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Soviet Economic Growth: 1928-1985

Gur Ofer

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40 Years
1948-1988

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Gur Ofer

May 1988

40 Years
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**RAND/UCLA
Center for the Study of
Soviet International Behavior**

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PREFACE

Established in October 1983, the RAND/UCLA Center for the Study of Soviet International Behavior supports a broad program of analytic and policy-relevant research. The Center examines subjects that cut across disciplines, with particular emphasis upon military and arms control issues, East-West economic relations, Soviet relations with the Third World, and domestic determinants of Soviet international behavior.

This document is the fourth in a series of publications transmitting the major results and findings of the Center's research program. A major part of the survey was prepared during the author's stay at The RAND Corporation in the summer of 1985, under the auspices and with the financial support of RAND and the RAND/UCLA Center. The study was also published in the December 1987 issue of the *Journal of Economic Literature*.



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SUMMARY

Within the framework of a general paradigm of modern economic growth, this document summarizes the Soviet growth record and evaluates the economic problems that the USSR now faces. It pays special attention to the effects of the Soviet economic system and political regime on patterns of economic modernization.

Since the Bolshevik Revolution of 1917, the Soviet Union has transformed itself from an undeveloped economy into a modern industrial state with a GNP second only to that of the United States. Until the late 1950s, the main question among Western scholars was *When* would the Soviet Union catch up with the United States? Today, however, after more than two decades of declining Soviet growth rates, the question instead is whether the present system can support sustained economic growth in the future, or whether it is capable of changing radically enough to assure such growth.

The annual average growth rate of Soviet GNP since 1928 is 4.2 percent. This clearly qualifies as a sustained growth record. However, there has been a sharp decline over time. In recent decades Soviet GNP growth rates have declined more than half, from 5.7 in the 1950s to 2.0 percent in the early 1980s. From about one-quarter the size of the U.S. economy in 1928, the Soviet economy climbed to about 40 percent in 1955, 50 percent in 1965, and about 60 percent in 1977. Soviet GNP per capita was also catching up, reaching 52 percent of the U.S. level by 1975. However, this pace has slowed drastically in the past two decades and even reversed itself in recent years. In spite of some relative Soviet advancement, the absolute gap between the two economies is now widening.

This decline seems rooted in certain aspects of the Soviet Union's traditional growth strategy, which features adherence to the "extensive growth" model, emphasis on industry and defense over agriculture and consumption, intense time pressure for rapid economic development, and authoritarian centralized control.

One of the Soviet strategy's outstanding characteristics is its commitment to extensive growth, which involves a policy of very high investment rates, leading to a rapid growth rate of capital stock. This heavy emphasis on input growth has the undesirable and unintended effect of causing low productivity growth. During the entire period 1928-85, inputs grew at 3.2 percent and contributed 76 percent of total Gross National Product (GNP) growth, while factor productivity grew 1.1 percent a year, accounting for only 24 percent of total growth. The

relative contribution of inputs to growth grew to 80 percent in the postwar period and became its only component from 1970 on, when productivity completely stagnated or even retreated. Currently, with labor growth near zero, Soviet extensive growth is led solely by capital.

A key feature of the extensive growth model is that capital grows faster than GNP. Consequently, to sustain the capital growth rate, the share of investment in GNP must grow continuously. Although the Soviet share of gross fixed investment in GNP has risen steeply since 1928, from about 1960 it has been fairly constant, stabilizing at 27-29 percent. These are quite high figures; very few countries have sustained such burdens for so long.

The defense burden on the Soviet economy is also extremely high. After a sharp decline in the defense share following Stalin's death, it resumed a monotonic climb from possibly less than 10 percent in the late 1950s to about 13 percent in 1970. The most recent estimates of the share of defense spending in the Soviet GNP are between 15 and 17 percent for the early 1980s. The current Soviet defense burden is about three times higher than that of the United States.

The final claimant on the GNP is consumption, whose share has declined over the years, from 73 percent in 1928 to 64 percent in 1950 down to 55 percent in 1980. This includes household consumption financed by disposable income and "communal services," chiefly education and health. The share of consumption in the Soviet GNP is lower than in most countries, typically by at least ten GNP points, which are taken up by investment and defense. The Soviet citizen seems to be catching up with his Western counterpart very slowly, if at all.

There are three major explanations for the decline in Soviet growth rates. First, extensive growth is by nature exhaustible, as manifested in the unavoidable decline in the growth rates of inputs. Second, technological change and improved efficiency failed to replace input growth or compensate for labor shortage. In fact, the contribution of technology declined over the years, reflecting the increased difficulty of borrowing Western technologies cheaply. Finally, the strategy of haste accelerated the decline in growth. The Soviet government has traditionally exerted tremendous pressure to catch up with the West rapidly. The resultant haste has created numerous bottlenecks in the production system, and it has hindered technological innovation and economic reform, both of which require flexible planning and long-term time investments.

Other factors contribute to the downward trend. First is the growing complexity of the economy. The Soviet system emphasizes central control. Planning from the center was fairly simple in a more primitive economy, but as the economy becomes more advanced the options

and variations multiply, the amount of required information and coordination grows much faster than the economy itself, and it becomes more and more difficult to cope. Second is the increasing drag on growth caused by the large percentage of defense spending. A third factor is the weakening of the material incentive system resulting from the inability to fulfill production targets for consumer goods. Declining growth cuts first into consumption increments, a low-priority target, which in turn negatively affects worker motivation, thus further reducing growth.

Under what conditions might the present trend of declining growth rates be reversed? Possible economic reforms designed to encourage faster growth range from reactionary to radical. Most likely to be implemented is the middle ground of the reform range. Under "moderate" reform the basic authoritarian regime and central planning system persist, but they undergo considerable change. Many of the "moderate" steps listed below are included in Gorbachev's reform package.

The reform's main effort is to "restructure" the economic mechanism so as to achieve, in Gorbachev's words, "the union of centralism and independence of economic organization." It attempts to create the entrepreneurship, dynamism, and flexibility of the market economy in a more decentralized but still centrally directed environment. This effort includes streamlining the top administrative and planning bodies and relieving them from much of the burden of directing the short-term operation of enterprises. With much more freedom of action, enterprises will be run according to the principle of "self-financing," where all costs will come out of earned revenues; thus profits and sales will be the main success criteria and the source of remuneration. Liberalization is also being extended to international trade, where some freedom of action has been granted to individual enterprises and ministries, and joint ventures with Western companies are permitted. The exact division of power between the central administration and market-like mechanisms will determine how radical the reform will be.

The proposed reform also involves changes in resource allocation: a stronger reliance on material standard-of-living incentives; changes in the sphere of investment; and an effort to reduce defense allocations if possible. It also requires a degree of "democratization" of the cultural, social, and political spheres.

A key question relates to the effect of reform on Soviet research and development, especially the introduction of the "information revolution" into Soviet society. Success will require that new developments are diffused across the entire economy, that long-established traditions of management and control are altered, and that ingrained tendencies

to preserve secrecy and monopolize information are ameliorated. Gorbachev's "openness" (*glasnost*) is partly motivated by a desire to raise the economic mechanism's efficiency level.

Gorbachev has acknowledged the problem of decelerating growth rates and pledged to reverse the trend by introducing technological innovation and carrying out a "truly revolutionary change"—a total "economic and social reconstruction." There is considerable debate among experts as to whether Gorbachev has the correct prescription for redirecting the Soviet economy toward sustained growth and the ability to push it through.

The study was published in the December 1987 issue of the *Journal of Economic Literature*.¹

This survey of modern Soviet economic growth is based almost exclusively on Western works and does not include direct references to Soviet scholarly work. It is directed to the general public of economists, and therefore contains a section (II) on sources of economic information about the Soviet Union and several subsections, such as the one describing the basics of the operation of the Soviet system, that are only indirectly related to the main issue. The amount of relevant literature on the topic is immense, but there seems to be a considerable degree of agreement on the main issues. Two results follow: first, not all the works that probably should have been cited are included. Second, in many places I chose to present issues and views as representing the consensus of the field, or, at the other extreme, my own views. I try to make clear which is which. In case of doubt, I take personal responsibility for unattributed statements. One example of a partial contribution of my own is the article's extended attention to the theme of "haste" as a major force driving many elements of the Soviet growth strategy and system.

— G. J. ...

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This document is dedicated to the memory of Simon Kuznets.

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I. INTRODUCTION

Since the Bolshevik revolution of 1917, the Soviet Union has transformed itself through an intense drive for economic modernization, from an undeveloped economy into a modern industrial state with a GNP second only to that of the United States. During that period the Soviet economy grew by a factor of ten and the level of GNP per capita grew more than fivefold. Its industrial structure has changed diametrically, from an economy with 82 percent rural population and most GNP originating in agriculture to one that is 78 percent urban with 40-45 percent of GNP originating in manufacturing and related industries. Furthermore, Soviet military capability is considered to be on a par with that of the United States.

At first glance, the Soviet case seems to be a classical example of economic modernization. In spite of this, many international comparisons of modern economic growth exclude the Soviet Union and the other communist countries. Chenery and Syrquin (1975, pp. 11-16) exclude them owing to "problems of comparability," without specifying what is noncomparable. Simon Kuznets (1963), who did compare the Soviet record to the Western one, nevertheless hesitated to include it in his general studies "because the social structure and the institutional means by which economic growth is secured in communist countries are so different" (Kuznets, 1971a, p. 10; see also Kuznets, 1966, pp. 400, 508; 1963, pp. 367-372).

The aim of this paper is to present and evaluate Soviet economic growth as it appears in the specialized "Western" literature, in a framework of "modern economic growth" as developed by Kuznets (1966, 1971a), Alexander Gerschenkron (1962, 1968), and many others. Does the Soviet experience belong to this general paradigm? Whether it does or not, how does its experience compare with that of the major (or minor) Western countries? What are the implications of the differences found for past records and for future prospects? Modern economic growth is perceived as a general framework, a wide concept, within which many variants and diverse itineraries are accepted and tolerated provided that certain essential features are present. A case in point is the distinction between leaders and followers, where latecomers face different internal and external environments calling for special growth strategies. The Soviet Union is a classical follower, whose experience served Gerschenkron and others in shaping a theory of the pattern of economic modernization. In fact, Gerschenkron (1962, 1968)

made "following" in the context of the European experience a sort of monotonic variable where the particular pattern of economic development is partly determined by the degree of lateness in a given country's development.

In addition to the country's rank in the development queue, growth patterns can also be affected by differences in historical background, in national culture, and, of particular interest here, by different economic and political systems and international aspirations. It was the Soviet Union's authoritarian regime and its particular "socialist" economic system that caused Kuznets to exclude it from his comparative studies. The Soviet model of development was introduced in the late 1920s, when it was heralded as superior, as promising to become the wave of the future, and as a model for other undeveloped countries. At the same time counterclaims were being voiced: that modernization cannot be achieved without basic freedoms and that central planning is inherently inefficient and bound to fail.¹ So far, history has proved both extreme claims wrong, but the debate on whether the Soviet system is capable of sustained economic development still rages on. We shall therefore pay particular attention to the effects of the economic system and the political regime on patterns of economic modernization.

Until the late 1950s, the era of rapid Soviet growth and of Sputnik, the main question among Western scholars was: *When* would the Soviet Union catch up with and overtake the United States? Even such sober and careful scholars as Abram Bergson (1961, pp. 297-98) did not exclude the possibility that this might be fairly imminent. Today, however, after more than two decades of declining growth rates (down to 1.5 percent GNP growth recently), can the present system support sustained economic growth in the future, or is it capable of changing radically enough to assure such growth? This question is posed not only by specialists on either side of the iron curtain, but by Mikhail Gorbachev himself, who is embarking on a program designed to prove that it can. It is still not clear whether Gorbachev will be able to start a truly new era of Soviet general and economic history. It is, however, an appropriate time to summarize the past record and to evaluate the problems to be faced in the future.

Because this is not the place to survey the large volume of Western literature on economic modernization and modern economic growth, Kuznets' synthesis and summary framework will serve as its represen-

¹This and related issues are at the heart of the "Socialist controversy." See Hayek, 1963; von Mises, 1974; and Lange, 1938.

tative.² Modern economic growth (MEG) as defined by Kuznets (1966, p. 1) "is a sustained increase in per capita or per worker product, most often accompanied by an increase in population and usually by 'sweeping structural changes' of a multidimensional nature"; it is driven by the "epochal innovation," which consists of "the application of science to the problems of economic production" and to "the material satisfaction of wants" (Kuznets, 1966, pp. 9, 11). Scientific advance and its application to production are the driving force of MEG; they assure sustained growth and growth in per capita income and make for permanent structural change. They also generate further scientific advances (Kuznets, 1966, 1971a). The qualitative dimensions assigned by Kuznets to the growth parameters and the particular kinds of structural changes in the economic, social, and political spheres occurring as MEG sets in will be discussed later. Here we emphasize only the ever-changing nature of the structure of the economy and society under MEG caused by the constant shift in leading sectors and in the focus of economic activity and by the character of technological changes.

For Kuznets (1966, Chs. 8, 9), S. Noah Eisenstadt (1973, 1985), Walt W. Rostow (1960, 1963) and others, MEG, as a major historical departure, originated in Western Europe and spread to other regions by virtue of its clear dominance in both economic and military spheres. But conditions in the latecomers differ in many respects from those in the more advanced countries at the time each entered the process of modern economic growth; and the mere existence of advanced countries also changes the environment of MEG for followers, so that it is likely to take a somewhat different course from that taken by the early starters. That is why Gerschenkron (1962, Chs. 1, 2, and pp. 253-366; 1968, Ch. 9) developed his theory that the nature of MEG in Europe varies with the level of economic backwardness at the time MEG sets in. The starting conditions of a latecomer create two sources of tension: One is the desire to narrow its income gap relative to the most advanced countries; the second is the greater difficulty in takeoff because of poorer preconditions for growth than those of leading countries at their starting point. The more backward the country at its starting point, the higher the tensions. Tension breeds impatience, which leads to more drastic, radical, even revolutionary discontinuous steps in all spheres—economic, political, and social. Impatience and different preconditions also lead to the choice of different growth paths. A major example is the choice to start with industrialization and to postpone changes in agriculture. An advantage that offsets

²For a short survey of the main contributions see Maddison, 1982, Ch. 1. See also Rostow, 1960, and the many volumes of argument on his theory.

some of these difficulties for a latecomer is the opportunity to borrow technologies from the advanced countries without going through the costly and time-consuming process of developing them from scratch. This advantage, first noticed by Veblen, though real, is not costless; and its fruitful exploitation also depends on frequently missing preconditions (Maddison, 1982, pp. 107-108). Finally, like any case of transfer and diffusion of a major innovation, success depends on the relationship between the partners and on the form of transfer.

As noted, the Russian and the Soviet cases are important historical examples on which Gerschenkron based his theory. The government-led industrialization drive during the last decades before the Bolshevik revolution is a case in point. The revolution; the authoritarian-dictatorial regime; the central direction, management, and control of the economy; the strategy of "industry before agriculture"—all these and other aspects are extreme manifestations and outcomes of aggravated tensions. In a sense, the acceptance and application of Marxist ideology as a major vehicle of the Western concept of rapid industrialization and its reshaping into Soviet socialism to fit the needs of a backward country with high aspirations also fall into the framework drawn by Gerschenkron (1962, Chs. 6, 7; 1968, Ch. 7; and 1971). With international fears and aspirations, the urge to prove the superiority of socialism and possibly also the character of the leaders, the Soviet case is clearly an extreme one even in Gerschenkron's framework.

Most of the major decisions on the development strategy of the Soviet Union and on the nature of the regime were made in the 1920s and in the early 1930s. But, as we shall see, their effects can be observed in Soviet patterns of behavior to this day.

A short discussion of the sources of economic information on the Soviet Union and their reliability (Sec. II) is followed by a survey of its growth record (Sec. III) and of the major structural changes in the Soviet economy (Sec. IV), both in a comparative setting. Sections V and VI discuss the elements of the Soviet system, its growth strategy, and the major economic policies that determine its growth patterns. The following section (VII) focuses on the explanation offered in the literature for the declining growth rates of the Soviet Union. The discussion makes use of both production function estimates and growth accounting. The concluding section discusses the Soviet system's prospects of reversing the declining trend and assuring sustained growth, in the light of changes and reforms that may be needed. It takes some notice of the reforms that are being introduced by Gorbachev.

II. AVAILABILITY AND RELIABILITY OF INFORMATION

More economic information emanates from official Soviet sources than is generally believed. While the amount is a far cry from what is usually available for free countries, it is often more than is available for many less developed countries. In most instances, information is unavailable because it is withheld from the public, internal or external, and not because it was not compiled. In a centrally planned system, very detailed economic information on the operation of economic units or sectors is essential for planning and for control. It must be transmitted through all stages of the hierarchical ladder and in many cases also through public media channels.

Nevertheless, Western students do face a serious problem in obtaining Soviet economic information. Furthermore, in most cases, even when the data *are* available, they need a great deal of checking, reestimating, and manipulating before they achieve the minimal standards of reliability and usability. Following a brief survey of what is and is not available, this section discusses the main reasons for the low usability and questionable reliability of much of the data and the steps being taken in the West to overcome these problems.

