed reviews for energy conservation. According to official statistics, the GDR uses less energy per unit of output than the average for the Organization of Economic Cooperation and Development (OECD) and much less than any other country in the bloc (Table 17).[1] However, when one uses reconstructed growth indices rather than the official figures, the GDR produces two-thirds the output per unit of energy of the OECD average. Furthermore, while the OECD increased output per unit of energy by 30 percent

[1]Hungary and Czechoslovakia are the second best performers.

between 1975 and 1982, this figure was only 13 percent for the GDR, using Alton's growth estimates.[2]

Most of the figures in Table 16 were calculated using official East German statistics. Keren (1987) has recomputed GDR growth rates using alternative consumer price indices calculated by the DIW. As shown in the table, the GDR's performance deteriorates markedly using these estimates. Increases in NMP fall by 2.3 percentage points, to an average of 2.4 percent per year between 1968 and 1983. Although comparisons between NMP and GDP are misleading,[3] these

Table 17

GROSS VALUE-ADDED IN INDUSTRY PER UNIT OF PRIMARY ENERGY CONSUMED
(1975 dollars per ton of petroleum equivalent)

Country	1965	1975	1982
GDR[a]	1087	1218	1375
GDR[b]	1203	1656	2136
Czechoslovakia[a]	783	807	1018
Czechoslovakia[b]	817	1025	1321
Hungary[a]	1071	1096	887
Hungary[b]	1085	1666	1661
CMEA-7 average[a]	762	873	878
CMEA-7 average[b]	791	1176	1363
Yugoslavia	1340	1601	1366
OECD-15 average[c]	1466	1583	2052

SOURCE: Rostowski, 1988, Tables 7, 8.

[a]Growth rates as computed by Alton et al., 1985.

[b]Growth rates as recorded in the national statistical yearbooks.

[c]Excludes Finland, Ireland, Portugal, Turkey, Australia, and New Zealand because of the unavailability of data.

[2]Rostowski, 1988.

[3]NMP excludes services. In economies where industry is a priority sector, as in the GDR, increases in the output of services generally lag increases in the material sectors so NMP grows more rapidly than GDP. In these cases a comparison of rates of growth in GDP in the West with NMP in the East imparts an upperward bias to the performance of the East Europeans.

figures show that the GDR has fallen relatively further behind the West, including the FRG.[4]

Collier notes that the GDR has reduced the consumption of inputs per unit of output.[5] He hypothesizes that the GDR's relatively better performance than its CMEA neighbors has been partly due to the adoption of a new economic policy in the 1980s stressing "intensification." GDR officials define this as:

> decreasing unnecessary costs, improving the organization of work, modernization of the economic structure, better qualification of the labor force and greater discipline.[6]

They have pursued this policy by shifting investment from the construction of new factories to renovation of existing facilities. In manufacturing rationalization and modernization took 77 percent of investment in 1986 as opposed to only 30 percent in the 1970s. Since 1983 the government has aimed at increasing the life of equipment by 30 percent.[7]

Another important improvement in efficiency has been in the reduction of inventories. Inventory investment has fallen from an average of 4.3 percent of UNI between 1970 and 1977 to 3.6 percent of UNI in the 1984–1986 period.

Incentive systems have also been revised. Collier has noted that the system appears to have shifted from an output orientation to cost reduction. This does not mean the GDR has implemented a liberalizing economic reform. In traditional central planning enterprises are constrained on the input side by quotas and encouraged to expand output by bonuses tied to targets. The GDR continues to be a centrally planned economy but has reversed the order of priorities. Since March 1983 net production has become the primary indicator for performance evaluation thereby pressuring managers to reduce input use subject to maintaining certain gross output targets.[8] This emphasis on reducing inputs appears to have been successful in the first part of the 1980s, but both Boot and Collier argue that this appears to have been a one-time phenomenon. Further reductions in input use have been substantially smaller (Table 18). It is as if the GDR has wrung a great deal of waste out of the system through a one-time change in priorities, but the system has now returned to its old growth path.

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[4]The FRG recorded average annual rates of growth of 2.8 percent between 1968 and 1983 (*International Financial Statistics*, various years).

[5]Personal communication.

[6]Koziolek, 1987, as cited in Boot, 1988, p. 5.

[7]Boot, 1988, p. 5.

[8]Ibid., p. 7.

Table 18

CHANGES IN ENERGY AND MATERIALS USAGE PER UNIT OF OUTPUT
(Percent)

	1980–82	1982–84	1984–86
Energy	–9	–6.6	–0.5
Materials	–5	–4.4	–3.0

SOURCE: Boot, 1988, p. 8.

The GDR has also sought to increase productivity through a greater emphasis on technological change. Despite strictures on the share of output composed of new products,[9] most of the changes have been minor modifications. The system still provides few incentives for the introduction of truly new items. It is very difficult to change suppliers or obtain the requisite materials for substantially different products. Enterprise managers are also penalized for production problems, so the teething that comes with introducing new products is costly in terms of bonuses. Despite official claims of increases in the ratio of introduction of new products, tangible evidence of a surge in marketable new products from the GDR has to be sought in East German foreign trade performance.

INTERNATIONAL COMPETITIVENESS

Hard Currency Trade

Because the GDR is a small industrial economy it is highly dependent on trade for the provision of raw materials and new technologies. It has, however, limited its gains from trade by curbing imports of consumer goods. Future economic growth will be highly dependent on its ability to efficiently generate the foreign exchange it needs to finance imports.

Past performance indicates the likelihood that the GDR will be able to finance more hard currency imports. Unfortunately, East German trade statistics are limited and difficult to interpret because they are recorded in deviza marks, a unit of account that has little or no

[9]Since June 1984, 30 percent of enterprise output must be composed of products introduced in that year; consumer goods producers are obliged to reach a target of 40 percent (ibid., p. 7).

Table 19

EUROPEAN CMEA SHARES IN OECD IMPORTS
(Percent)

Years	Total Non-OECD	CMEA	GDR	Hungary	Czecho-slovakia	Poland
			Total Trade			
1965 only	27.93	3.25	0.46	0.22	0.34	0.51
1970–75	27.10	3.02	0.41	0.24	0.30	0.50
1976–80	33.07	3.23	0.37	0.21	0.24	0.47
1981–85	32.52	3.25	0.39	0.19	0.21	0.28
Difference 1970–75 and 1981–85	5.42	0.23	–0.02	–0.05	–0.09	–0.22
			Fuels and Lubricants (SITC 3)			
1970–75	74.99	4.98	0.18	0.03	0.21	0.91
1976–80	79.17	5.76	0.25	0.04	0.13	0.59
1981–85	71.26	7.65	0.43	0.08	0.14	0.32
Difference 1970–75 and 1981–85	–3.73	2.67	0.25	0.05	–0.07	–0.59

bearing on domestic prices. Consequently, I used an alternative data series, OECD imports from the GDR, to assess trade performance. In particular, I assess East German performance by comparing changes in its share of OECD import markets with those of its East European neighbors and the rest of the world.

I chose the OECD rather than the nonsocialist world market because the East European countries sell the bulk of their hard currency exports to OECD countries, especially Europe, and because the OECD is considered the most competitive export market.

One problem with this method is the exclusion of East German trade with the FRG from OECD statistics. I dealt with it by converting FRG-GDR trade as reported by the FRG into dollars and adding it to the OECD figures. Since the GDR conducts over half its hard currency trade with the FRG, the omission of this trade would severely bias the results.

The results of the study are shown in Table 19. As can be seen, the East European CMEA slightly increased its share of total OECD imports between the 1970–75 period and the 1981–85 period. However, the entire increase was accounted for by the Soviet Union. The

four Eastern European countries all lost market share. Of the four, the GDR fared the best, losing less than 5 percent of its 1970–75 share (.02 percentage points of the OECD market). Hungary lost about 20 percent of its market share; Czechoslovakia, one-third; and Poland, almost one-half.

These changes were partially due to shifts in relative prices. The large increase in the value of oil in the early 1970s accounts for the increase in Soviet market share as well as that of the Middle East. However, the major reason for the decline in East European shares has been due to competition from other non-OECD suppliers, especially the newly industrialized countries (NICs). The share of imports from the CMEA to the OECD in total imports to the OECD from outside the region has fallen from 11.3 to 10 percentage points. As shown by Poznanski (1986) the NICs have taken market share from the European CMEA in manufactured goods, especially in consumer goods (SITC 8) and machinery and transport goods (SITC 7).

In order to assess the loss of competitiveness in these industries more carefully I also compared OECD market share for manufactured goods, in particular chemicals (SITC 5), manufactured goods classified by material (SITC 6), machinery (SITC 7), and consumer goods, excluding foodstuffs (SITC 8). Some articles in SITC 6 such as refined copper and silver are not as heavily processed as articles in SITC 7 and 8. For this reason, I ascribe somewhat more importance to changes in market share in these two categories.

Here the declines are even more marked (Table 20). Between 1970–75 and 1981–85 the European CMEA fell from 16 to 7 percent of the OECD import market for consumer goods from non-OECD suppliers and 27 to 8 percent of this market for machinery.