With few exceptions, the information available to the West on the Soviet economy comes from Soviet official publications and sources. The major publication is the annual *Statistical Yearbook*, issued for the Soviet Union as a whole and for each republic and some lower regional units separately. Occasional special yearbooks or statistical compendia are devoted to a particular area: agriculture, education, labor, and the like. One of these is on Soviet international trade (*Vneshnaya Torgov'ia*), which presents very detailed trade statistics by type of good and country, and is issued every year. Another important source of information is the publication of the returns of the population censuses taken in the Soviet Union approximately every decade (1939, 1959, 1971, 1979). Many journals publish economic information, either in a special appendix, such as the *Vestnik Statistiki*, the official journal of the Central Statistical Administration (CSA), or as an integral part of ordinary articles. Finally, economic information is available from newspapers, from other mass media, and from books and other publications.

In some spheres the West gathers information on the Soviet Union in less conventional ways, ranging from interviewing emigrés, such as

was done by the Harvard Project in the 1950s, the Israeli Soviet Interview Project (ISIP), the American Project (SIP), to collecting information (such as on prices) during visits to the Soviet Union, estimating the grain crop or other visible objects using pictures taken from satellites, and other clandestine methods.

The availability of economic information on the Soviet Union has varied quite drastically over time according to the degree of general openness of the system. Information was readily available during the 1920s but severely restricted during most of Stalin's era. During the dark era of the late 1930s and up to the mid-1950s, even such basic economic information as the *Statistical Yearbook* was unavailable, and it took great efforts to screen large volumes of publications and "read between the lines." The flow of information was renewed in the mid-1950s and reached its peak during the mid-1960s, followed by more and more restrictions, mostly in specific areas, imposed by the Brezhnev administration. Beginning under Andropov and picking up steam since Gorbachev, the pendulum has swung again toward more openness. Gorbachev's call for more publicity, openness, and accessibility of information (*glasnost*) and more open criticism and debate relates first and foremost to the economic sphere and is bound to raise the level of available information (Timothy Colton 1986, pp. 160-164).¹

This discussion on the availability and reliability of Soviet data relates mostly to the post-Stalin era. With regard to availability, first of all, data on the Soviet defense effort, very broadly defined, are unavailable. Other sensitive spheres are also classified secrets. A recent example of the latter is the suppression, since the late 1970s, of previously provided information on trade in crude oil with individual countries. Second, "embarrassing" information is suppressed. The system, which declares one of its main goals to be a high level of income equality, publishes scant and not very revealing data on this topic. It is known that the CSA regularly compiles such data. Another example is the suppression for a number of years of detailed data on infant mortality (and other demographic changes), when these rates started to rise in the early 1970s (Davis and Feshbach, 1980; Feshbach 1985). In general, much data on negative social or economic phenomena are suppressed, including most data on activity in the "second economy."

A third type of data that are very difficult to obtain from Soviet sources are microdata on the behavior of individual economic units, households, or firms. Here, the various interview projects mentioned above are of value. Most of the official economic data are highly

¹Jan Vanous (1987), however, demonstrates a deterioration in the quality and consistency of national accounts figures produced by the Soviet Central Statistical Administration during 1985 and 1986.

aggregated, and most published analyses are restricted to tables classified by one or two explanatory variables. It is also not easy to acquire detailed data on individual prices, and very difficult to receive systematic data on price compilations and other economic calculations.

Finally, whether as part of the secrecy screen, or for other reasons, much information published by the Soviet authorities is partial and presented in obscure, cryptic, or incomplete fashion. Percentage breakdowns with no information on absolute levels and with wide leftovers of undefined residuals are very common. The breakdown in many incomplete series does not add up to the total. The balance-of-payments data are restricted to trade in goods, with no information on trade in services and on the capital account, so that no balance-of-payments accounts can readily be estimated (Treml and Kostinsky, 1982).

This last point takes us from the question of availability to that of the quality, usability, and reliability of published information. Outright use of Soviet official data is in many cases impossible first because of uncertainty regarding the quality and reliability of the information received and collected by the central Soviet authorities from the field. Next comes the major question of the conceptual and methodological frameworks and the particular sets of definitions used in order to organize, aggregate, and compile economic data series. Finally there is the critical question of truth in reporting: To what extent is false reporting used in the service of internal or external political and public-relations goals? The secrecy cover over the work of most agencies producing economic information causes difficulties in giving definite answers to these questions or to the understanding of the exact source of the problem with the data. All this imposes a heavy burden on interested parties in the West of interpreting, checking, and recalculating much of the presented data before it can be meaningfully used.

The literature mentions two specific sources of possible biases in data reported to or collected by the central Soviet statistical agencies. The first stems from the fact that in many cases the units that report and transmit economic information to higher echelons are judged and remunerated on the basis of their reports. The problem is also present to some degree in many other countries—for example, the reporting of personal income for tax-collecting purposes. In the Soviet Union this problem pervades almost the entire economy. The second bias is created by peculiarities, probably motivated by propaganda or ideological considerations, in the design of samples for official statistical surveys and inquiries: The structure of the family-budget survey is biased

in favor of families with two or more working members; the sample of collective farm markets is biased in favor of certain locations.²

With regard to the question of true reporting, most Western scholars seem to agree that the Soviet Union does not keep two sets of books or two sets of economic accounts, one to use and another to publish for propaganda purposes. Such an endeavor is first of all very expensive and burdensome, and second, two sets of economic information would cause serious confusion. Published data are used so extensively by decisionmakers and control offices at all levels that double bookkeeping as a general practice is inconceivable. It follows from the argument that the reliability of data may be assumed to be higher the closer it is to the decisionmaking and control apparatus, and vice versa. It may be assumed that less aggregated series, especially those defined in physical terms, are more directly related to the operation of the system, while the more aggregated series, denominated in monetary terms, are less so connected. This could be one reason why the latter, such as data on national accounts, general price indices, are considered much less reliable by Western students and are, indeed, subject to extensive reestimation.

Propaganda is most often served by publishing the better economic results and restricting the publication of failures; by manipulating information to provide half-truths rather than outright lies; and by carefully choosing definitions, methodology, concepts, and variables in terms of which information is published. All this makes some of the Soviet data, while still "reliable" in a formal sense, hard to interpret and use in Western research; in some cases the data are deliberately misleading, and in some cases the system may, so to speak, cheat itself. The most notorious example comes from Stalin's era, when harvest reports were given in terms of grain in the field, before harvesting and threshing losses. The definition has since improved (reports are made post-harvest) but still does not fully accord with Western usage. The reported figures are still inflated, and Western students must engage in guesstimates to translate them into terms of grain in silos, the acceptable definition in the West. Another extreme example where a definitional problem becomes an open evasion is the entry for Soviet defense expenses in the federal budget. According to Western estimates this entry (with or without a Soviet conceptual meaning) is but a small part of total defense spending, which does not even reflect trends over time. Some scholars are searching for a definition of defense spending that may be consistent with the budget entry as given (Wiles, 1985).

²See Trembl and Hardt, 1972; McAuley, 1979, Ch. 3; Shenfield, 1982; Trembl, 1985. A very interesting and revealing article on false reporting and many other serious shortcomings of Soviet statistics appeared in the Soviet journal *Novy Mir* in February 1986 (Selyunin and Khanin, 1987).

In many cases, definitions of terms differ from common Western practice not only for propaganda reasons but also for ideological or practical purposes. A major example is the entire system of national accounts, which, following Marxist doctrine, excludes most services from national product on the grounds that they are "nonproductive," and excludes interest on capital from national income because it is a nonlegitimate factor payment. A probable example of expediency is the wide use of gross production series, including intermediate uses, as major indices of production results. Even without questioning the motivations for the difference in each case, much effort is required to make Soviet data comparable to and consistent with corresponding Western concepts and data. In many cases such efforts are severely hampered by the fact that the definitions and conceptual frameworks are withheld or obscured. At times changes in definitions or scope are also made without much warning or publicity.

A third major difficulty in the interpretation of Soviet data is the different meaning of prices in the Soviet system. First, almost all prices are determined by the central authorities, not by market forces, according to some kind of average cost *plus* a profit norm where costs exclude rents and at least some interest charges. Consequently, prices are not as a rule scarcity prices. When goods must clear markets, as in the consumer sector, taxes are added to factory or wholesale prices. Convenience of accounting and control and difficulties in making frequent calculations in order to change prices result in an administratively determined price stability, taken individually or as price indices.

Most price changes occur in periods of "price reforms," which happen every ten or fifteen years. This is not the place to discuss the allocative problems and distortions caused by nonscarcity prices, but we should note that because most economic data involve the use of prices it is quite difficult to evaluate economic magnitudes and to compare them with corresponding magnitudes in countries where prices are nearer to market prices.

Enormous efforts have been made over the years to estimate "adjusted factor costs" in the Soviet Union that would correspond to conventional Western definitions (Bergson, 1961, Chs. 8, 11), but these cannot hope to correct all distortions fully. Stability of prices over time may be an advantage when time series are estimated and evaluated, and in this respect Soviet prices are an asset. The caveats are that official prices do not usually reflect actual costs, and in a country where prices fixed at the top are combined with excess demand for goods, hidden inflation is bound to set in. The problem of hidden inflation becomes even more serious because of the peculiar Soviet practice of calculating many price indexes apparently by combining

new products into the indices at too high (later year) initial prices. In this way, quantity indices are biased upward while price indices are biased downward. As we shall see, this problem is most serious in the machinery production sector, where the physical series for individual machines show much more moderate rates of growth than does the aggregated quantity index (Gerschenkron, 1962, p. 263). Because the outcome serves mainly propaganda purposes, it is hard to dismiss the assumption that this peculiar methodology was deliberately chosen primarily for that reason. All these factors make it very difficult to estimate correct price indices or to evaluate the contribution of hidden inflation to Soviet economic achievements.

In view of the above, and because it is most important for the United States and the West to have reliable economic information on the Soviet Union, it is not surprising that Western countries and scholars, and especially the United States, have been investing substantial resources to collect and interpret this information for the use of policymakers and scholars. First priority is given to the estimation of the Soviet defense budget; the system of Soviet national accounts and general economic performance come second. The CIA, the Census Bureau, the Department of Agriculture and many other U.S. government agencies, The RAND Corporation and many nonprofit research groups, and Russian research centers in many big universities have joined with several for-profit organizations to reveal the Soviet economic picture. In addition to regular statistical series, many macroeconomic models or frameworks for the Soviet economy are used as analytical tools to study and understand past changes and to predict future developments.

The methods used to check the reliability of Soviet economic data or to reestimate them vary, of course, in accordance with the quality of the initial data and the nature of the problem. Most such processes entail some common steps: Soviet data are checked for consistency with all relevant available Soviet sources. As far as possible aggregate magnitudes are reconstructed on the basis of Soviet quantity series of individual items, individual Soviet prices or values, and in conformity with definitions and methodologies common in the West. This combination of disaggregated Soviet physical series and individual prices within a Western conceptual framework produces a body of data that is both reasonably reliable and compatible with corresponding data on Western countries.

More details on the outcome of these Western efforts are given in the following sections, where specific data categories are presented and discussed. As we shall see, despite the great efforts invested in collecting, understanding, recalculating, and checking the Soviet sources, many ambiguities, doubts, blank spots, and disagreements remain.

Nevertheless, the reader who wonders at this point whether he or she should proceed any further can, I think, be reassured by a general agreement among researchers in this field that we do have a basically sound body of economic data about the Soviet Union that is also comparable to similar records of market economies.³

³Older studies on the reliability of Soviet economic information are Bergson, 1947, 1953a; Gerschenkron, 1953; Nove, 1964. A relatively recent contribution to this field was made by Trembl and Hardt, 1972. Information based on Soviet input-output data is presented and analyzed in Trembl and Hardt 1972; Trembl 1977; Tretyakova and Birman, 1976. A recent summary of Soviet national income definitions and a comparison with Western GNP definitions is CIA (1978). Systematic series on Soviet national accounts and the economic magnitudes are presented in CIA (1983) and JEC (1982a) and in the CIA's annual *Handbook of Economic Statistics*. A description of Western macro models of the Soviet economy appears in Hildebrandt (1985a). The most comprehensive effort is the construction of the Sovmod model (Green and Higgins, 1977), now with a number of offspring. Other relevant sources will be cited below. A reconstruction and reestimation of Soviet national accounts according to Soviet definitions was compiled by PlanEcon (PlanEcon Report, 1986).

III. THE GROWTH RECORD

In this and the following section the Soviet growth record and structural changes are presented and compared with the experience in the non-Socialist world and with general quantitative frameworks of "modern economic growth" of market economies, such as the one formulated by Kuznets. Before embarking on the analysis itself, however, we must establish the basis for such comparisons. A common pattern of such studies is to compare the growth record of the country under investigation with that of other countries "at a similar stage of development." The initial working hypothesis is that because each country deviates from the average pattern, if the growth record conforms to the general pattern, the significant deviations form the basis for investigation (Kuznets, 1971a; Chenery and Syrquin, 1975; Ofer, 1973).

The main dependent variable in most comparative studies, and their main normalizing criterion, is GNP per capita, which is accepted as the best, though far from ideal, single variable capturing many developmental features. The first step is thus to establish the level of Soviet GNP per capita in a comparative setting. A recent extensive CIA effort to compare the Soviet and U.S. economies between 1956 and 1977 estimates Soviet GNP in 1975 at 62 percent of the U.S. level (Edwards et al., 1979, pp. 381-383). Data on later years are obtained by adjusting this figure according to Soviet and U.S. growth rates of GNP and GNP per capita to the desired date. These calculations produce a USSR/U.S. GNP per capita ratio of 50.3 percent for 1980. The comparison is based on the purchasing power parity (PPP) method, and the figures given are the geometric mean between the comparisons in ruble weights and those in dollar weights.¹ This estimate provides a link to the study of Kravis et al. (1982), where international GNPs and some subaggregates are estimated and compared, all based on PPP. The countries classified in this source as Groups IV and V (Kravis et al., 1982, p. 22), from Spain, the poorest, to West Germany, range between 54 and 81 percent of the U.S. level in 1975,² and are appropriately compared to the Soviet Union.

Comparisons are also made with the European members of OECD (E-OECD; OECD, 1982) and with the industrial market economies

¹Rates of economic growth in the Soviet Union and in the United States are taken from the same sources as for the corresponding data in Table 3.

²The figures are the geometric averages of comparisons in U.S. and the relevant country's prices (Kravis et al., 1982, pp. 239-241, Table 7.2).

(IMEs), as defined by the World Bank (1984). Most of the countries included in all three groups, which overlap one another to a considerable degree, belong to a similar range of GNP per capita mentioned above, though some exceed it.³ Special comparisons are also carried out with the United States, as these are of obvious interest.

Finally, further comparisons are made using the set of development equations estimated by Chenery and Syrquin (C&S, 1975). These regressions are based on data from some 100 countries in 1959-69. In each case the Soviet level of the relevant variable is compared with the level estimated from the regression and then the differences are evaluated. The C&S regressions use GNP per capita levels in 1964 U.S. dollars, converted from local currencies at official exchange rates. Kravis (1982) has demonstrated the weaknesses of official exchange rates but has also found that in most cases the ordinal ranking between countries is not affected. We have estimated the Soviet GNP per capita levels (in 1964 U.S. \$) at about \$300 in 1928, about \$600 in 1950, \$850 in 1960, \$1,250 in 1970, and about \$1,500 in 1980.

The main parameters of the Soviet growth record and the accompanying structural changes in 1928-83 are presented in Tables 1-4. I chose 1928 as the initial point for two reasons: (a) the Soviet Union regained its prewar (1913) production level approximately then, and (b) this was also the initial year of the first Five Year Plan (FYP), which embodied the new Soviet growth strategy. The year 1928 is also the starting point of most Western efforts to estimate the Soviet growth record. As explained in the notes to the tables, most of the estimates relate to national accounts and input changes based on the works of Bergson and the team at the Office of Soviet Analysis (previously the Office of Economic Research) at the CIA. In both cases the data are the culmination of many years of research in academia, research institutes (notably The RAND Corporation), and various U.S. government offices. The present estimates were preceded by many earlier calculations belonging to the same main line of effort.⁴ Earlier estimates may differ from the results presented here partly because, with time, more information has been accumulated and methodologies have improved, and partly because the base-year of the series has been moving forward. We discuss alternative estimates only if the differences are important. Unless otherwise specified, all definitions of variables are in accordance with common Western practice.

³The IMEs range from Ireland at the bottom to Switzerland at the top.

⁴Bergson, 1953b, 1961; Bornstein, 1959; Becker, 1969; Cohn, 1970, 1976a; Bergson and Heymann, 1954; Nimitz, 1962; Hoeffding and Nimitz, 1959; Anderson, 1968; Moorsteen and Powell, 1966; Kaplan, 1969; as well as Rush V. Greenslade (1976), who led the CIA team for many years.