The East European members of the CMEA have not lost corresponding shares of gross OECD imports because of their exports of petroleum and other sources of energy. Only Poland and, to a lesser extent, Czechoslovakia have large reserves of coal or other energy carriers, so this trade presents a puzzle. In the case of the GDR, Hungary, and, to some extent, Czechoslovakia, it represents reexports of oil or the export of petroleum products refined from imported crude oil. The importance of this trade is staggering. In 1985 24 percent ($1192 million) of GDR's exports to the OECD (including the FRG) consisted of energy. Because the profitability of exporting refined products is highly variable, depending on fluctuations in the price of crude oil, the GDR is vulnerable to sudden changes on the international oil market.

Notwithstanding the poor performance of the region as a whole, the four countries examined performed markedly differently during

Table 20

EUROPEAN CMEA SHARES IN OECD IMPORTS OF MANUFACTURES

Years	Total Non-OECD	CMEA	GDR	Hungary	Czecho-slovakia	Poland
			Chemicals (SITC 5)			
1970–75	7.38	2.42	0.68	0.21	0.27	0.33
1976–80	7.82	3.04	0.62	0.27	0.25	0.27
1981–85	9.58	2.96	0.74	0.30	0.30	0.18
Difference 1970–75 and 1981–85	2.20	0.54	0.06	0.09	0.03	–0.15
			Manufactures (SITC 6)			
1970–75	15.98	2.52	0.41	0.25	0.50	0.43
1976–80	18.09	2.88	0.37	0.24	0.45	0.50
1981–85	20.07	2.46	0.46	0.22	0.39	0.35
Difference 1970–75 and 1981–85	4.09	–0.06	0.05	–0.03	–0.11	–0.08
			Machinery (SITC 7)			
1970–75	4.09	1.06	0.29	0.07	0.22	0.18
1976–80	6.26	1.14	0.25	0.10	0.15	0.29
1981–85	9.08	0.72	0.19	0.09	0.10	0.13
Difference 1970–75 and 1981–85	4.99	–0.34	–0.10	0.02	–0.12	–0.05
			Consumer Goods (SITC 8)			
1970–75	19.79	3.18	1.17	0.43	0.46	0.43
1976–80	27.04	3.09	0.96	0.44	0.37	0.50
1981–85	32.32	2.22	0.72	0.31	0.27	0.28
Difference 1970–75 and 1981–85	12.53	–0.96	–0.45	–0.12	–0.19	–0.15

this period. Hungary increased its market share in chemicals by almost half, more in relative and absolute terms than the GDR or Czechoslovakia (Poland lost market share). Hungary was also the only one of the four to increase its share of OECD machinery import markets, by 30 percent. The GDR lost one-third of its share over this period. All four countries lost shares of OECD consumer goods markets to the NICs, although Hungary's losses were smaller than the GDR's. Manufactured articles classified chiefly by material of origin (SITC 6), which consists of iron and steel products, refined metals,

paper, and other semiprocessed manufacturing, was the only market in which the GDR's performance was superior to that of the other three countries. Considering that the GDR started the period with the most sophisticated industrial base and better market access than the other countries, these data indicate the country's export performance has been mediocre, even when compared with that of other centrally planned economies.

Even that mediocre export performance has been purchased at substantial economic cost. In the GDR, UNI has grown more slowly than NMP in recent years because of the export drive launched to prevent default on hard currency debts and to balance trade with the Soviet Union. The GDR has also been hit hard by a marked deterioration in its terms of trade, especially with the Soviet Union because of increases in the price of oil. A comparison of GDR trade balances recorded in the CMEA statistical yearbooks with differentials in the rate of growth of UNI and NMP indicates that the profitability of exports has fallen and the marginal domestic cost of an additional unit of net exports has risen. East German economists have also admitted that the profitability of exports has declined. Enterprises must have been compensated for loss-making exports by subsidies. That partly explains the explosive growth of the government budget as a percentage of NMP.

Trade with the Soviet Union

The GDR's most important trading partner is the Soviet Union, which accounts for roughly two-fifths of its total trade. Thus, East German economic development is driven to a great degree by the market and supply conditions of its most important trading partner.

The East Germans have run trade deficits with the Soviet Union every year since the early 1970s. By 1987 their cumulative trade deficit totaled 4760 billion rubles or roughly two-thirds of their exports to the Soviet Union in that year. Actual East German debt may be substantially lower than this figure: The Soviets pay transit charges for shipping goods across East German territory to the West not recorded in the trade statistics. Nonetheless the East Germans probably owe a substantial debt to the Soviet Union.

The Soviet leadership has suggested that after they financed East European trade deficits over the past decade, it is Eastern Europe's turn to finance Soviet growth, that the Soviet Union should become a net debtor to Eastern Europe in the decade. If this turn of events transpires, the GDR would face another difficult period in its trade with the Soviets. Between 1977 and 1986 East German imports from

socialist countries, over half of which came from the Soviet Union, essentially stagnated (they grew at .8 percent per year) while exports grew at an average annual rate of 3.0 percent between 1977 and 1986.[10] These different rates of growth placed a significant burden on the East German economy. However, in 1987 and 1988, declining oil prices in CMEA trade have reduced the need for the GDR to export such large volumes of goods to the Soviet Union. East German exports have declined considerably.

Another feature of East German-Soviet trade is the preeminent role of fuels and raw materials in East German imports (about two-thirds) and of manufactured goods in exports (also about two-thirds). The sharp declines in the price of oil on Western markets have been followed by an increase in the volume of Soviet petroleum sales to the West. This, coupled with small increases or stagnation in Soviet oil production, promises that East German oil imports from the Soviet Union are likely to stagnate over the next decade as they have during the past several years. However, the GDR has had limited success in selling its machinery exports to other markets. If the East Germans no longer sell such a large quantity of machinery to the Soviet Union, yet have no other takers for the machinery, they face a difficult period of restructuring in the coming few years.

Hard Currency Debt

The GDR has handled its hard currency debt very successfully. After peaking at $13,273 million in 1981, net hard currency debt had declined to $9,149 million in 1986.[11] It may have risen by $400 million in 1987.[12] Debt has declined as a percentage of hard currency exports, from 198 percent in 1981 to 99 percent in 1986. Thus East Germany appears to have surmounted its hard currency debt problems for the time being.

OVERALL ASSESSMENT

Several measures indicate that the East German government will face increasing economic stringencies in the years ahead.

- First, the decline in the percent of UNI devoted to investment has been significant, from 23.7 percent in 1979 to 18.2 percent

[10]Calculated from data in Vanous, 1987.

[11]*East-West*, No. 424, December 3, 1987, p. 7.

[12]Vanous, 1988, p. 5.

in 1986. At a time of slow growth this has meant absolute declines in the level of investment implying slower future economic growth.

- Second, the budget now equals all of NMP; in no other centrally planned or market economy does the government redistribute such a large share of final output. The East German government currently taxes almost all profits and wages and returns these incomes in the form of investment and price subsidies, producing an economic system in which neither prices nor profits give proper signals for investment, production, or purchasing decisions.
- Third, the continual deterioration in the GDR's position on hard currency markets is unlikely to stop. The government has neither made systemic changes designed to increase the efficiency of or incentives for hard currency exports nor channeled investments toward the traditional consumer goods industries that have provided much of the GDR's hard currency export earnings.

IMPLICATIONS OF ECONOMIC TRENDS FOR MILITARY SPENDING

One can already see signs of the effects of current economic stringencies on the military. Although Herspring (1988) cogently lays out the political rationale for the GDR's military expenditures and argues that the government values its military contribution as an important policy instrument for currying favor with the Soviets, statements in the East German military press indicate that reductions are being made at the margin. Numerous articles in *Militaertechnik*, the East German military journal, at least 44 since 1980, have concentrated on economizing on equipment, fuel, and expenditures in military operations. One author writes, "the ordered military task is to be fulfilled with the least possible utilization of forces and resources." He goes on to emphasize the importance of extending the life of military equipment.[13] Another article notes that officers are evaluated on how much fuel their units consume for a set period of training.[14] This emphasis on saving has been ordered by the Politburo, according to the Deputy Minister of National Defense Joachim

[13]Schoenherr, 1985, pp. 228–229.

[14]Malinka, 1983, pp. 290–294.

Goldbach. He states that Honecker issued guidelines commanding the military to use "available means sparingly."[15]

Since the early 1980s the emphasis on efficiency and cost reductions by the military has increased. For example, in a 1986 article, otherwise characterized by an emphasis on the importance of a strong defense, a major general quoted party delegates as demanding that "intensification, rationalization and economy measures are to be pursued in such a fashion as to achieve maximum combat readiness and as not to place unnecessary burdens on the economy."[16] Further evidence of pressure to economize comes from the 14th Conference of Delegates of the Party Organization of the East German Communist Party in the NVA and Border Guards held in 1986. The conference focused on the importance of economic thinking in the military.[17] It called for more care in the maintenance and repair of weapons and equipment.