GROWTH OF OUTPUT

The annual average growth rate of GNP during the 57 years since 1928 (line 1, Table 1) was 4.2 percent, or 4.7 percent when the five World War II years are excluded. The growth rate of population over the period (line 11) averaged 1.3 percent, giving 3.0 percent of annual growth of GNP per capita (line 12). All these rates are just above the upper limit of Kuznets' ranges for modern economic growth (1966, pp. 490-492) and were achieved despite somewhat faster rates of population growth than Kuznets' "norm." Hence, this growth record clearly qualifies as "sustained." True, since World War II there has been some acceleration in the growth rates of many countries, but the Soviet record is still among the best for such an extended period.

The second major feature revealed by Table 1 is the sharp decline in growth rates over time. GNP growth rates decline more than half, from 5.7 in the 1950s to 2.0 percent in the early 1980s (line 1). The corresponding figures for GNP per capita are 3.9 and 1.1, respectively (line 12). This decline and the very low recent rates have been a special cause for concern among the Soviet leadership for some time (e.g., Gorbachev, 1986, pp. 29-32) and a focal point of research and argument for students of the Soviet Union both in the West and in the Soviet Union itself. Much of what follows in this survey is related, in one way or another, to this major issue. Is the decline cyclical? Is it normal? Is it caused by the particular Soviet growth strategy? Can the Soviet Union sustain its military position and its internal stability with such low rates? Can the trend be reversed, and how?

When compared with the growth record of other countries (Table 2) the Soviet record is generally better during the prewar period and less impressive during the postwar period, and is consistently better for GNP than for GNP per capita.⁵ The Soviet record is almost always superior to that of the United States, even when comparing the Soviet record in 1928-55 to the U.S. record during the last decades of the nineteenth century, when both countries were at similar stages of economic development (Bergson, 1963, pp. 6-7). From 1950 to 1980 annual growth rates of Soviet GNP were slightly higher than those for the E-OECD and the IME groups (1960-80 for IMEs). The annual growth rates of Soviet GNP per capita were similar to those of the E-OECD and IME groups. For the decade 1970-80 the Soviet record is even less distinguished by comparison. (All comparisons are along lines 1 and 5 of Table 2.) The comparison of average growth rates for groups of countries in the West conceals the fact that several countries

⁵For prewar and postwar comparisons not included in Table 2 see Kuznets, 1963, pp. 334-342; Bergson, 1963, pp. 6-7; and Pitzer, 1982, p. 20.

Table 1
GNP, INPUTS, AND PRODUCTIVITY, 1928-83
 (Annual rates of growth)

	1928-85 ^a	1928-40	1940-50 ^b	1950-85	1950-60	1960-70	1970-75	1975-80	1980-85
1. Gross national product	4.2 (4.7)	5.8	2.2	4.3	5.7	5.2	3.7	2.6	2.0
2. Combined inputs	3.2 (3.4)	4.0	0.6	3.6	4.0	3.7	3.7	3.0	2.5
3. Labor (manhours)	1.8 (1.9)	3.3	0.7	1.4	1.2	1.7	1.7	1.2	0.7
4. Employment	1.9 (2.0)	3.9	0.3	1.5	1.6	2.1	1.5	1.2	0.7
5. Capital	6.9 (7.5)	9.0	0.4	8.0	9.5	8.0	7.9	6.8	6.3
6. Land	0.8 (0.8)	1.6	-1.3	1.1	3.3	0.2	1.0	-0.1	-0.1
7. Total factor productivity ^c	1.1 (1.2)	1.7	1.6	0.7	1.6	1.5	0.0	-0.4	-0.5
8. GNP per hour worked	2.4 (2.6)	2.4	1.5	3.0	4.4	3.4	2.0	1.4	1.3
9. GNP per employed	2.3 (2.5)	1.8	1.4	2.8	4.0	3.0	2.2	1.4	1.3
10. GNP per unit of capital	-2.4 (-2.6)	-2.9	3.4	-3.3	-3.5	2.6	-3.9	-3.9	-4.0
11. Population	1.3 (1.4)	2.1	-0.8	1.3	1.8	1.3	0.9	0.8	0.9
12. GNP per capita	3.0 (3.3)	3.6	2.9	3.2	3.9	3.9	2.7	1.8	1.1
13. Investment	7.3 (8.1)	9.6	5.6	7.0	11.4	6.8	5.4	4.3	3.2
14. Defense	7.1 ^d (7.1)	26.6	-0.8	3.2 ^e	-2.1 ^f	6.1	3.8	2.6	2.2 ^g
15. Consumption (a) ^h	3.3 (3.6)	3.1	1.5	3.9	5.3	4.5	3.7	2.7	2.0 ^g

Table 1—continued

	1928-85 ^a	1928-40	1940-50 ^b	1950-85	1960-70	1970-75	1975-80	1980-85
16. Consumption (b) ^h	3.8 ^d (4.1) ^d	3.5	1.7	4.6	6.1	5.1	3.1	2.0 ^g
17. Household consumption (b) ^h	3.6 ⁱ (4.0)	1.9	1.7	5.0 ⁱ	6.3	4.8	3.2	— ^j
18. Communal services (b) ^h	5.6 ⁱ (6.3) ⁱ	13.8	1.9	3.8 ⁱ	4.2	5.1	2.4	—
19. Consumption per capita (16)/(11)	2.3 (3.0)	1.4	2.5	3.3	4.2	3.8	2.3	1.1 ^k
20. Household consumption per capita (b) (17)/(11)	4.2 ⁱ (2.6) ⁱ	-0.2	2.5	3.7 ⁱ	4.4	3.5	2.4	—
21. Consumption per employed (16)/(4)	2.0 (2.2)	-0.4	1.4	2.9	4.4	2.9	1.9	1.3
22. Value added of A sector (1.9)	1.8 (1.9)	1.6	0.0	2.3	4.4	2.2	-0.2	2.0
23. Value added of M sector (6.9)	6.2 (6.9)	9.2	3.3	6.1	9.6	6.2	3.2	2.3
24. Value added S sector (4.6)	4.3 (4.6)	6.9	1.9	4.1	4.3	5.3	3.0	2.1

SOURCES: 1928-1950: GNP is in "ruble factor cost" of 1937, as in Bergson, 1961, Table 51, p. 210. Population: Bergson, 1961, Table 60, p. 230. GNP per capita is computed, but also consistent with Bergson, 1961, Table 72, p. 264. Inputs are from Bergson and Kuznets, 1963, Table 1.2, p. 6. Employment is estimated as closely as possible to full-year equivalents (line 4) and then adjusted to take account of changes in hours (line 3). It includes military forces but excludes forced labor. Capital refers to "reproducible fixed capital" and excludes changes in livestock inventories. Because livestock was declining, the inclusive figures are slightly lower. Weights: Bergson's original weights (1961, p. 19, set A) were used as a base. They assume that return on capital is 20 percent and that land rent amounts to 40 percent of agricultural wages. Because Bergson's weights are for net national product, we have adjusted them to account for GNP by adding the appropriate amount of depreciation to returns from capital and to the total (15 billion rubles in 1937, according to Bergson, 1961, p. 144). When forced labor is also excluded, the rate of growth of combined inputs comes to exactly 4 percent, and when it is included it comes to 4.3 percent.

End-use categories: All categories at ruble factor cost of 1950 are from Bergson, 1961, Table 51, p. 210. Consumption in established prices is from Bergson, 1961, Tables 16, 18, pp. 85, 93.

Table 1—continued

Sector of origin: "A" stands for agriculture and forestry; "M" for mining, manufacturing, and construction; and "S" for all other branches. The data for 1928-50 are from Kaplan, 1969, Table 1, p. 5, and Table A-6, p. 123.

1950-1985: GNP, population, GNP per capita: 1950-80—Pitzer, 1982, Table A-6, pp. 65-67, and Table A-9, pp. 72-74. 1980-85—CIA, 1986, Tables 39, 40, 43, pp. 67, 70. All GNP figures are at 1970 factor cost, except for 1980-85, which are at 1982 factor cost.

Inputs 1950-83: Labor force (line 4) defined as full-time civilian employment *plus* military personnel. The former is from Rapawy, 1985, Table 4, p. 8; and the latter from Feshbach and Rapawy, 1976, Table 8, p. 132. In line 3 the figures are adjusted to account for changes in hours, as in Rapawy, 1985, Table 9, p. 18. Capital inputs are for fixed capital, plus livestock, in "comparable prices" of various years as in Soviet official series (Narkhoz 1971, p. 60; 1983, p. 48). Land is measured by area under cultivation, not farmland or arable land, which are used more commonly in the West. Combined inputs are weighted using Bergson's weights of 0.62 for labor (measured in hours, line 3), 0.33 for capital, and 0.05 for farmland (1982, p. 37). Data for 1980-85 are from CIA HB, 1986, Table 43, p. 70.

End-use categories (except defense) and sector of origin: 1950-80—Pitzer (1982); 1980-85—CIA, HB (1986, Tables 3, 37, 39, 40, pp. 66-67). Figures on consumption in established prices are from Schroeder and Denton (1982, Tables 3, 4, p. 329). The defense series is from Becker (1986, Table 1, p. 4).

NOTE: As emerges from the notes below, the data for 1928-50 are not fully consistent with those for 1950 on. We have reason to believe that basic trends are not seriously affected by these inconsistencies. The overall figures for 1928-85 are simply the sum of the changes over the subperiods.

Figures in parentheses in this column are calculated on the basis of only 50 years, excluding the World War II years.

^bThis period covers World War II years and the following reconstruction period; therefore many of the figures are averages of extremely different magnitudes. For example, GNP stagnated over 1940-44 and grew at 3.6 percent per annum over 1944-50; the corresponding figures for population growth are -2.7 and 0.5 percent, respectively, giving 2.7 and 3.1 percent per year for growth of GNP per capita for the two subperiods.

^cFigures in parentheses in this line (except for 1928-85) are CIA estimates of total factor productivity, based on an alternative set of weights: 0.558 for hours, 0.412 for capital, and 0.03 for land (CIA, HB, 1984, p. 68). For 1980-85 the weights are 0.512, 0.458, and 0.03, respectively (CIA, HB, 1986, p. 70).

^d1928-82.

^e1955-82.

^f1955-60.

^g1960-82.

^h(a) = at factor cost; (b) = in established prices.

ⁱ1950-80.

^j— = not available.

^kBased on consumption at factor cost.

^lFor 1950-80—based on five-year averages; for 1950—the average for 1950-52.

Table 2
GROWTH RECORDS COMPARED
(Annual rates of growth)

	Soviet Union						E-OECD			IMEs ^a			USA	
	1928-80	1950-80	1960-80	1970-80	1980-80	1970-80	1950-80	1970-80	1980-80	1970-80	1980-80	1950-80	1970-80	1980-80
1. GNP	4.4	4.7	4.2	3.1	4.2	3.0	4.2	4.2	4.2	3.2	3.2	3.3	3.3	3.0
2. Population	1.3	1.3	1.1	1.0	0.9	0.7	0.9	0.9	0.9	0.8	0.8	1.4	1.4	1.0
3. Civilian labor force	2.1	1.7	1.8	1.3	1.0	0.7	1.0	1.3	1.3	1.3	1.3	1.7	1.7	2.3
4. Civilian employment	2.1	1.7	1.8	1.3	0.3	0.3	0.3	— ^c	—	—	—	1.7	1.7	2.3
5. GNP per capita	3.1	3.3	3.1	2.1	3.3	2.3	3.3	3.3	3.3	2.4	2.4	1.9	1.9	2.0
6. GNP per 1/f member	2.3	2.9	2.3	1.8	3.2	2.3	3.2	2.9	2.9	1.9	1.9	1.4	1.4	0.7
7. GNP per employed	2.3	2.9	2.3	1.8	3.9	2.7	3.9	—	—	—	—	1.6	1.6	0.7
8. Household consumption ^d	3.6	5.0	4.3	3.6	4.1	3.3	4.1	3.9	3.9	3.4	3.4	3.5	3.5	3.3
9. Communal consumption ^f	5.6	3.8	3.6	2.4	3.8	3.5	3.8	4.1	4.1	3.7	3.7	3.5	3.5	1.8
10. Government consumption ^f	6.8	2.4	2.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
11. Fixed investment	7.4	7.6	5.8	4.8	4.9	1.9	4.9	3.9	3.9	1.6 ^e	1.6 ^e	2.7	2.7	1.9
12. Household consumption per capita ^d	2.3	3.7	3.2	2.6	3.2	2.6	3.2	2.6	2.6	2.6	2.6	2.1	2.1	2.3

Table 2—continued

	Soviet Union				E-OECD			IMEs ^a		USA	
	1928-80	1950-80	1960-80	1970-80	1970-80	1950-80	1970-80	1960-80	1970-80	1950-80	1970-80
13. Household consumption per 1/f member ^d	1.5	3.2	2.5	2.3	3.1	3.1	2.6	2.6	2.1	1.8	1.0
14. Household consumption per worker ^d	1.5	3.2	2.5	2.3	3.8	3.8	3.0	—	—	1.8	1.0

SOURCES: Soviet Union: See sources to Table 1; E-OECD, and the United States: OECD (1970, 1982), and International Labor Office (1977, various tables), IMEs: The World Bank (1984, 1986, various tables).

NOTE: The data for E-OECD countries are presented for the sum of the group, and that of IMEs are presented as weighted averages for the countries included, according to the size of the different economies. Data for E-OECD and USA are always GDP rather than GNP.

^aIndustrial Market Economies.

^bSometimes the period is slightly different.

^c— = not available.

^dFor the Soviet Union at established prices. For all other countries at factor cost.

^eGross domestic investment.

^fFor the Soviet Union, government consumption excludes communal services, but includes a number of undefined residuals such as most (but not all) defense expenditures. In all other countries defense expenditures are included in government consumption.

have growth records (GNP per capita) superior to that of the Soviet Union, such as West Germany, Italy, France, Austria, Spain, Greece.⁶ Maddison (1982, pp. 43-46, 102-109) articulated the theory that follower countries may have the opportunity to grow faster than leaders. If so, one should have expected the Soviet record to be better than that of E-OECD or IME, but at least since 1950 it was not.

Much of the development literature treats changes in GNP per capita and per employed person as similar magnitudes, because in many cases the denominators move together. In the Soviet case, where employment grew faster than population, this is not so; and all measures of growth, whether of GNP or of consumption, are lower when they are measured per employed person. Thus the Soviet record of growth of GNP per employed is less impressive than that for GNP per capita (compare lines 9 and 12 in Table 1). The comparative record is also less favorable: While in E-OECD GNP per employed person (3.9 percent for 1950-80) is higher than that of GNP per capita (3.3 percent), in the Soviet Union it is lower, with corresponding figures of 2.9 and 3.3 percent for the same period (lines 5 and 7 in Table 2).

Throughout the period, the Soviet Union has been closing the gap with the United States and with some other countries in the West. From about one-quarter the size of the U.S. economy in 1928, the Soviet economy climbed to about 40 percent in 1955, 50 percent in 1965, and about 60 percent in 1977. Soviet GNP per capita was also catching up, reaching 52 percent of the U.S. level by 1975 (Edwards et al., 1979, pp. 381-83; see p. 12 above); however, this pace has slowed down drastically in the past two decades (it even reversed itself in recent years), and in spite of some relative Soviet advancement, the absolute gap between the two economies has continued to widen (Edwards et al., 1979). At the same time, other countries have been catching up with and overtaking the Soviet Union, notably Japan (Pitzer, 1982, p. 20). All this comparative evidence leads to the conclusion that although the Soviet Union has been doing quite well in terms of overall growth, its record is far from outstanding.

A few comments are warranted about alternative estimates of Soviet output growth. Most Western estimates of Soviet growth are close enough to the figures cited here and do not affect any of the above conclusions. In general, earlier estimates, which also covered shorter postwar periods, were somewhat higher than those shown in Table 1 (Pitzer, 1982, p. 26; Bergson, 1961, p. 149; Moorsteen and Powell, 1966, pp. 623-24; Kaplan, 1969, p. 14; Cohn 1970, p. 17; Becker, 1969,

⁶Between 1950 and 1980. See the sources cited in Table 2; Pitzer, 1982, p. 20; and Maddison, 1982, p. 44.

p. 128). Some of the differences are due to the use of an earlier year price base, or slightly different weights for the same base year, and others, for lack of a better alternative, to the use of official Soviet price indices. In most cases the earlier estimates would have been closer to those used here had their constructors had the information that is available today.

The only period in which the index number problem has considerable implications for growth rates is 1928-40. During that period the Soviet Union went through an extreme shift in industrial structure and in relative prices so that when GNP is estimated in 1928 prices the growth rates obtained are much higher. For 1928-37 Bergson estimated a Laspeyres growth rate of 11.4 percent per year and a Paasche rate of 4.9 percent (Bergson, 1961, p. 180).⁷ Were the higher figure substituted for the one used in Table 1, the overall annual rate for the entire period would go up to 5.2 percent, and the trend of declining rates would be even more pronounced. As is clear from index number theory, there are no theoretical grounds for preferring one base year to another. Still, when comparisons are made with other countries or periods this factor must be taken into account.