In 1987 the East German government took more immediate steps to reduce the military burden. The government budgeted a 3.38 percent increase in nominal military spending, while planning for a 4.1 percent increase in NMP for 1988.[18] Thus, the percentage of NMP devoted to the military was scheduled to decline in 1988. The 1989 budget has also been restricted to a 3.4 percent nominal increase, roughly half the rate of the early 1980s. This has been followed by the promise of a 10 percent reduction in real terms in the 1990 budget. Economic as well as political factors doubtless played a role in the decision.

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[15]*Volksarmee*, No. 17, 1983, p. 3, as translated in JPRS 84427, September 28, 1983, pp. 1–9.

[16]Lorenz, 1986, pp. 57–59.

[17]Lehman, 1987, pp. 3–5.

[18]Reuter, East Berlin, December 18, 1987, 9:54 a.m.

VI. CONCLUSIONS

This study was designed to determine whether the military role of the GDR within the Warsaw Pact has changed over the last decade, in particular whether the very large nominal increases in military spending reported by the GDR have been converted into a much stronger NVA. A second objective has been to determine whether the GDR will be able to sustain current expenditure and force levels over the next decade.

EXPENDITURES

The study first examined the veracity of reported military expenditures to determine whether they covered actual East German spending. Although there are several categories in the total East German budget that could hide military spending, my estimates of actual East German expenditures closely track reported expenditures, with the exception of some personnel costs and military research and development. Building block estimates in Eastmarks by the DIA were less than reported expenditures. My reconstructions of military and security expenditures ranged from 88 to 98 percent of reported expenditures during the 1970s. The margins of error in these reconstructed expenditure series are such that the reported series easily fall into reasonable bounds of these estimates.

Spending not reported under military expenditures include military pension costs, travel, medical examination costs, and some other social service costs that fall into this category in the West. Alton et al., 1980, estimate these costs as averaging 28 percent of reported military expenditures in the 1960s and 1970s. Military R&D is also probably not reported under this category. Some rough and ready estimates of what these could be indicate they might add 3–4 percent to the reported budget.

Assuming reported military expenditures reflect actual military spending, the East German military and security budgets have been absorbing a large and increasing portion of East German utilized national income. These two budget categories have risen from 3.7 percent of UNI in 1962 to 9.2 percent in 1986. This is a very large share, much higher than in any other country in the Warsaw Pact except the Soviet Union. Roughly a quarter of these expenditures are

spent on the Border Troops and paramilitary organizations. However, military expenditures alone ran 6.6 percent of UNI in 1986, close to double the figures for Hungary and Poland.

FORCES

Despite the large share of UNI devoted to the military and large nominal increases in military budgets, the GDR does not appear to have modernized its air force or ground forces appreciably faster than Czechoslovakia or Poland. Modernization of its air force appears to have proceeded slightly faster. Part of East German expenditure increases may have gone into training; the NVA is regarded in the West as the best of the non-Soviet forces in the Pact. However, emphasis in military publications on economizing suggests that increased expenditures on training have been modest at best. As documented by Herspring (1984) and argued in Sec. III, the only area in which there is a clear disparity in force modernization is in the East German and Polish navies. It is possible that much of the increase in expenditures has been devoted to this area. The sparse data also failed to indicate that the NVA is closing the gap in military capability with the Group of Soviet Forces-Germany.

The lack of a substantial difference between the rate of modernization in Czechoslovakia and the GDR and the failure of the East Germans to reduce their force capability gap with the GSFG suggests that much of the increase in the East German military budget has been eaten up by inflation. Although the East German government claims that consumer price inflation is nonexistent, alternative measures of inflation constructed by Keren suggest that the military budget may have increased by 3.4 percent per year in real terms, rather than 6 percent as implied by the official consumer price deflator.

The large differences in military and security expenditures as a share of UNI in the GDR and Czechoslovakia probably stem from the GDR's huge security apparatus, especially the Border Troops. The difference in the ratio of military spending (only) to UNI between the GDR and Poland can probably be traced to differences in expenditures on training and readiness and the buildup of the East German navy and somewhat more rapid modernization of its air force.

MANPOWER

The GDR will be unable to sustain current force levels over the next decade. Since 1984 the NVA has faced a very severe decline in

the number of draft age men. Even after the announced cuts of 10,000 men, the GDR will be short 6000 conscripts in 1992 and 1993.

The government does have the option of raising conscription periods from 18 to 24 months in the army to ameliorate this decline. However, even with a two-year term of enlistment, in 1992 100 percent of all draftable 18-year-old males would still have to be conscripted; in 1984 the GDR was taking only 80 percent of potential conscripts with an 18-month conscription period.