We must also consider Soviet official data on growth rates. The Soviet Union uses "net material product" (NMP) as its main national aggregate, which is more or less the Western concept of net national product (NNP) less the value added of most services. The official growth rate of NNP is 16.7 percent for 1928-37, at 1926-27 prices (Bergson, 1961, p. 180), 7.4 percent for 1950-80, and 6.0 percent for 1960-80 at 1950 or later year prices (Pitzer, 1982, p. 25). These rates are higher than those estimated in the West. They are explained partly by the definitional differences (about two-thirds of the difference in 1950-80; Pitzer, 1982) and partly by Soviet practice, which underestimates price increases in their series. Most notable in Western discussion on the problem is the Soviet practice of introducing new products into constant price series at their high prices at the time of introduction (Gerschenkron, 1962, p. 263).⁸

⁷On the particular nature of Soviet 1928 prices see Bergson, 1978, p. 168.

⁸A discussion of most of the relevant issues appears in Trembl and Hardt, 1972, Parts II, V, VI.

A recent Western reconstruction of the Soviet NMP series estimates NMP growth in 1960-80 at 4.9-5.5 percent annually and in 1980-85 at 2.5-2.7 percent (PlanEcon Report, 1986, p. 25, Table 14). The 1960-80 figure exceeds the GNP rates presented in Table 2 (4.2 percent) by 1 percentage point, and the figure for 1981-85 is identical to the corresponding GNP figure. The differences in coverage can explain these gaps. This further supports the hypothesis that different treatment of price indices causes some of the gap between official Soviet figures and Western estimates.

At least two Western students of the Soviet economy, William T. Lee and Steven Rosefielde, obtain significantly higher estimates of Soviet growth rates. Lee's annual

EXPLAINING GROWTH

Unlike growth itself, which conforms with Kuznets' definition of MEG, the sources of growth of the Soviet economy deviate from the common patterns described by Kuznets. During the entire period, but more so with time, Soviet growth is generated by high rises in inputs and declining growth of overall input productivity. As shown in lines 2 and 7 of Table 1, during the entire period 1928-85 inputs grew at 3.2 percent and contributed 76 percent of total GNP growth, while factor productivity grew 1.1 percent a year, accounting for only 24 percent of total growth. The relative contribution of inputs to growth grew to 80 percent in the postwar period and became its sole component from 1970 on, when productivity completely stagnated or even retreated.⁹ The proportions of inputs and productivity are diametrically opposed to those of a normal MEG pattern (Kuznets, 1966, p. 491). This divergence from "normal" patterns, as we shall see, lies at the core of Soviet growth patterns and strategy, and is related, as can be seen from the data, to the declining growth trend. Indeed the Soviet experience reveals two sides of this diverging pattern: unusually high growth of inputs and a slow rise in productivity.

Labor Inputs

The main characteristic of labor inputs is that they grow over the entire period at a substantially higher rate than population (compare lines 3, 4, 11 in Table 1). While the population increased at an annual rate of 1.3 percent, the number of employed was growing 1.9 percent annually, and hours worked grew 1.8 percent. Only during the 1950s did a reverse order prevail. In this way the rise in labor contributed substantially not only to GNP growth but also to the growth of GNP per capita—not a very common phenomenon. Another result of these trends is an exceptionally high rate of participation in the labor force, much higher than in any other country. In 1980 the Soviet participation rate, measured as a ratio of all those working to the population aged 15-64, was 86.6 percent, compared with 66.5 and 70.9 percent in

growth estimate of 7.7 percent between 1955-75 and Rosefielde's similar figure are based mainly on accepting the official Soviet NNP series as a measure of growth at constant prices. Their main argument is that the Soviet series should not be deflated by estimates of hidden inflation because the higher prices for new goods, especially equipment, represent quality improvements (Lee, 1979a; Rosefielde, 1982; see also Rosefielde, 1981, 1983). Most students in the field (see Steiner, 1978, 1982, 1983) do not accept this argument.

⁹Likewise, total factor productivity growth accounts for only 37 percent of per capita growth in 1928-83, declining over time from almost half to zero (lines 7 and 12 in Table 1).

E-OECD and the United States respectively (OECD 1982; Feshbach and Rapawy, 1976; Baldwin, 1979; see also Cohn, 1970, p. 66). Much of the Soviet advantage in labor force participation rates comes from the exceptionally high rates for women. These rates rose over the period to nearly 87 percent in 1980, again the highest rate in the world. Comparable rates are 48.5 in E-OECD and 59.7 percent in the U.S. (OECD, 1982). The actual gap for women is even wider, as few women in the Soviet Union are allowed to hold part-time jobs, while many do in the West.

The main factors contributing to these trends include the elimination of most legal nonwork income sources; the legal requirement that all able-bodied males have a job; and the enlisting of most women into the labor force by wage policies, ideological education and indoctrination, and the opening of new schooling and occupational opportunities.

Despite a rapid rise in the enrollment of youth in all kinds of schools and despite the low retirement age (55 for women, 60 for men), participation rates increased, because nearly half the students were directed to evening and correspondence schools and thus kept in the labor force (Rapawy, 1976, pp. 10-12):

Recently, because the rates of natural increase have declined drastically, special efforts are also made to keep retired persons on the job. Finally, the rise in labor inputs was also somewhat slowed by a rather sharp one-time decline in work hours during the 1950s and early 1960s—from 45 to 40 standard hours per week in industry (Rapawy, 1976, pp. 43-55).¹⁰

One can argue that Soviet-Western comparisons should be made between rates of actual employment rather than participation rates, to account for unemployment in the West and its virtual absence in the Soviet Union. The corresponding employment rates for E-OECD and the United States for 1980 are 63 and 67 percent respectively, more than 20 percentage points lower than the Soviet figures (Rapawy, 1976). The counterargument is that the Soviet Union tolerates disguised unemployment and that this factor shows up as lower labor (and overall) productivity rates.

Even when enlisting labor is entirely successful, rates of growth of employment are bound eventually to gravitate toward the growth rate of population. The secular decline in the latter placed a constantly descending ceiling on the former so that in recent years increments to

¹⁰On population and labor force issues see Eason, 1963; Feshbach, 1983; Feshbach and Rapawy, 1976; Rapawy, 1976; Baldwin, 1979. The above discussion ignores the relatively small effects of changes in the age structure on trends and comparisons of participation rates. Much of these effects are excluded in any case by relating the labor force to the population aged 15-64.

the labor force are reduced to less than 1 percent per year and are now bottoming out—down to 0.6 percent per year (Goodman and Schleifer, 1982, p. 324). Population and labor force growth rates are much lower among the European nationalities of the Soviet Union, and the overall rates are kept at present levels only because of the much higher growth rate of the Moslem populations. These by now account for about 21 percent of the total population and generate most of the net additions to both population and labor force. Because economic activity is highly concentrated outside the Moslem republics and also owing to language problems and lower education levels among the Moslem populations, these labor increments are less readily available for productive employment.

Capital

The most outstanding characteristic of Soviet growth strategy is its consistent policy of very high rates of investment, leading to a rapid growth rate of capital stock. The Soviet capital stock has been growing since 1928 at an annual rate of 6.9 percent and of 7.5 percent if World War II years, when capital was destroyed, are excluded (Table 1, line 5). Until 1975 the growth rate of capital remained between 8 and 9.5 percent, doubling its size every 8–9 years. These high rates, with the implied high rates of growth of investment and share in GNP, are all almost without precedent for such long periods (see Table 2) and are the hallmark of Soviet growth strategy. Only since 1976, with a change of policy, were the growth rates of capital allowed to decline to between 6 and 7 percent annually (still very high by international standards). Even so, in view of the much sharper decline in the growth rates of labor, capital now remains almost the sole carrier of the modest growth of the Soviet economy. A more detailed discussion of the underlying policies is presented below.

A word is required on the estimates of the capital series presented in Table 1, taken directly from the *Soviet Statistical Yearbook*, following the accepted practice in the field (Bergson, 1983a, p. 69; 1986). For reasons that are still not fully understood, these official statistics do not seem to be subject to the substantial upward bias that all agree affects most similar aggregated “constant price” series.¹¹

¹¹Direct use may be justified, quite surprisingly in this case, by the rather peculiar Soviet method of compiling the relevant data. The Soviet capital series is based on two elements: two capital censuses (one in 1959–60 and another in the early 1970s) and interim and following investment series. The methodology that apparently makes these series less afflicted with hidden inflation is the use of “estimated prices” (instead of the usual set of “comparable prices”), prices that are established and monitored by special agencies to avoid price creeping (Cohn, 1981; Bergson, 1986). One check on the reliability of the Soviet official

While this is the accepted view, and the basis of most Western series on Soviet capital, there is a dissenting voice, that of the "British contingent." Based on several recent Soviet sources, they claim that, like most Soviet series on machinery and equipment, the investment series also contains a substantial element of inflation, and that the implied growth rates are therefore exaggerated and the implied productivities downward biased. With the recent low rates of increase in investment, Wiles and Nove even wonder whether the entire growth of investment is not made up of price increases (Nove, 1981; Wiles, 1982; Hanson, 1984; see also Selyunin and Khanin, 1987). Some of the responses to these arguments have already been included in the discussion above, and detailed discussions appear in Cohn, 1981; and Bergson, 1986. One source of difficulty in both the Soviet sources and the debate seems to be a confusion between hidden inflation and increased capital costs per unit of output and between capacity resulting from technological input substitution and inefficiencies (Bergson, 1986, pp. 18-25). The issue is not yet settled, and we must reserve judgment when productivity figures are discussed.

Land

Line 6 of Table 1 shows data on the expansion of land under cultivation. The figure for 1928-40 (1.6) reflects the Soviet territorial acquisitions of 1939, and the figure for 1950-60 (3.3) reflects Khrushchev's Virgin Land Program—the drive to raise food production by expanding the sown area, mainly in Kazakhstan and Western Siberia. This and similar drives are part of the contribution of land in the general effort of input expansion.

Combined Inputs

The common practice of combining inputs by their factor shares in national income is not readily feasible in the Soviet case. For ideological reasons the Soviet Union does not recognize as an economic

capital series was provided by independent estimates of Soviet capital series through the heroic efforts of Moorsteen and Powell (1966). These estimates have been discontinued, but for the period covered (up to 1973) they come fairly close to the Soviet series. A second check is provided by ongoing independent CIA estimates of the Soviet investment series, which is also not dissimilar to the corresponding Soviet counterpart (Bergson, 1986, especially Table 1; Powell, 1979). In the case of investment, however, it is assumed that some element of hidden inflation (between 1 and 3 percent annually) is presented in the series especially during the second half of the 1970s (Converse, 1982; Cohn, 1981; Bergson, 1986, pp. 24-25). The effect of the bias on the capital series is much smaller because a 1 percent bias in the investment series is translated into a much smaller fraction in the capital series, and because the accumulated bias in the latter is periodically corrected by a new capital census.

category capital charges other than depreciation, and such charges are therefore not included in Soviet national accounting. Instead, until 1966-67 "profits" were calculated as a percentage of production costs and then added to production costs to yield wholesale prices. Since then, profit norms are determined as a percentage of total assets, and a capital charge of 6 percent is levied from profits; however, for various reasons, profit norms vary substantially among branches and individual products. Similarly, rents on land and natural resources were introduced only after 1966-67, but also only halfheartedly (Bornstein, 1976, 1978). In order to arrive at appropriate Western types of factor shares and, for that matter, national income estimates, all Soviet prices must be transformed from official "established" prices into "adjusted factor cost" prices, stripped from taxes and subsidies and with an appropriate return on capital and land. The most common alternative practice in the West has been to assign reasonable rates of return and rental values to capital and land, as a basis for calculating their income shares (Greenslade, 1976; Bergson, 1961, 1963, 1973, 1978a, 1983b, 1985; Moorsteen and Powell, 1966; and others). The rates used as returns to (net fixed) capital over the years were 6, 12, and 20 percent, the middle rate being the most commonly used, apparently also by Soviet planners when making project evaluations (Bergson, 1983b, pp. 39-41).¹² Depending on the method and on the estimates of labor inputs, each investigator arrives at a slightly different set of weights and therefore obtains a slightly different series for combined inputs.¹³

The weights used by Bergson to combine inputs are 0.62 for labor, 0.33 for capital, and 0.05 for land. The figures used by the CIA for up to 1980 were respectively 0.558, 0.412, and 0.03 (CIA, HB, 1984, p. 68; Greenslade, 1976, p. 279) and slightly different for 1980-85. Because capital is growing faster than labor and land, a lower weight for capital generates a lower rate of growth of inputs and a higher residual, that is, productivity growth. Thus the CIA estimates for productivity growth are about 0.5 percentage points lower than Bergson's, as shown in Table 1 (CIA, HB, 1984).¹⁴ The estimates of factor contributions and factor productivity in Table 1 are consistent with the assumption that the Soviet production of GNP lies along a Cobb-Douglas

¹²A new method of calculating factor costs and input shares was recently developed based on the Soviet input-output table, which involves computing factor cost prices under the assumption that all sectors have the same rate of return on their capital inputs (Pitzer, 1982, p. 40).

See also notes and sources to Table 1.

¹⁴To illustrate, using a 6 percent return to capital instead of 12 percent would reduce the growth rate of combined inputs over the period 1960-70 to 3.12 (rather than 3.69) and raise that of productivity to 2.14 (instead of 1.51). See Bergson, 1963, p. 38.

production function with constant returns to scale. Other interpretations of the production data are discussed in Sec. VII.

The pattern of Soviet growth as shown in Table 1 is called *extensive growth* in the Soviet and Western literature. As we have seen, its main characteristic is in generating growth mostly through the expansion of inputs and only marginally through rises in productivity. Indeed, emphasis on input growth has been a strategic decision of Soviet policymakers from the beginning (Erllich, 1967; Bergson, 1973; Cohn, 1970; Millar, 1981; and many others). The other aspect of the extensive model, the small contribution of productivity growth, is clearly an undesirable and unintended outcome. The interesting questions are, To what extent is this failure a systemic problem that can be corrected by radical changes? If so, what are its sources and what are the changes needed? Is it affected by various policy aspects including different elements of the growth strategy? To what extent may it result from the extensive aspect of the growth strategy itself, where the emphasis on maximizing input expansion may have created conditions that are disruptive to productivity growth? More on this later, after a review of the other structural changes in Soviet economic growth.

IV. STRUCTURAL CHANGES

According to Kuznets, 1966, 1971b, the discussion of structural change covers three aspects: changes in GNP distributed by end uses, changes in the industrial composition of GNP and of inputs, and changes in the extent and structure of external economic relations.

END USE

A key feature of the extensive growth model is that capital grows faster than GNP because of the high growth rate of capital on one hand, and low productivity advance on the other. Consequently, to sustain the growth rate of capital, the share of investment in GNP, in constant prices, must grow continuously. The share in current prices can move in both directions, depending on the change in the price of investment goods relative to other GNP uses.¹

As shown in Table 3, the share of gross fixed investment in GNP, when defined in constant 1970 factor cost prices,² rises continuously and rather steeply. From 1950 to 1980 it rose from 14 to 33 percent of GNP (line 12). This manifests itself in a faster rise of investment compared to GNP growth (see Table 1); however, when measured in current prices, the share is fairly constant from about 1960 on—which means that at least since then the relative prices of investment goods have been *declining*. Since 1960, the investment shares are stable at 27–29 percent (Table 3, line 1). These are fairly high figures; very few

¹The relation between I (investment), K (the capital stock), and Y (national product) in real terms is given by:

$$I/K = (I/Y)(Y/K)$$

Let us describe growth by $\dot{Y} = \alpha\dot{K} + \beta\dot{L} + \dot{A}$, where (\cdot) denotes growth rates, L is labor, and A is the level of technology.

Under intensive growth, $K < \dot{Y}$, so Y/K rises over time. For $I/K (= K/K)$ to stay constant, I/Y must decline, i.e., $\dot{I} < \dot{Y}$.

Under extensive growth, $K > \dot{Y}$, so Y/K declines and a constant I/K implies a rising I/Y .

The share of investment in GNP in current prices may be written as $I_c/Y_c = IP_I/YP_P$, where c stands for "in current prices" and P for "price level."

A change in the relative price of I , for example because of faster technological change, may slow down the rise of I/Y in real terms.

²Factor costs are calculated by adding subsidies to and subtracting (turnover) taxes from established prices. No adjustments are made to make factor prices scarcity prices as in "adjusted factor costs."

countries have sustained such burdens for so long. Kuznets estimates that "normal" investment shares reach about 20 percent of GNP at an advanced stage of development (1966, pp. 496-497). Indeed, most of the figures for various groups of countries are about 20 percent (Table 3).³ Compared with this estimate there is an excess Soviet investment of about 8 percentage points of GNP. The only other countries belonging to the control group that invest that much or more, and for such extended periods, are Japan and Norway (OECD, 1982, p. 60). Another characteristic of the growth orientation of Soviet investment is that less than 20 percent goes to residential construction compared with more than one-quarter in E-OECD (OECD, 1982; Cohn, 1976b, p. 452). To the basic figure of 28 percent in fixed investment one must add 2-3 percent of investment in inventories and 2-3 percent spent on R&D, to get a grand total of about one-third of GNP in current prices for investment.