Increasing the period of conscription would be difficult. East German youth are very aware of West German conditions where conscription periods are only 15 months. During a period of relaxation in East-West relations and increasingly vocal opposition to the militarization of East German society and military service, it will be politically difficult for the East German government to lengthen conscription periods and take a higher percentage of draft age males.

The government has already introduced other measures to mitigate this problem. More women are being permitted to serve in administrative jobs. The government is attempting to increase the number of career soldiers through earlier recruitment and expanding the number of slots. It is also trying to reduce employment possibilities for young males elsewhere in the economy.

In 1988 the East German government began to permit more young and middle-aged citizens to travel to the West. In 1988 the West German government counted 5 million visitors. In the 1970s visits by working-age East Germans were almost unheard of. The prohibition on travel to the West has long been one of the most unpopular policies of the East German regime. To this point most visitors have returned to the GDR, but young people are disproportionately represented in those that stay. If these visits continue, the GDR may find it is losing draft age youth to the West. If visits are then halted, the government faces the political discontent of reverting to a very unpopular policy. The East German Defense Minister has also noted that increased East-West contacts have made it increasingly difficult to motivate young people for military service.

SUSTAINABILITY OF EXPENDITURES

As noted above, the East Germans devote a higher share of utilized national income to defense and security than any other member of the Warsaw Pact outside the Soviets. The share devoted to the military alone is almost double that of Hungary and Poland. As argued by Herspring (1988), the GDR government appears to have given a high

priority to devoting more resources to the military, possibly to curry favor with the Soviets and to create institutions that would provide strong support to the government in the case of a crisis.

The prospects for increasing current levels are mixed. UNI declined 4 percent in 1982, stagnated at this lower level in 1983, and only regained its 1981 peak in 1985. In other words, the country went through a severe recession in the early 1980s. Official output figures show growth in NMP averaged 4.65 percent since 1984, although growth rates fell in 1987 and probably in 1988 as well. Nonetheless, my small model of the East German economy constructed with East German data indicates that these reported rates can probably be sustained. East German statistics are, however, not the most reliable data source. In many respects they are among the worst in the bloc; only Romania publishes consistently poorer statistics. Studies by the DIW, an economic research institute located in West Berlin, show consumer price inflation accelerating in the GDR during the 1980s, indicating that economic growth rates have been inflated by a factor of almost two.

Although living standards appear to have recovered from the sharp declines in 1982 and 1983, investment is still very low by historical standards, and the productivity of capital is falling. The East German government continues to do a poor job of allocating investment, stressing energy independence in an energy poor country and the development of their own indigenous electronics industry while the rest of the world is becoming more and more technologically integrated.

Furthermore, the capacity of the government to determine the most profitable allocation of resources appears to have declined. Although the formation of giant combinates may have somewhat improved managerial efficiency, the East German price and wage system is probably the most distorted in the bloc. The government budget now equals NMP. In other words, the entire East German wage and investment bill is covered by equal amounts of taxes and subsidies.

The fruits of this system are most readily apparent in the performance of East German exports on hard currency markets. East Germany has lost a third of its market share on OECD markets in machinery and consumer goods. It has been able to raise exports in the 1980s only because of large exports of refined petroleum products.

The GDR did substantially increase capital productivity and reduce labor and raw material inputs in manufacturing in the early 1980s. However, Collier notes that this was probably a one-off efficiency gain. After the initial declines, performance has returned to the trends exhibited in the late 1970s.

This somewhat pessimistic assessment of the East German economy indicates that increasing military spending is becoming more difficult. If hard currency exports are to be maintained at current levels or increased, product quality will have to improve. The Soviet Union, the GDR's most important trading partner, has also applied more pressure for improvements in East German exports. These changes imply more investment and, more specifically, more investment in Western machinery. They also imply expanded trade with the West to procure intermediate goods and materials that are unavailable in the GDR or of too low quality to satisfy either the Soviet or the domestic market. It is hard to imagine that the military budget could be spared, if the GDR attempts to increase investment and hard currency exports (needed to pay for hard currency imports) to achieve the improvements in product quality that consumers are likely to demand.

Signs of pressure on the East German military budget are already appearing. After a decade of increases in the combined defense and security budgets averaging 6.4 percent per year, the combined 1988 budget increased by only 3.8 percent and the defense budget by only 3.38 percent, roughly half the average rate of the previous decade. The defense budget for 1989 is budgeted for only a 3.4 percent increase. This has been followed by Honeker's announcement of a planned 10 percent reduction in military expenditures in 1990. Moreover, the East German military press contains numerous articles stressing the importance of efficiency and conservation in the conduct of military operations.