The most recent estimates of the share of defense spending⁴ in Soviet GNP (the defense burden) are between 15 and 17 percent for the early 1980s, estimated in 1982 prices. After a sharp decline in the share of defense following Stalin's death, it resumed a monotonic climb from possibly less than 10 percent in the late 1950s to about 13 percent in 1970.⁵ This rise in the defense burden represents a combination of varying proportions of increases in real spending at rates higher than GNP growth, and an apparent monotonic increase in the relative price of defense. The first factor was more important up to the mid-1970s, when a major policy decision trimmed the real annual growth of defense spending from about 4 percent to 2 percent with almost a freeze on growth of the procurement of weapons (see Table 1, line 14).

³The figure estimated from the C&S regressions, 23 percent, includes investment in inventories, as do the World Bank figures.

⁴See note "a" to Table 3. Soviet defense spending is usually defined in Western statistics in two ways. A lower range of spending estimates is based on the definition of defense used in the U.S. and includes the U.S. equivalents of (a) national security programs funded by the Department of Defense, (b) defense-related nuclear programs, (c) selective service activities, and (d) defense-related activities of the Coast Guard. This definition is broadened in the upper range to include other activities that the Soviets may view as part of their defense effort: (a) internal security, (b) construction and railroad troops, (c) civil defense (in part), (d) military assistance, and (e) military stockpiling. Both definitions exclude military pensions and veterans' benefits. The estimated defense spending according to the second definition is usually larger by 2 percent of GNP than the estimate based on the first definition. The figures in Table 3 rely on the first definition (which is better for comparison purposes). See U.S. Congress, 1981, pp. 129-30; CIA, 1981, p. 10.

⁵The figures for 1970 and 1982 are in established Soviet prices as estimated in the West. For years before 1970 and between 1970 and 1982 the shares are usually calculated in 1970 prices. The inferences about the behavior of current price shares are made on the basis of estimates of relative price rises by Becker, 1986, pp. 16-18; CIA, 1986, pp. 35-37, and others.

Table 3
END-USE GNP SHARES
(Percentage)

	Soviet Union							Kravis 1975	E-OECD		USA		C&S	
	1928	1950	1960	1970	1980	1980	1975		1980	1980	1980	1982	1980	
<i>Current Established Prices</i>														
1. Gross fixed investment	19	17	27	29	28	28	21,24	21	—	18	20	22	—	
2. Inventory change	4 ^a	6 ^a	3	4	3	3	— ^b	—	—	—	—	—	—	
3. R&D ^c	—	—	2	3	3	3	—	—	—	—	—	—	—	
4. Consumption	73	64	59	55	55	65,71	—	60	65	62	64	64	18	
5. Household	68	55	53	49	49	18	—	—	—	—	—	—	—	
6. Food ^d	—	—	—	—	—	—	—	—	—	—	—	—	—	
7. Communal services	5	9	6	6	6	6	—	18	18	18	18	14	—	
8. Government	5	13	10	10	11	11	—	—	—	—	—	—	—	
9. Civilian administration	3	4	2	3	3	3	8,11	—	—	—	—	—	—	
10. Other ^e	2	9	8	7	8	8	—	—	—	—	—	—	—	
11. Defense ^f	2	9	12	13	16	16	—	1-5	5	4	4	—	—	
<i>Constant Factor Cost (1970 Prices)</i>														
12. Gross fixed investment	—	—	—	—	—	—	—	—	—	—	—	—	—	
13. Consumption	—	14.2	24.2	28.2	33.0	33.0	—	—	—	—	—	—	—	
		59.9	57.7	54.2	53.6	53.6	—	—	—	—	—	—	—	

SOURCES: The Soviet Union: 1928, 1950—Bergson, 1961, Table 3, p. 46; 1960-80—CIA, 1983, Tables 5 and 18. Constant factor cost shares are from CIA, 1983, Table 9. The figure for food consumption is from Schroeder and Edwards, 1981, p. 20. Defense expenditures for 1950-70 are from Becker, 1986, Table 2, p. 14; the figure for 1980 is from CIA, 1986, p. 35. Other countries: "Kravis"—Kravis et al., 1982, Table 1-6, p. 18; "E-OECD"—OECD, 1982, various tables; C&S—Chenery and Syrquin, 1975, Table 3, pp. 20-21. Defense shares are from CIA, HB, 1984, Table 22, p. 47.

NOTE: E-OECD and USA data are based on GDP rather than GNP. It is assumed that the distortions created by taxes and the exclusion of proper factor payments are much more important in the Soviet Union than those created by taxes in other countries. In 1970, the consumption share in the Soviet Union at factor cost was lower by 1 percentage point than that estimated at established prices

Table 3—continued

(54.2 and 55.1 respectively; CIA, 1983, p. 8; Pitzer, 1982, p. 21). OECD, IMEs, and USA data are as in Table 2, except that the IMEs figure is the median value for the group. Kravis' data are simple averages for two groups of countries; the left-hand figure is the average for Italy and Spain, and the right-hand figure is the average for nine industrialized countries (eight European and Japan), excluding the United States; C&S stands for Chenery and Syrquin, 1975. The figures in this column are the levels as estimated from their equations for a GNP per capita of about \$1,500 (of 1965), the approximate level for the Soviet Union in about 1980.

Consumption includes the provision of communal services, mostly education and health, by governments. Household consumption excludes services supplied by governments.

As apparent from the table and the related discussion in the text, the sum of the shares of investment (lines 1, 2, and 3), consumption (line 4), civilian administration (line 9), and defense (line 11) add up to more than 100 percent in all years since 1970. This results from the fact that expenditures covered by "other" government expenses include, in the reconstruction of Soviet GNP in the West, only part of the Soviet defense expenditures. Western analysts believe that the amounts spent on defense but unaccounted for in "other" government expenses (line 10) are allocated and reported according to the Soviet practice in other categories, fixed investment, changes in inventory, R&D (where over half the expenditure is probably spent on military R&D), and consumption (military subsistence and pay). See Becker, 1969, Ch. 7; JEC 1982b, pp. 121-123. It is also possible that in the reconstruction some defense expenditures are left out of total GNP. Western analysts are not sure how to allocate the rest of defense among other uses and thus are also unable to reallocate them to defense. Therefore, there is no breakdown of Soviet GNP by end use with defense as one of its categories (CIA, 1983). The above implies that the shares of consumption (and household consumption) and of investment (especially R&D and inventories) are overstated by a few points for purposes of international comparisons. But this does not greatly affect any of the observations in the text.

^aIncluding changes in livestock.

^b— = not available.

^cR&D figures for the Soviet Union in 1928 and 1950 are included in the government budget. For other countries the figure is included in other categories.

^dFood excludes beverages and tobacco.

^eIn 1928 and 1950, includes defense expenditures as recorded in the budget—that is, only part of such outlays. In 1960-80, in addition to part of all defense expenditure the category may contain other (small) unspecified government expenditures.

^fFor 1928 and 1950 the data are official Soviet figures as recorded in the budget. The figure in parentheses for 1950 is from Becker, 1986, and includes, as do the figures for 1970 and 1980, all defense expenditures, some of which are recorded in the various investment categories (including inventories and R&D) and consumption. The defense share is recorded at factor cost, not in established prices as are the rest of the figures in the table. The bias created is small.

Increases in the cost of defense relative to economy-wide price rises have been more important and more pronounced since the early 1970s.⁶ These cost increases stem from the rising level of sophistication of the new weapon systems and from the difficulties encountered by the Soviet system in coping with them (Becker, 1986).

By all standards, the defense burden on the Soviet economy is especially high. As shown in Table 3 (line 11), it is at least three times higher (and often more than that) than for the group of industrial countries. It is also about three times higher than the defense burden of the United States. This exceptionally high defense share reflects both Soviet aspirations to achieve world-power status and sustain its position in the arms race, and the need to support this effort by a national product that is about half the size of its chief adversary. While the defense effort cannot be considered an integral part of a "socialist growth strategy" in an abstract sense, it clearly has a very strong influence on the realities of the Soviet growth pattern.⁷

Government administration and general government collective services, such as internal security, take up only 2-3 percent of GNP in current prices and do not require special attention. This figure may

⁶It is estimated that the price level of defense has been rising since 1970 at about 3 percent per year compared with a general price rise of about 2 percent (CIA, 1986, pp. 33, 35).

⁷The above discussion over the relative size of the Soviet defense effort represents the current estimates and views of what may be called the mainstream in the field, including the CIA, which, for obvious reasons, invests most of its resources in the investigation of this question. Comprehensive surveys on the methods of estimation and the nature of existing disagreements can be found in Becker, 1986; Kaufman, 1985; Burton, 1983; and Hanson, 1978a. The major method of estimating Soviet defense spending, the building-blocks method, starts from estimates of physical series of the production of weapons, employment of military personnel, and so on. These series are then valued and aggregated by estimates of their dollar costs in the United States. Finally, estimated ruble/dollar price ratios are employed to transform the dollar into ruble series. The problems and difficulties encountered at every step may explain why twice in one decade the CIA came out with major revisions of its own estimates. In 1973, the revision consisted mostly of near doubling the ruble cost of more or less unchanged dollar estimates of Soviet defense spending. In 1983, the revision involved scaling down the estimates of real rates of growth, mostly of weapons procurement. The major dissenting views are, on one side, those of Lee (1977a, 1977b, 1979b) and Rosefielde (1982), who consistently come up with higher estimates of Soviet defense spending, its growth rate, and its GNP shares (see also Birman, 1984). They claim that what the CIA considers cost increases are real increases in spending reflecting quality improvements. It follows that the differences in estimates of the defense shares in current prices are now relatively narrow. Dissents on the other side of the estimates are mainly by Holzman (1980, 1982), who questions the finding about rising relative costs of defense, in contrast with Gerschenkron's theory of declining costs of advanced products (1947), and also with claims of the relatively higher efficiency of defense production in the Soviet Union. All estimates, however, agree that the share of defense in the Soviet Union has been exceptionally high in comparison, and this is the main relevant point for the purpose of this survey.

appear far too low for a system that is the symbol of bureaucracy and internal security, but I believe it is of the right order of magnitude.⁸

The final claimant on GNP is *consumption*, whose share has declined over the years, in current prices, from 73 percent in 1928 to 64 percent in 1950 down to 55 percent in 1980. Consumption here includes household consumption financed by disposable income, and "communal services," chiefly education and health, provided almost entirely free of charge by the government.⁹

The share of consumption in GNP is lower in the Soviet Union than in most countries, typically by at least ten GNP points, which are taken up as seen above by investment and defense. The comparisons are presented in Table 3; some are for private consumption and others for household consumption only—that is, without communal services. The typical Western level of household consumption is 60–65 percent compared to the Soviet 50 percent, while the typical level for total private consumption is 65–71 percent compared to the Soviet 55 percent.¹⁰

Figures on the increase in consumption per capita and per worker are presented in Table 1, and international comparisons are made in Table 2. Growth rates of consumption and of its components are presented at factor cost and at established prices. Factor costs are consistent with the GNP series; and established prices, paid by consumers, better represent changes in welfare. During 1928–40 consumption per capita rose by only 1.4 percent, but the entire rise is credited to communal services. Household consumption per capita actually declined (Table 1, lines 18–20). During those years the Soviet regime was engaged in rapid expansion both of medical services and of the educational system, an intensive effort of investment in human capital alongside that in material capital. The combined volume of these two services quadrupled in 1928–40 (line 18). The fact that household consumption per capita declined somewhat over that period is an extreme manifestation of Stalin's industrialization policies. After 1950,

⁸I tried to check this point (Ofer, 1973, Chs. 3–4) and received a dissenting rejoinder (Schroeder, 1976). I stand by my conclusion that labor and money resources devoted to civilian public administration are, at least, not strikingly large even by the standards of market economies. Some support for this claim is presented in Table 3 (lines 7, 8) where "normal" shares for government services, with communal services, are only slightly excessive in the Soviet Union, considering that they include the bulk of the large defense outlays. See also Schroeder and Pitzer, 1983; and Bahry, 1983.

⁹The rate of decline shown here may be slightly exaggerated because estimates for earlier years (Chapman, 1963; Bergson, 1961) may be slightly upward biased according to more recent methodology.

¹⁰Similar comparisons and results are presented by Schroeder and Edwards, 1981, p. 26; Bergson, 1983c, pp. 205–206; and Pitzer, 1982, p. 22.

consumption per capita was allowed to grow more rapidly for almost three decades, creating a real revolution in the Soviet standard of living, one that goes beyond the quantitative rise. The estimates do not capture the improved consumption environment and the variety and quality of goods and services that together brought a radical change in the quality of life in the Soviet Union; however, it should be borne in mind that this started from very low initial levels. Growth of consumption per capita has tapered off recently, following the trends in GNP, reaching the very low annual rate of about 1 percent. The apparent contradiction between increasing consumption levels on the one hand and declining consumption shares in GNP on the other reflects a decline in the relative prices of household consumption (primarily the result of reducing sales taxes and raising subsidies) and the fact that the growth rate of consumption over most of the period, even after World War II, was kept below that of GNP (Table 1).

All along, except for one interval, consumption per worker rose more slowly, and household consumption per worker even declined substantially in 1928-40 (Table 1, lines 17 and 4). While GNP per worker measures productivity, consumption per worker is a better measure of overall consumer welfare than consumption per capita because it also takes account of the amount of work effort or leisure forgone.

Soviet growth rates of household consumption per capita for 1950-80 are somewhat higher than the E-OECD average for the same period and than those of IMEs for 1960-80. Soviet rates are equal to the other groups of countries (Table 2, line 12). E-OECD rates per worker are, however, equal to or higher than Soviet rates (lines 13 and 14), whether the former are presented per labor force member or per worker. In both comparisons the U.S. rates are lower. At least six OECD members, and possibly 14, have higher per capita rates, and more countries have higher rates per employed person (OECD, 1982).¹¹ The welfare implications of unemployment aside, the Soviet citizen seems to be catching up with his Western counterpart very slowly, if at all.

The smaller and declining share of consumption in Soviet GNP brought about a situation in which the relative level of consumption of the average Soviet citizen, when compared across countries, is lower than that of GNP per capita. According to Schroeder and Edwards (1981, p. 19), Soviet per capita consumption level in 1976 is just above one-third of that in the United States compared with 45 percent of GNP per capita, and 36 percent of GNP per employed person (p. 26).

¹¹Similar evidence is presented by Bergson, 1983c, Schroeder and Edwards, 1981, and Schroeder, 1982.

The actual figure for the Soviet citizen is bound to be even lower, because the comparison necessarily fails to take into account the limited variety and choice of goods, the effort that must be invested in shopping, the lines, the perennial shortages, the lower level of retail trade services, and possibly the unaccounted for lower quality of many goods and services (Bergson, 1983c; Schroeder and Edwards, 1981; Schroeder, 1982). Birman (1983), in a criticism of Schroeder and Edwards' paper, estimates Soviet per capita consumption at only 22 percent of the U.S. level. This is probably much too low, but some of Birman's points are valid and are mentioned above. One additional point is that when comparing consumption of retail goods in the Soviet Union and the United States, the huge differences in the quality of retail services are disregarded (Birman, 1983). This difference means extra time pressure on the Soviet consumer, who must spend many nonwork hours attempting to obtain retail services.

SECTOR OF ORIGIN AND URBANIZATION

More than 50 years after the initial industrialization drive, the Soviet Union still lags behind the West in some of the main characteristics of structural change. Comparative data are presented in Table 4. The level of urbanization was 63 percent in 1980 compared with a C&S "norm" of 70 percent for its level of development, and an average of 78 percent for E-OECD countries. The gap is actually even wider, because within the Soviet Union very few places are defined as rural unless they are either collective or state farms, whereas in most other countries many small nonagricultural locations are classified as rural. Correspondingly, more than a quarter of the persons employed in the Soviet Union (in 1980) still worked in agriculture, compared with the "normal" figure of about 15 percent, and 20 percent of the Soviet GNP is still derived from agriculture, compared with "norms" of 4-12 percent.¹² On the urban side of the industrial structure there is, first, a deficiency in labor and GNP shares of the service sectors, in each case by 10-15 points, and only normal shares (not higher) for the M sector including manufacturing, mining, and construction. Here, too, the figures in the table are not exactly comparable, and make the Soviet Union seem closer to "normal" than it really is.¹³ The word *only* is used

¹²GNP shares should be compared across countries in current prices, so the following refers to lines 5-8 in Table 4. Labor force shares are compared in lines 1-4.

¹³In the C&S data, mining and quarrying are included in the A sector, and the Soviet labor series are for full-time annual equivalents, which usually reduces the estimate for agriculture.

Table 4
INDUSTRIAL STRUCTURE BY SECTOR OF ORIGIN AND URBANIZATION

Employment Shares	A. Shares in Labor Force and GNP (percentage)									
	Soviet Union				E-OECD					
	1926	1940	1950	1970	1980	1950	1980	1950	1980	
1. Agriculture	71	54	54	32	26	38	16	29	15	
2. Manufacturing	14	23	23	34	35	25	34	37	36	
3. Services	15	23	22	34	37	37	50	34	50	
4. A / (A + M)	84	70	70	48	43	60	32	44	29	
GNP (Current Prices) ^a										
5. Agriculture	—	29	31	21	20	18	9	15	4	
6. Manufacturing	—	34	31	39	41	31	36	34	39	
7. Services	—	37	38	40	40	50	54	51	57	
8. A / (A + M)	—	46	50	35	33	37	20	31	9	
Urbanization (percentage of population)	18	33	39	56	63	55	70	—	78	
B. Changes Over Time (percentage points)										
Employment Shares	Soviet Union				C&S				E-OECD	
	1928-80		1950-80		1928-80		1950-80		1960-80	
	1928-80	1950-80	1950-70	Range	1928-80	1950-80	1950-80	1960-80	1960-80	1960-80
9. Agriculture	-45	-28	-22	-55	-33	-22	-22	-14	-14	-14
10. Manufacturing	21	12	11	24	13	11	11	-1	-1	-1
11. Services	22	15	12	28	20	13	13	16	16	16
12. A / (A + M)	-41	-27	-22	-56	-38	-28	-28	-15	-15	-15
GNP (Current Prices) ^a										
13. Agriculture	—	-11	-10	-43	-17	-9	-9	-11	-11	-11
14. Manufacturing	—	10	8	23	11	5	5	5	5	5
15. Services	—	2	2	18	5	4	4	6	6	6
16. A / (A + M)	—	-17	-15	-60	-31	-17	-17	-22	-22	-22
Urbanization	45	24	17	57	26	20	20	—	—	—

Table 4—continued

SOURCES: Soviet Union: Labor shares, 1926, 1940—Ofer, 1973, Table E-1, p. 187; 1950-83—Repawy, 1985, Tables 1, 4, pp. 1, 8. Product shares, 1937, 1950—Kaplan, 1969, Table A-6.1, p. 123; 1960-80—in current prices; 1950-80—CIA, 1983, Table 10, p. 10. Urbanization levels, Narkhoz—various years. Other countries: C&S, Chenery and Syrquin, 1975, Table 3, pp. 20-21; E-OECD and United States, OECD, 1982, various tables.

NOTE: Here, too, as in earlier tables, data for the period up to 1950 are not fully consistent with later data. The definition of the sectors is as in Table 1. "1950" and "980" under C&S stand for GNP per capita values of approximately \$600 and \$1,500 of 1965. The "range" in Part B of the table stands for changes from a level of GNP per capita of about \$70-\$1,500. "1928-80" covers the income range of \$300-\$1500. In each case the dates attached correspond to the approximate time when Soviet GNP per capita was at the corresponding level. Data for E-OECD are based on GDP and represent the structure of the sum of the entire group of countries.

^aData for 1940 are for 1937. Data for GNP in current prices for 1950 are in 1955 prices. The bias created must be very small.

above in referring to the M shares because one would expect to find high levels of activity in that sector in the Soviet Union. The lower than normal service shares stem from, among other things, a persistent Marxist-doctrinal bias against service activities. Most services to people, including government administration, are considered "nonproductive."

When the emphasis is shifted from the Soviet economy today to comparisons of changes over time, one finds that by and large the Soviet Union has followed a normal pattern of change, and indeed quite rapidly (Table 4b). Between 1928 and 1980, and even since 1950, most changes are equal to or larger than those called for by estimates derived from the C&S equations. This is even true with respect to labor and product shares. On this basis Kuznets and others judged the changes to be normal in direction and *intensive* in pace (Kuznets, 1963, pp. 345-347; Millar, 1981).

How can one reconcile this apparent contradiction between a normal pattern of structural shifts and a biased structure still in effect in 1980? There are several possible explanations. First, it has been shown that in 1928 the industrial structure of the Soviet economy was already tilted in the same direction as it is today, but much more so (Ofer, 1973, 1976, 1977, 1980c). In fact the industrial distribution of the labor force in 1928 resembled the one shown by C&S for countries with a per capita income of \$70, not \$300, as was estimated for the Soviet Union. This finding may explain the different Soviet structure by long-range historical factors, or simply because the USSR needs more time to catch up. Both explanations are partly valid, but they cannot explain the entire gap. Based on comparative analysis with a more limited group of countries, I have shown that even when the historical legacy is taken into account, until the mid-1960s structural changes in the Soviet Union were not as rapid as has been typical elsewhere: Urbanization levels, the decline in the A labor share, and the rise in the S labor share were all below the norm. It was claimed that the biased structure and the slow changes reflected two major strategic development decisions: first, to go with the smallest possible increase in consumption levels, including minimum development of agriculture and services, and second, to concentrate most investment resources in industrial growth while limiting them in all other sectors including agriculture, urban infrastructure, services, and even transportation. Such a strategy implies slower urban growth, less than normal rural-to-urban migration, higher than normal labor-to-capital ratios in agriculture and services, and higher ratios in manufacturing. Because technology and productivity are at least partly embodied in capital, it

also follows that both the A and the S sectors lag in productivity relative to the M sector.¹⁴

Since the mid-1960s structural changes accelerated and moved closer to normal patterns. This is especially true of urbanization and of the labor share in agriculture, but also, to some extent, of services. The main causes of this change were labor shortages, especially in manufacturing and related branches and the shift to more favorable policies toward agriculture. The more tolerant attitude toward the growth of consumption also contributed to this result.

EXTERNAL ECONOMIC RELATIONS

Foreign trade and aid, and the movement of people, capital, and technology have played important roles in the theory and viability of economic development everywhere. External economic relations strongly affect both the rate of growth and the pattern of the accompanying structural changes. Have Soviet external relations, like other aspects of Soviet industrialization, been atypical? And if so, what are the growth and structural implications?

Several difficulties arise in comparing the Soviet Union's external economic relations with typical patterns of modern economic growth. First, there is no single unique pattern for all countries, but a variety of patterns depending on the strategy chosen (e.g., export lead or import substitution), the time, and world conditions (Kuznets, 1966, Chs. 6, 10; Chenery and Syrquin, 1975, Chs. 4 and 6). Second, on the Soviet side there is its large size and abundance of most raw materials that make it almost *sui generis*. In addition to the above objective problems, there is also the difficulty in interpreting official Soviet trade statistics: Soviet trade is conducted by the Ministry of Foreign Trade, which has been until very recently virtually the sole Soviet trader in foreign markets. Internally, the Ministry buys and sells at domestic prices, but trade is conducted in international transferable rubles, reflecting prices related to world prices, but different from domestic prices (Trembl, 1980; Trembl and Kostinsky, 1982). This obscures the volume of trade relative to the size of the economy and its economic

¹⁴This can be seen from the changes in the implied sectoral relative prices computed from GNP shares in current and constant prices. Between 1950 and 1980 relative A prices (to GNP) increased 38 percent, relative M prices declined 24 percent, and relative S prices rose 52 percent—based on data on the distribution of GNP by sector of origin in current (established), and constant, 1970 prices in CIA, 1983, Table 10, p. 10. These relative price changes may also reflect government policy in raising A prices and resisting raising M prices even when such changes were warranted.

effect. Lack of official data on trade in services and on the capital account adds to such difficulties.

As a rule, large countries engage less in international trade, which also has a smaller effect on their internal economic structure. In spite of this, Soviet external economic relations have attracted much attention in Western literature for two reasons. First, there is the natural interest of other countries as potential partners or competitors. Second, there is interest in the theoretical and empirical aspects of the conduct of trade by a centrally planned system, its internal and external effects, and how trade is conducted when internal prices are so extremely remote from world prices. In view of the limited effects of trade on large economies, this survey will restrict itself to a brief discussion of the main issues. (Some recent surveys of the literature are Holzman, 1974, 1976; Hewett, 1982; Goldman, 1975; Dohan, 1979.)

Autarky

Compared with many other countries, even with pre-Revolutionary Russia, the Soviet Union has received a very small amount of external economic aid. There was very little private inflow of capital during the early 1930s, and with the exception of lend-lease during World War II and forced transfers of resources from East Germany and Eastern Europe thereafter, there was very little government-to-government aid. Growth was self-financed all the way, mainly through compulsory saving.

Second, no matter how it is estimated, the volume of Soviet trade up to the mid-1950s was below reasonable international standards, and also below trade levels achieved during the Tsarist era. Holzman (1963, p. 290) estimated the share of exports in national income at 10.4 percent in 1913, 3.1 percent in 1929, 0.5 percent in 1937, and 2 percent in 1955. These figures, since 1929, are small enough to justify the claim of autarky even for a country the size of the Soviet Union. But since 1946 Soviet trade figures have been growing very rapidly in real terms—13 percent annually in the 1950s, 8 percent in the 1960s, and 9 percent in the 1970s—thus constituting a rapidly increasing proportion of GNP. Soviet trade shares were estimated by Treml (1980), following necessary price adjustments.

An attempt to compare Soviet trade shares with "normal" patterns is made with the help of the C&S equations. After an adjustment of the C&S estimates for GNP size, and taking into account the secular rise in world trade since 1965 (the base year for the equations), and on the basis of Treml's estimates with some adjustments, I estimate that in 1965 the Soviet trade ratios (imports *plus* exports *divided* by GNP)

were about one-third below the "norm," and that by 1980 they had probably caught up and closed the gap. It is possible that by 1980 Soviet commodity trade reached 15-20 percent of GNP (based on Trembl, 1980), which may be similar to the U.S. ratio (The World Bank, *WDR*, 1984, p. 227).¹⁵

The expansion of trade after World War II was first concentrated in trade with the newly established socialist regimes in Eastern Europe, but since the mid-1950s trade with Third World countries and then also with the developed West began growing rapidly. Autarky, in the sense of trade proportions, was thus part of Soviet policy only up to World War II or shortly thereafter. It was partly the Soviet Union's large size, partly the concentration of trade within Eastern Europe, and partly—perhaps most important—the way it conducted trade (the isolation of the economy from world market prices and from external connections, and inconvertibility of the ruble) that helped sustain the autarky claim or image (Holzman, 1974). The quite rapid development of trade shares by the much smaller Eastern European socialist countries further contributed to weaken the assumed close association between autarky and the socialist system (Holzman, 1974, 1976).

The structure of Soviet trade is shaped by the Soviet Union's growth strategy, its natural endowment, and its choice of partners. Here, too, size vitiates simple comparisons. The evolution of the structure of Soviet trade differs in at least three ways from the patterns in other countries trading along the same development road. First, the balance of trade in agricultural products turned negative rather early, in 1958. By the 1970s, it was 18 percent in favor of imports with almost no exports.¹⁶ The change is much more extreme than for OECD countries, which today still have a balanced trade in agricultural products. The contrast is especially marked in view of the traditional position of Russia as a large exporter of such goods.

Second, the Soviet Union developed a large export capacity of nonagricultural raw materials and other natural resources, including oil

¹⁵Trembl's figure for commodity trade as a percentage of Soviet national income, both in domestic established prices, is 14.9 for 1970 and 21.1 for 1976. Since 1976 it has grown further as trade has been expanding faster than national income. An adjustment of the denominator from "national income," Soviet definition, to Western-type GNP reduces the Soviet trade proportion 10-20 percent (Bergson, 1980, p. 207). In his comment on Trembl's paper, Bergson (1980) raises some other issues, most of them about the proper prices that should be used, that may reduce the Soviet trade proportion even further. Hewett (1983, pp. 274-276) also questions Trembl's figures, first, because he doubts the correctness of the prices used, and second, because he believes that Soviet imports in domestic prices contain a high proportion of tariffs that must be eliminated. See also Trembl and Kostinsky, 1982.

¹⁶The percentages here and below are for net flows of exports *minus* imports as percent of total exports.

and gas. From a negative balance until World War II, the Soviet Union moved to a positive balance of about 20 percent since the early 1960s. During the late 1970 and early 1980s more than half of Soviet exports belonged to raw materials. Most industrial countries have a negative balance in raw materials (the United States has a 20 percent negative balance).

In terms of all primary products combined, agricultural and nonagricultural, the Soviet Union has developed in a peculiar cycle: Starting with an export surplus based on agriculture, it reached a balance in the 1930s and 1950s, and then, in the 1960s, developed a large surplus based on raw materials. This surplus has been declining lately owing to a rise in Soviet dependence on food imports, and not to a decline in the export of new materials. The Soviet Union still maintains a small export surplus of primary products, whereas most industrial countries run a large import surplus. OECD had a 20 percent net primary import surplus in 1980. According to Chenery and Syrquin (1975), the exports of a country like the Soviet Union should be made up of 30 percent primary goods and 70 percent industrial goods; the actual Soviet proportions are almost the reverse. Data on trade presented here do not include trade in arms, data not reported by the Soviet Union. With arms the proportions of both imports and exports should be higher and the export deficit somewhat lower.

This leads to the final point: With rapid industrial growth the Soviet Union would have been expected to be a large net exporter of machinery and equipment. It is, however, a large net importer of machinery, with a deficit of over 20 percent in the late 1970s and early 1980s (CIA, HB, 1985, pp. 97-98, Tables 62, 63), in contrast with most industrial countries, which are net exporters of machinery and equipment. (Most of the data in this paragraph are from Holzman, 1963; Treml, 1980; Hewett, 1983; The World Bank, WDR, 1984; OECD, 1983; and Bornstein, 1985.)

Most of the features of Soviet trade structure are explained in the literature by its broad comparative advantage. The Soviet Union and other socialist countries rapidly developed a relative disadvantage in food production and a regional food deficit. This comparative disadvantage resulted from the socialist industrialization strategy including the neglect of agriculture (Ofer, 1976, 1980a; Goldman, 1983, Chs. 3, 4). The Soviet Union's harsh climatic conditions are also seen as a justification (Ambroziak and Carey, 1982). The Soviet comparative advantage in raw materials and, lately, in energy products, is based first of all on the availability of resources, but possibly also on the mode of production such as high capital intensity, only moderately advanced technological sophistication, and large-scale production, all in line with

Soviet systemic tendencies. Finally, and most important, the Soviet failure to reach Western technological frontiers in many sectors prevented it from shifting its export structure in the direction of machinery and equipment (M&E). The same applies to consumer goods with the added reason that it is also a low-priority sector. The Soviet Union exports M&E mainly to its East European fellow-members in Comecon and to Third World countries and imports more advanced technology from the West, and from advanced Comecon countries. The opening up of trade with the West has been motivated by Soviet Bloc demand for agricultural products and high-technology M&E. For this reason the structure of Soviet trade with the developed West is even more tilted than total Soviet trade in the directions described above (Bornstein, 1985, Ch. 5).

Technology Transfer

The most studied and discussed aspect of Soviet trade in recent years is the effect of technology transfers (TT) from the West to the Soviet Union. TT from advanced countries is considered to be the major latecomer's advantage (the advantage of being backward; see Gerschenkron, 1962, Ch. 2; Maddison, 1982) derived from external economic relations. It serves the dual purpose of raising the technological level of current production and providing the basis for the development of an indigenous R&D sector capable of eventually taking over. For reasons discussed later, the Soviet indigenous R&D capability has not developed to a level that would put it on a par with advanced countries; and partly for this reason, Soviet dependence on Western technology has been prolonged to the present and is expected to continue into the future.

With the very important exception of the early 1930s, lend-lease during World War II, and the massive importation of German technology after the war, most of the TT to the Soviet Union until the early 1960s was obtained by "reverse engineering" of individual pieces of equipment acquired and by the collection of relevant information. This strategy is inexpensive in terms of foreign currency but very costly in terms of domestic resources. It was only under Khrushchev that TT took the form of importing large quantities of equipment and entire plants, some under turnkey arrangements and other forms of transfer (such as patents, licensing, and training agreements; Bornstein, 1985, Ch. 3).¹⁷ Even so, direct Western investments had not been permitted

¹⁷One of the most innovative of Gorbachev's reforms is in opening up possible joint Western-Soviet ventures in the Soviet Union. Rules and details are now being worked out.

until very recently, and both the prolonged presence of Western experts in the Soviet Union and the training of Soviet scientists and technicians abroad are restricted.¹⁸

Difficulties in incorporating Western technology into the Soviet production system and the failure to use it as a catalyst for domestic R&D activity are among the explanations for the decline in imports of technology after 1977 and contributed to what Hanson dubbed "the end of import-led growth" (1982a). As things stand now, there seems to be no better alternative and one should expect Soviet effort to resume such imports when conditions prove favorable.¹⁹

Benefits from Trade

Even though the broad structure of Soviet trade is consistent with the principle of comparative advantage, opinions still differ on the extent to which (a) Soviet trade really conforms to this principle—whether (given distorted internal prices) Soviet planners can guide their trade along these lines in the first place—and (b) the actual outcome exploits the full potential of benefits from trade.