POTENTIAL CHANGES IN FORCES

Despite this emphasis on demographic and economic constraints on the military, political factors will determine the shape of the East German military in the future, as they have in the past. The East German government has chosen to expend large shares of economic and human resources on the military over the past two and one-half decades, increasing military spending at average annual rates of over 11 percent between 1962 and 1970. Herspring (1988) argues that the East German leadership has been trying to buy security. By making the East German military an essential component of the Warsaw Pact, the East German government may be calculating that the Soviets will find it impossible to use German reunification as a bargaining chip in its relations with the West. By devoting such large amounts of resources to the military and Border Troops, the East

German leadership has created two powerful institutions that will support it in a crisis.

Gorbachev and the warming of East-West relations over the past few years have changed the political context for the East German leadership. A large, well-trained army no longer appears to be the most effective way to curry favor with the Soviets. Domestic political pressures for more contact with the FRG and government acquiescence to travel by East German youth to the FRG are making it more and more difficult to maintain the image of the Western "enemy." Domestic and international pressure is mounting to dismantle the "Wall." As these pressures mount the traditional rationales of the NVA and the Border Troops are being challenged. Gorbachev's promise to remove six tank divisions, 5000 tanks, and 50,000 men from Eastern Europe has added further complication. Honeker probably foresaw the argument, "If the Soviets see no need to maintain past force levels, why should the East Germans?"

These events are occurring at a time when the numbers of conscript-age youth are declining and economic constraints on military expenditures are becoming more binding. They have already affected force levels and are highly likely to affect readiness within the next two or three years. Political pressures, international and domestic, and their own announced cuts made it virtually impossible for the NVA to increase conscription terms. Without such an increase, further cuts besides the announced six regiments will have to be made. Western analysts should pay close attention to changes in manning levels to determine the extent and timing of these changes.

The composition and tempo of force modernization also need to be closely monitored. Since the early 1980s the GDR appears to have concentrated its modernization efforts on the air force and navy. Ground force modernization appears to have been slow. Given the announced cuts and ongoing budgetary stringencies, it is highly unlikely that the East Germans will attempt to modernize their ground forces rapidly in the coming few years. Thus large discrepancies in equipment between GSFG and NVA divisions are likely to remain with the resulting difficulties in combined operations.

In light of the severe manpower constraints facing the East German military and pressure to restrain military spending, the East German government should find a further reduction in its own forces under a conventional arms control agreement an attractive solution to its own budgetary and manning problems. If NATO countries embark on serious negotiations concerning reductions in ground forces with the members of the Warsaw Pact, a Warsaw Pact proposal

to disband an East German division would not be surprising. Negotiators must be aware, however, that the artillery and tank holdings of East German divisions continue to be substantially weaker than those of the GSFG. Furthermore, the East Germans are likely to be forced into reducing manning levels for demographic reasons even without a conventional arms control agreement.

Appendix A

ESTIMATING UTILIZED NATIONAL INCOME

Utilized national income equals material goods available for domestic use, be that consumption, investment, or the accumulation of inventories. It is calculated by subtracting net exports (exports minus imports) and losses from NMP.

The GDR publishes data on UNI only in terms of index numbers, but publishes NMP in Eastmarks of particular base years. To estimate UNI in current and base year Eastmarks I took the figure for 1967 NMP in nominal prices and subtracted an estimate of losses and net exports from this figure.

I could find nothing in the East German statistical yearbooks on the size of losses. I estimated losses as .72 percent of NMP. This figure is the average difference between Polish NMP and UNI minus the trade surplus in the 1980s (figures for earlier years could not be calculated), which I assume to equal losses. Because the Polish economy is generally judged to be more prone to waste than the East German this figure is used as an upper bound. Soviet data combine statistical discrepancies, the trade balance and losses. These run less than 1.75 percent of NMP. In light of the very large Soviet internal trade surpluses in recent years, most of this figure probably stems from the trade surplus.

I then converted the 1967 trade deficit from deviza marks to domestic marks using exchange rates of 1.7 domestic marks for one deviza mark for imports, and 1.5 for exports.[1] This figure was then added to NMP minus losses to estimate 1967 UNI. UNI index numbers in nominal prices were then used to create a time series from 1960 to 1966, and UNI index numbers in constant 1967 prices were used to construct a constant price series until 1970. This series was linked to subsequent indices in 1975, 1980, and 1985 base year prices. The composite index in constant prices of 1967 was converted to nominal terms using an NMP inflator constructed from the NMP constant price series.