Rosefielde (1973, 1974, 1977, 1981) believes that the Soviet Union can overcome price calculation problems and can lead trade according to what he calls "fundamental comparative advantage," which goes most of the way toward full comparative advantage. Other students are more skeptical. In fact, the inability to calculate correct prices is presented as a major cause of the Soviet tendency toward autarky (Holzman, 1974, pp. 139–141; Hewett, 1974; McMillan, 1973, 1974; see

¹⁸Many attempts have been made to quantitatively estimate the benefits to the Soviet Union from technology imports from the West. One factor that limits potential gains is, again, the large size of the Soviet economy. Any reasonable amount of credit or equipment can provide only a small proportion of total Soviet investment in new equipment. For example, at its peak, in 1975–77, imports of Western M&E came to no more than 6–7 percent of Soviet domestic investment in M&E (Hanson, 1982a, p. 136). Attempts to estimate the effect of such imports using production function analysis and other methods arrived at conflicting results, ranging from an estimate that Western equipment may be more than ten times as productive as domestic M&E (Green and Levine, 1977; Green, 1979) to ones that showed no differential effect (Weitzman, 1979; Toda, 1979). Hanson, following Gomulka (1977; and Gomulka and Sylwestrowicz, 1976), offers an upper-limit estimate of the contribution of imported M&E from the West at 0.5 percent growth of industrial production, which, he claims, while modest, "is not to be sneezed at" (Hanson, 1981, Ch. 9). Half of 1 percent of industry probably translates into one-quarter of 1 percent of GNP. But considering that total factor productivity, including in Soviet industry, was recently estimated to be negative, such imports may deserve more than a nonsneeze.

¹⁹Recent surveys and analyses of technological transfer are Hanson, 1981, and his 1976, 1978b, 1982a, 1982b papers; Gomulka and Nove, 1984; Bornstein, 1985; see also Holliday, 1979; Campbell and Marer, 1974; Hewett, 1975; Holliday 1982, 1984. See also the discussion on technological change below.

also Gardener, 1979; Holzman, 1976, Ch. 3; Marrese and Vanous, 1983; Wolf et al., 1983). Whether or not calculation of correct prices is feasible, the virtual insulation of producers and users from the direct influence of world prices is a source of long-term economic inefficiency and, in essence, an autarkic element, the actual trade volume notwithstanding.

In his study of technology transfer to the Soviet Union, Hanson (1981, pp. 138-139) suggests that in such a large country as the Soviet Union, where imports of technology from the West cannot constitute more than a modest proportion of total investment in equipment, it is fairly simple to identify the spheres of greatest need. This argument may be extended to trade to indicate that although big mistakes may not be made, many small ones are highly probable. This suggests that while the Soviet Union does indeed benefit from trade, at least from trade with the nonsocialist world (Hewett 1983; Jacobs, 1978), such benefits must be to some degree limited. The major forgone benefit, however, is the isolation of the domestic economy from the competitive pressures of world markets.

V. THE SOCIALIST SYSTEM AND ITS GROWTH STRATEGY

The growth record and patterns described here were shaped by an economic-political system and a growth strategy usually called socialist. This section surveys, in the light of relevant Western writings, the central features of that system and strategy, and relates them to the growth record and patterns mentioned.

THE OBJECTIVE FUNCTION AND CATCHING UP

An underlying driving force has been the desire to catch up rapidly with the West, even to "overtake and surpass" it. Berliner (1966, p. 161) quotes Stalin's famous call in 1931: "We are fifty or a hundred years behind the advanced countries. We must make good the distance in ten years. Either we do it or they crush us." Since then, similar pronouncements have frequently been made, and in 1961 the goal of surpassing the USA within the "current decade" (1961-70) was officially incorporated into the Communist party program by Khrushchev and remained there until the recent revision, when it was replaced by more general language (Communist Party of the Soviet Union, 1961, p. 512; 1985, p. 9; Grossman, 1962).

This powerful drive is, first, a manifestation of the tension that builds up in a follower country between the distance it has to travel to reach economic modernization and the adverse internal conditions that constrain its growth potential (Gerschenkron, 1962, Chs. 1, 2 and postscript). Second, catching up is the expected outcome of the introduction of the more efficient, so it is claimed, socialist system. Finally, there is a combination of the Soviet fear of outside threat and the Soviet and Russian national aspiration to become a leading world power. In each of the three motivations there is a strong element of competition and conflict between the two economic systems and powers. These three forces clearly interact. Specifically, a case has been made that Marxism took root in Russian intellectual and revolutionary circles because it was seen as an inspirational and operational vehicle toward modernization (Gerschenkron, 1971). The particular shape of socialist economic and political models, with many elements actually developed and shaped in Russia, conforms to its economic, political, and national aspirations and reflects the haste syndrome.

According to Gerschenkron, the tension that builds up in follower countries is translated into more radical institutional arrangements and more drastic means than those utilized in countries that started MEG earlier. While early starters could leave growth initiatives in the hands of private entrepreneurs, late starters needed strong government intervention and direction (Gerschenkron, 1971).

Haste, impatience, and radical action translate into a high time preference, a high discount rate for future benefits for the sake of short-term achievements. This observation is, however, the diametrical opposite of another image of the Soviet economy, one usually associated with a high rate of investment, distant horizons, low time preferences, and low discount rates of future benefits. This contradiction can be resolved by observing that the objective function of the Soviet leadership, the maximand for growth, differs from what is usually assumed in MEG models. High investment rates represent low time preferences when the goal is to maximize consumption and the welfare of the population in the long run. The Soviets first learned of a model of this kind in Marx's "expanded reproduction" and developed their own versions early on in the industrialization debate and the preparations of the first Five Year Plan (FYP) in the 1920s. Domar, 1957, describes a model prepared by Feldman in 1928; see also Erlich, 1960. The early FYPs included both extraordinarily high rates of investment *and* high rates of consumption growth, the latter being more of a sop to public expectations than a realistic goal. Since the early FYPs, the imposed sacrifices in consumption have been consistently justified by the promise of abundance in the future and have been viewed as an example of a prudent and farsighted strategy to which many other countries were not equal. It has been felt that if it takes "stronger" measures to restrain the impatient consumption-hungry population, this should be understood and tolerated.

In 60 years, consumption levels, though substantially higher, have not become a high priority goal, and the share of consumption in total production is still low. Thus some competing, shorter-term goals were placed higher up in the objective function of the system. Much earlier the Soviet leadership satisfied its goal of becoming a world power, militarily and politically, and of projecting this power far beyond its borders. Internally, the leadership secured its power and hold over the country so as to become one of the most stable regimes on earth. Revealed preference demonstrates that the above "composite good" was a goal in itself. If so, the growth strategy becomes much more consistent, achievements were secured early, the horizons are much nearer, and the instruments used more rational. The need to concentrate on defense and heavy industry during the 1930s was justified at the time,

and obviously later, by the vital need to prepare for a German invasion. The above citation from Stalin and other pronouncements are evidence of Stalin's foresight. That threat and later exogenous pressures on the Soviet Union to build up its military strength also partly determine the Soviets' chosen goals.

An extreme view is that the maximand is internal and external power building, and that its translation into economic terms is the maximization of the growth rate of heavy industry and defense production capacity. The final use of much of the product of heavy industry, as well as its own expansion, consists of investment goods; therefore high rates of investment become part of the goal rather than just the means to achieve it. Consumption, on this line, becomes a constraint, an intermediate cost of production to be economized. It should be kept at the minimum level feasible to assure internal stability, and at some level of acceptable work incentives (see Wolf's comments in Hildebrandt, 1985a, pp. 141-148). These last two minima were termed by Berliner (1983a, p. 43) "the political and incentive thresholds of minimum consumption."

This extreme view need not be fully accepted, and is probably not entirely true. First, it is claimed that consumption or welfare belongs in the maximand, at least as part of the Soviet effort to project the superior nature of the socialist system, and help it win new adherents. Second, it is difficult to explain the drastic changes in consumption trends following Stalin's death on the basis of the above. Also, since that period there has been a shift from (mostly) repression to a more mixed bag of "carrot and stick," of repression combined with rising living standards, to stimulate effort. Finally, the repeated official pronouncements on raising the population's welfare as an independent goal cannot be discarded as mere propaganda. The best judgment may be that the welfare of the population takes an intermediate position, being both a constraint and a weak competitor in a crowded objective function.¹

Whether the extreme or more moderate view on the objective function is accepted, all the comparisons of the previous section are off the mark from the Soviet point of view. It is not GNP or consumption or welfare per capita that should be compared but levels and rates of growth of total GNP *less* consumption. And if consumption is taken as an input and the stock of capital as part of the maximand, total factor

¹This is not far from Berliner's formulation: "But if we are to capture faithfully the aims of the Soviet elite then we must accord first place to military defense, and derivatively to heavy industry, as the aim of economic development. This assumption does not compel us to deny that in some ultimate sense material affluence is also their goal" (1966, p. 162).

productivity should be measured as total investment *plus* defense per unit of consumption and other inputs. No calculations are needed to show that Soviet achievements, at least until recently, are far more impressive if measured in this way. They would be even more so if expenditures on human capital, most education, and health care services were reclassified as investment.

When investment growth and power building become goals, the apparent contradiction about time preferences also clears itself up. Such goals are fully consistent with haste, high rates of time preference, and short horizons. One manifestation of high rates of time preference is the readiness to borrow at high rates of interest. With very limited opportunities to borrow abroad, "borrowing" was mostly from the future, in two major forms: first, heavy commitment of resources to present growth at the cost of exceptionally high losses of such resources in the future. This form can be looked on as *high depletion rates*, though, as is made clear later, the term is extended beyond its ordinary use. The second form is the postponement of investments with lower yields, mostly in infrastructure, causing much higher current operating costs. The eventual need in the future to make up for postponed investments can be considered repayment of principal on the loans, and the higher operating costs, and excess "depletion" costs as interest payments. Both restrict the potential of future growth. Many specific examples are mentioned in the following pages.

Trading future growth for present growth may or may not be profitable, depending on the relation between the "interest" actually paid and the rate of time preference. Whatever the case, such a policy of haste becomes an additional factor to those usually mentioned in the literature explaining the recent sharp decline in growth rates, or a factor underlying some of the usual explanations.

The following discussion on the main elements of the system and its growth strategy pays special attention to elements of high time preference and haste.

THE SYSTEM AND ITS OPERATION²

The overriding feature of the Soviet economic system is the combination of state ownership of most means of production and of the central planning of production and distribution. Since 1928, the Five Year Plan has been the main instrument of strategic development and the

²The literature describing the Soviet system is very extensive. To mention only a few: Levine, 1959; Montias, 1959; Bergson, 1964; Nove, 1977, 1980, 1983, part 2; Ellman, 1971; Kornai, 1980; Hare, 1982; Berliner, 1957, 1976; and Wiles, 1962.

annual plan its short-term operational translation. Ideally, in such a centralized system the essence of Soviet socialism aspires to have full and sole control over the entire economy; it should be able to define clear targets and to emphasize their implementation. In principle, less time should be lost on deliberations and decisionmaking, and less must be spent on gaining political and popular consent and on secondary missions. To assure that directives are obeyed and that the population accepts the decisions on the allocation of resources, a political dictatorship ("of the proletariat") is established, with strong ideological and disciplinary authority and apparatus to complement the command economy. The advantages of this system are obvious considering its goals. The main disadvantages, many Western observers believe, are that command replaces initiative and entrepreneurship, discipline replaces motivation, and a rigid bureaucratic organization replaces the more flexible market. In many cases the decisionmaking process gets bogged down in a labyrinth of commissions.

Every shortcoming usually attributed to a bureaucratic organization is found here—and in the Soviet Union the bureaucracy encompasses the entire production sector. If the decisions are right and the structure of incentives reasonable, this kind of system can move ahead rapidly. But mistakes, when made, are also huge and more difficult to correct. The system is at its best immediately after a course is set; it is much weaker later on, when changes in course are required.

The three major elements of the centrally planned system are as follows: (a) production plans are very ambitious—the jargon uses the term *taut*; (b) the main success indicator and the basis for the incentive and reward system are the fulfillment of the annual plan's output targets; and (c) priorities are set for which targets to aim at first when difficulties arise. The most important time horizon for all the above is one year, which should be included as the fourth major element of the system. One year is a reasonable length of time for routine production plans, but it is much too short for any important change (organizational or technological) involving disruption of routine performance, especially if the targets for routine production are exacting.

The plans are taut first because of the need to move ahead rapidly. The pressure of the political leaders on planners has been constant since the days of the first FYP. Tautness also aims at stimulating effort and extracting better results at all levels of the command hierarchy and is an important instrument of control and discipline. Because plans encompass the entire economy, *priorities* must be established to fulfill the plans of important sectors first. In this way the low priority sectors become substitutes for the absent reserves or slack in the plan. The *incentive* system must primarily reward the meeting of output

targets because they are usually inputs in plans of other enterprises—the most critical links of the plan. Indirect signaling, using prices or profits, can rarely be used as substitutes, chiefly because prices are seldom scarcity prices; thus profits do not mean much. Finally, it is difficult to extend the basic annual planning period, because this would reduce control, especially in production and supply. All the elements combined create a permanent seller's-market environment, an economy of constant shortage, where most efforts are directed at receiving inputs and very little to selling (Kornai, 1980, 1986). The salesman and the market expert of a market economy are replaced by the *tol-kach*, the “expediter,” whose (officially nonexistent) job is to see that supplies arrive on time. Shortages and uncertainty of supply encourage “intraenterprise autarky” (Kontorovich, 1985a) as a substitute. Enterprises hoard inputs and establish auxiliary departments to produce spare parts, and in extreme cases even produce food for their workers.

Emphasis on fulfillment of output targets comes at the expense of most other efficiency criteria and leads to a phenomenon termed by Kornai the “soft budget constraint” (1980, 1986). To assure fulfillment, plants are ultimately allowed to use more inputs and labor and to disregard costs. Almost by definition, enterprises cannot fail and can count on being bailed out by the authorities when in trouble. It is easy to see that the soft budget constraint is a major source of inefficiency and also severely aggravates the conditions of shortage.

Another feature and consequence of the system of central planning is the strong bias toward short-term goals to the detriment of long-term results and gains. In general, all inputs at the disposal of the management that under normal conditions would be employed in tasks relevant to longer horizons are diverted to short-horizon tasks. The main consequence is very slow and inefficient innovation and diffusion. But this bias affects all changes in the production routine, from such simple matters as changing the supplier of inputs to changing the product mix, stopping production for major repairs, or maintaining a decent system of quality control. Short-term considerations are very costly, such as when equipment is not properly maintained; when oil is pumped out too fast, so that penetrating water damages next year's pumping potential (Goldman, 1980, pp. 173–178); when summer fallow areas are sown beyond optimal levels to acquire small short-term gains in grain output (Johnson, 1983, pp. 133–134); and similar phenomena in investment allocation. All the above show a strong tendency to borrow from future production potential.

Finally there is the issue of the tradeoff between efficiency and equality under socialism.³ In principle, remuneration for work in the Soviet Union is according to work performed, which leaves room for

³The discussion follows Bergson (1984) on this issue.

substantial wage differentials. Wide differentials indeed existed under Stalin and up to the late 1950s, but they have been narrowed down substantially since then, mainly because of the dramatic expansion of the educational system. Add to this the almost complete elimination of nonlabor incomes, and one would expect to find an income distribution that is substantially more equal than in market economies. Bergson demonstrated that the distribution of wages is not substantially more equal than in many market economies and that incomes are distributed only slightly more equally by similar comparisons. To the extent that equality hinders efficiency in the Soviet Union, it may be the result either of the inefficient use of wage differentials or of the denial of the opportunity to accumulate private wealth and to use it productively. The first problem, if it exists, can in principle be attended to. The second is at the heart of the socialist system and, so far, the state is still in search of alternative incentives or institutional structures that can efficiently replace the highly remunerated entrepreneur or manager of the market economy.

ELEMENTS OF GROWTH STRATEGY

The economic system described above can be seen as one complex strategic decision on the Soviet course of modernization. The other strategic decisions are allocative decisions. Given the goal of maximum growth of the heavy-industry sector and the desire to economize on the growth of consumption, the decision to bypass agriculture is only natural, at least during the early phases. Early self-development of raw materials and of heavy industrial bases is also connected with one version of going it alone—that is, with autarky. Finally, there is the vector of strategic and policy decisions that come under the umbrella of extensive growth.