Vanous (1986) and Collier (1985) have also constructed figures for utilized national income. Vanous, however, starts from 1980 and sub-

[1]Collier, 1985, p. 30.

tracts 2.5 percent of NMP (the trade surplus) and 1.2 percent of NMP (losses) from the NMP figure for that year in order to derive utilized national income.[2] He then uses the indices to construct values for other years.

My figures exceed Vanous's by an average of 1.58 percent, primarily because I assume losses are only .72 percent of NMP. As noted above, this is the average figure for Poland in the 1980s and thus seems a reasonable upper bound for the GDR. Vanous's rate of loss seems too high. My estimates also average 1.3 percent more than Collier's estimates for 1960–1980 in 1975 prices. Collier made these estimates on the assumption that disposable income is 72 percent of UNI, a figure cited by an East German economist.[3] Collier argues very plausibly that this figure is accurate. My 1967 estimate runs 98.3 percent of Collier's. Collier's 1967 estimate was constructed from investment, inventory, consumption, and trade data.

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[2]Vanous, 1986, p. 7.

[3]Collier cites Willi Ehlert et al., *Woerterbuch der Oekonomie Sozialismus*, Dietz Verlag, East Berlin, 1979.

Appendix B

MODELING THE EAST GERMAN ECONOMY

To project military spending through the turn of the century, I needed to project East German UNI to the year 2000. I constructed a small model of the East German economy to accomplish this task. In the model NMP (Eq. (1)) is the sum of the net output of three sectors: industry (IND), agriculture (AG), and other (OTH) (construction, trade, and transportation and communications). I projected net industrial output using a Cobb-Douglas production function with constant returns to scale (Eq. (2)). The model was estimated by regressing East German data on industry's contribution to NMP on workers employed in industry and handicrafts, the lagged industrial capital stock, and time, which is included to track increases in total factor productivity. Net agricultural output is assumed to be a function of technological change; it increases exogenously over time. Net output of other sectors of the economy is a function of the demand of the industrial sector. Thus

$$\mathrm{NMP} = \mathrm{IND} + \mathrm{AG} + \mathrm{OTH} \tag{1}$$

where

$$\mathrm{IND}_t = -3.07e^{.036\ \mathrm{TIME}}\ \mathrm{LABOR}_t^{.77}\ \mathrm{CAPITAL}_{t-1}^{.23}$$

$$\mathrm{AG}_t = \mathrm{AG}_{t-1} \times 1.015 \tag{2}$$

$$\mathrm{OTH}_t = .56 \times \mathrm{IND}_t^{.86} \tag{3}$$

The projections were made using population projections provided by the Center for International Research, Bureau of the Census. Projections for the industrial and handicraft labor force were derived from these figures assuming that current labor force participation rates and current proportions of the labor force employed in industry would remain constant for the period of analysis. A capital series was projected assuming net industrial investment would retain the same share of UNI it has averaged since 1975. UNI was derived under the assumption that the GDR's current export surplus in domestic marks would stagnate in absolute terms through 2000. Military spending was assumed to retain the same share of UNI that it had in 1987.

Appendix C

FACTOR PRODUCTIVITY MEASURES

Labor and capital productivity measures were computed by dividing NMP produced by industry by the industrial labor force and capital stock, respectively. I was unable to divide either the capital stock or NMP into socialist and private components so these have been lumped together; the labor force is for the socialist sector only. The private sector has had such a small role in industry in these countries (less than 2 percent) that this distortion is unlikely to have affected the results. I computed total factor productivity growth by estimating factor shares in net output through Cobb-Douglas production functions. The models for the four countries provided very different estimates.[1] Because Czech and Polish weights were theoretically unjustifiable, I used only East German and Hungarian weights.

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[1]After imposing the constraint that the sum of the coefficients on capital and labor equal one, labor shares for Czechoslovakia, the GDR, and Hungary were .94, .74, and .54, respectively. The share of capital for the Polish data was negative.

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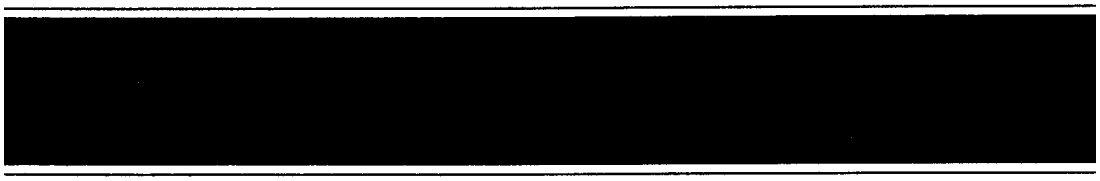
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