Bypassing Agriculture and Collectivization

Leaving the modernization of agriculture for later stages, unlike the "organic" pattern of leading countries, is a classical example of a Gerschenkronian act of impatience by a follower. It was tried before by Witte during the earlier Russian industrialization drive. Agriculture was expected to pay heavy taxes and to export grain to finance an ambitious industrialization drive, which was only moderately successful. Agriculture went through a series of famines, and the outcome was crisis and revolution (1905). Stalin's decision to collectivize agriculture in 1928 (Russia's third revolution) was aimed at least partly at the

same goal: first to assume tight control and then to press for rapid industrialization. To this day, the literature debate on the motivations and the outcome of that move is an important part of the bigger debate on "was Stalin really necessary?" (Nove, 1964, 1969, 1971; Millar, 1970, 1974, 1977, 1981; Millar and Guntzel, 1970; Hunter, 1983). Views range from "maybe necessary but very costly" (Nove), and motivated partly on political grounds, to "Stalin's major economic mistake" (Millar, 1981). It is clear that the economic payoff fell far short of expectations in the 1930s and that the Soviet Union is still paying dearly for the decision to collectivize and for the way the decision was implemented. Everyone agrees that one of the main economic motivations for collectivization was to "collect," but there was also the belief, based on Marxist learning, that by transforming agriculture into industry-like large-scale mechanized production, productivity would go up.⁴ Early plans called for a large share of agriculture to take the form of state farms, not collectives, but the heavy losses of livestock and grave inefficiencies in state-farm operation caused heavier reliance on collective farms, *Kolkhozi*, where losses and risks are borne by the farmers and not by the state procurement agencies.

The hopes for low-cost productivity gains in agriculture have not materialized to this day; indeed, the sector has been transformed from a net provider of resources into a net absorber of government funds. Since the mid-1950s, when consumption moved up somewhat in the objective function, agriculture went through a series of reforms in organization and in the structure and levels of incentives. Prices paid to farmers were raised; incomes were secured; and the supply of machinery, fertilizers, and other industrial inputs increased dramatically. The share of total investment to agriculture rose from 10 percent in 1950 to about 30 percent since the early 1970s. In 1980 the state subsidized agriculture with 37 billion rubles, about one-third of the value of its production (Trembl, 1982, p. 171). More recently they grew to over 50 billion rubles (Colton, 1986, p. 153). Subsidies support both input and output prices. Yet despite considerable improvements in performance, Soviet agriculture still lags badly in productivity and is unable to meet expectations of either the leadership or the population.

The initial organization of collectivized agriculture created a small private sector consisting of a private plot allocated to every farmer and to others as well, mainly for production of food for their own needs, but also for sale in private markets to the urban population. It turned out that these small plots became a major supplier of food not only for

⁴Collectivization was, of course, also motivated by the fear of potential resistance to the regime and by the desire to establish control over and discipline throughout the hostile countryside.

the rural but also for the urban sector. The private plot was crucial to the Soviet Union in earlier years and is quite important even today as a major supplier of fruit, vegetables, and dairy products and thus of work incentives to the entire population. Its presence is, however, a constant reminder of the low level of efficiency of socialized agriculture. Although these plots account for only 3-4 percent of total land under cultivation (animal fodder is grown largely on public land), they yield about a quarter of the entire Soviet food production (Lane, 1982, pp. 25-26; Wadekin, 1973).

Three groups of factors are responsible for the poor performance of Soviet agriculture: the collective system itself as manifested mainly by the curtailment of the direct link between the farmer and his produce; the particular inherent difficulties in managing agriculture by central planning; and the long legacy of neglect, low priority, poor quality machinery and inputs, and poor transport and storage and supply systems.⁵ All three clearly interact and there is no simple way to assign responsibility. It must be clear that collectivization and central planning were imposed on agriculture for quick results. The immediate benefits gained took a long-term toll, which must be paid now, with high interest.

Autarky

Initial autarky and prolonged autarkic elements were discussed in detail above. The initial decision to go it alone fits perfectly into the formulation of the objective function and the time horizons. There is also a Marxist bias here. Even if faster growth could be achieved by developing agriculture first for trade purposes it would not have fulfilled the objectives as fast as desired. True, heavy industry could not be developed solely on the basis of previous Russian technological achievements, hence the one-time rush to collect a basket of up-to-date modern Western technology in 1929-32, on the basis of which self-growth proceeded. As shown above, autarky in the sense of very low trade proportions no longer exists—nor has it for some time. Even the goal of self-sufficiency in essential needs was relaxed with respect to agricultural products. The most important remaining element of autarky under the present Soviet practice is the high degree of isolation of the economy from world markets. Restrictions on most kinds of contact and the very limited connection between internal prices and

⁵Recent summaries on the operation and performance of Soviet agriculture are by Laird et al., 1977; Johnson, 1982b, 1983; Diamond, Bettis, and Ramsson, 1983. See also Stuart, 1972; Volin, 1970. On private plots see Wadekin, 1973.

world prices deny the Soviet economy the beneficial efficiency effect of such relations.⁶

The Extensive Model: Mobilization

One of the cornerstones of the Soviet growth strategy is the mobilization of a maximum number of inputs to the growth effort. This is the input side of the extensive growth model. Most of the factual evidence and some of the policies of this drive were described in a previous section; this one concentrates on a more general discussion of its sources and implications.

Mobilization of inputs first serves the major goal of rapid growth and catching up. It fits in very well with the nature of the system and with the regime of growth through pressure. It is also a rational and convenient source of growth at early stages, when labor participation rates are very low and growth leverage through a rise in the initial small capital stock is very powerful. Mobilization of inputs is also consistent with the Soviet objective function, which gives the standard of living and general welfare of the population a lower priority level. Investment levels are higher at the expense of consumption and there are heavy pressures to work harder and to use one's leisure to produce services for oneself.

Some aspects of mobilization are also consistent with socialist ideology and Marxist doctrine. The Marxist labor theory of value and the elimination of most nonwage sources of household income created economic and political motivations to join the labor force. The economic incentives affect household behavior directly; they are reinforced by laws requiring all able-bodied men to work and by educational and indoctrination campaigns. These, together with the doctrines of equality between the sexes and of the economic independence of women, also contributed (again with the help of economic incentives) to the rapid rise in the participation of women in the labor force. Similarly, the high rates of capital investment, especially in producer goods, are an integral part of Marxist growth theory. Marxist doctrine also influences the pattern of investment, as we shall see below.

The input mobilization side of the extensive model is necessarily temporary; the relative increments of inputs must decline over time

⁶With the dramatic rise in trade volume some influence of world prices on domestic prices does emerge, especially when world price changes are as extreme as the case of energy prices in the 1970s. Many price changes in the Soviet Union take the form of changing retail prices without changing the price paid to producers. But there were also some price changes of machinery and equipment in spheres associated with imports or exports. In most cases price adjustments of this sort are partial and occur with a considerable time lag. See Treml, 1980, pp. 191-196; Treml and Kostinsky, 1982.

and hence, too, their contribution to growth. If a strong element of haste is also introduced, exhaustion will be further hastened. The decline in the rate of growth of labor comes naturally after reserves are utilized and the rate of rise of labor inputs converges with a declining growth rate of the population. While the decline in the population is partly a natural corollary of economic modernization and partly a direct outcome of World War II, it was probably accelerated by pressure, especially on women and mothers, to join the labor force, by other pressures on free time, and by the low consumption, especially of housing and household amenities.

It is clear that the labor potential for extensive growth is exhausted. Given the heavy value placed on growth, and the limited value awarded to consumption, population growth must be welcomed by the system's directors. Therefore some policies believed to be responsible for declining birth rates have been reversed during the past decade (Lapidus, 1978, 1982; Feshbach, 1983; Feshbach and Rapawy, 1976; Hahn, 1982; McAuley, 1981; Gregory, 1982, 1983; Berliner, 1983b; Baldwin, 1979; Rapawy, 1976; Goodman and Schleifer, 1982).

The fact that the contribution of each unit of *capital* to growth must decline in the extensive model is the essence of this model. Extensive growth may be defined as a growth path along which capital grows at a (much) faster rate than output. Given the slow growth of labor, this path will be followed whenever overall productivity growth is lagging. A necessary condition for rapid growth is that the share of investment in GNP grow monotonically, for it takes a larger share of a slower-growing GNP to keep the growth rate of a faster-growing capital stock constant. Only productivity growth at a rate that equalizes the growth rates of output and capital can avert this outcome, and its absence is what makes Soviet growth extensive. Bergson, who pointed out this application of growth theory to the Soviet record, also demonstrated that in order to sustain a 2.5-3 percent contribution of capital to output growth, assuming low productivity growth, capital has to continue to grow at 8-9 percent. This, however, would push the share of investment in GNP not only far beyond the present 30 percent level but also to the point where noninvestment uses would begin to decline in absolute terms (Bergson, 1973, 1975). To avoid this, investment shares must stop growing and the growth rate of investment must decline to the rate of GNP growth. This, in turn, reduces the growth rate of capital, which will eventually also converge to the rate of growth of output, leading to a decline in capital's contribution to growth. Such developments have indeed been taking place over the past decade, and the contribution of capital to growth had declined to only 1 percentage point (Tables 1 and 3). The leadership's concern over this development is

evidenced in the apparent reversal of the declining trend of investment growth in the current (12th) FYP (Hewett, 1985, pp. 300-303).

Haste to reach the upper limit of the investment share is in itself a no-cost loan from the future, provided no loss is incurred by speed. Even so, later growth rates of output are bound to decline. Costs are involved if the speed at which the capital stock is growing adversely affects both its quality and that of the embodied technology, the lead time of construction, and the efficiency of installation and of eventual production. The literature abounds with examples of inefficiencies in all these aspects; there is no question that a slower pace would have been much more efficient and that a reserve of potential increase in the investment share could have been built up (Cohn, 1970, 1976a, 1976b, 1979, 1982; Rumer, 1982, 1984a, 1984b, 1984c).

Finally, with near zero growth of labor, the extensive growth turns into growth led solely by capital. Such an extreme imbalance between capital and labor adds to the difficulties in the introduction of new capital and further reduces capital and overall efficiency.

Specific Investment Policies

The classical Soviet investment strategy first follows the objective function in directing the lion's share of investment to producer-goods industries. The concentration of investment in such industries ("Sector I" in Marxist terminology) is the key to rapid growth in Marxist and Soviet growth models. A second Marxist and Soviet distinction is between "productive" and "nonproductive" investments. The latter include all investments in services such as housing, urban infrastructure, and consumer services, as well as in public administration, banking, and other business services. A third preference of Soviet investors is for core production processes rather than auxiliary functions, which are left to simpler, labor-intensive technologies. One motivation for such a policy is to allow the concentration of scarce capital in key processes that absorb the most advanced Western technology and that are usually highly capital intensive. In this way, the most important technologies can be incorporated, while the overall capital/labor ratio remains low and reflects Soviet factor availabilities. This aspect is developed in detail by Granick, 1967, Ch. 6. Another aspect of this preference is to start production early, putting off auxiliary functions for later, also a manifestation of the haste strategy. Under such a policy, investments in transportation and communication networks, in storage and shipping facilities, and in urban infrastructure are all postponed or minimized to concentrate on "real" production. In many cases the investment requirements for infrastructure or transportation

are very large and the payoffs indirect and slow, so capital productivity without them may be higher in the short run.

One example of such preferences is the development of the raw material bases in Siberia with very limited investment in infrastructure and in industries of both consumer, "nonproductive," and productive types (Rumer, 1984a; Cohn, 1976b)—a clear example of haste. Another is the constant underinvestment in the transportation network (Hunter and Kaple, 1982).

Another important manifestation of such investment policies is the lower level of urbanization, at least until very recently. Directing investment to manufacturing raised the capital/labor ratios beyond "normal" levels and left those in agriculture abnormally low. Such a shift in the capital/labor ratios was also desired because it helped reduce the required rural-to-urban migration and hence the urban infrastructure needed. Economizing on urbanization was also achieved by the demand that every able-bodied migrant participate in the labor force, by a lower demand for labor for urban services, and by limitations on construction of infrastructure for services. The amount of urban infrastructure per capita was also minimized. A final advantage of the policy of economizing on migration to cities is that it helps limit consumption and consumption expectations. Rural populations do not need as many services as do city dwellers, and their expectations for improved consumption develop much more slowly. In pursuing such a policy the Soviet authorities made it difficult for people to move freely to the cities. Until recently collective farm members did not have personal passports and were not allowed to leave their farms without permission. Moreover, permission to reside in major cities still had to be obtained (see Ofer, 1976, 1977, 1980a; on East Europe see Ehrlich, 1973, and Konrad and Szelenzyi, 1974).

Another distinctive feature of Soviet investment policy is the over-concentration of investment in new plants compared with replacing equipment in existing enterprises. Such a pattern, very natural in the early stages of industrialization, has prevailed in the Soviet Union to the present (Cohn, 1979, 1982; Hanson, 1981, 1982b). The main reasons are the ease of planning and directing new plants from the center compared with planning and enforcing replacement investment in existing enterprises. One corollary, but also a possible consequence of the policy, is that service lives of machinery and equipment in the Soviet Union are extremely long (Cohn, 1979).⁷ Pressures to meet exacting output targets also contribute to the reluctance on the part of

⁷Until after Stalin's death obsolescence was not recognized as a legitimate reason to retire equipment.

managers to introduce new and retire old equipment. Such old equipment needs much maintenance and repair, another form of "interest" payments because of haste. A second consequence of the concentration of investment in new plants, when combined with the general pressure on current production, is the increasing stock of incomplete projects. Such stocks hold up production and delay the introduction of new technologies. Finally, investment in new plants raises the proportion of construction in total investment, thus again reducing its technological content (Cohn, 1979, 1982; Martens and Young, 1979; Hanson, 1981, Ch. 4). Lately, Soviet planners have tried to tackle these problems by cutting down on new projects and by redirecting investment to the replacement of equipment in existing enterprises (Kontorovich, 1985b; Grossman, 1953, 1955).

While resisting the introduction of replacement equipment, plant managers overdemand investment funds, also as part of their effort to meet exacting production plans. Accumulated excess capacity can help meet production norms under conditions of frequent shortages due to equipment failures and supply interruptions, and can be used to produce unobtainable spare parts for oneself, albeit at high cost. Similar factors, as well as rigid pricing policies and low-quality production, lead to high investment in inventories. The long tradition of no charge or low charge for capital funds also contribute to excess demand. The accumulated capital "reserves," which are quite large despite the strong rationing efforts of the planning authorities, also contribute to the low level of capital productivity.

Soviet investment policies, in summary, reflect first and foremost the allocation decisions embodied in the growth strategy, including many elements of haste and high time preference. They may also reflect the ability of a center to internalize and take into account external effects of urbanization. Finally, they respond to particular systemic and organizational difficulties, as observed in the bias in favor of new plants and against replacement investment.

CONCLUSIONS

Our review of the Soviet growth record and our discussion of the nature of the Soviet system (Secs. III-V) have pointed out the substantial differences between the Stalinist and the post-Stalinist eras. In many respects, however, the entire period can be seen as belonging to the same basic system and growth strategy.

The most striking difference is, of course, the substitution in the post-Stalinist era of some coercive and punitive pressures with more

generous increases in consumption levels. From the population's point of view, this was indeed a revolutionary change, and not only in the economic sense. In terms of the objective function discussed above, the weight allotted to consumption was clearly increased. In the early years of the post-Stalin era, consumption could grow out of resources that became available through postwar reconstruction, from the decline in defense spending, and from efficiency gains created by the relief from oppression. The change in investment patterns, however, was very small or nonexistent. Indeed, the share of investment in GNP continued to climb until the early 1960s, when it reached a plateau of 28-29 percent in gross fixed investment (Table 3). The level of investment could not be allowed to grow any further if the hoped for increase in consumption and defense was to be achieved.

In the post-Stalin period, although more attention was paid to agriculture and international trade, there was no shift from the extensive to an intensive model, nor were there any important changes in the basic system and its modes of operation.⁸

⁸On the question of how distinct these two periods are from one another, see Bergson, 1986, pp. 4-5.

VI. R&D AND TECHNOLOGICAL CHANGE

The other side of the coin of the extensive model of growth is the relatively (and eventually absolutely) small contribution of the rise in overall productivity to Soviet growth. R&D and the introduction and diffusion of new technologies into the production system are among the major potential contributors to advances in productivity in general. In the Soviet Union, however, they are among the main victims of the central planning system and of the policy of haste. Considering the central role of productivity growth and technological change in the growth process of most other countries (Kuznets, 1966, Chs. 1 and 10), Soviet technological performance must be carefully examined and evaluated.¹

The slow pace of technological change was certainly unintentional. On the contrary, technological change as a main aspect of economic modernization was always emphasized by Soviet leaders; allocation of inputs to R&D activities was always generous; and there seem to be good a priori reasons to assume that a centrally planned system should favor rapid technological advance. The results must therefore be attributed largely to unexpected negative consequences of policies in other spheres and to the economic system. Parrott (1983, Ch. 2) suggests that the difficulties in R&D and technological change are due partly to the leadership's underestimation of the requirements for success.

Technological change under a centrally planned system has several advantages over a pure market system, where externalities and market failures reduce its efficiency. Lange (1938), among others, applauded the economic advantages of socialism in large degree on the basis of these advantages. In a centrally planned system, the center in principle can formulate a national scientific technological development program based on all available information and in accordance with national priorities. It can then build the organizational structure for its execution; secure the needed resources, manpower, and funds; and monitor implementation throughout the entire innovation cycle, from basic research through diffusion. All potential benefits from

¹The literature on this topic is abundant. The major recent works are Berliner, 1976; Amann, Cooper, and Davies, 1977; and Amann and Cooper, 1982; the three-volume work by Sutton, 1968, 1971, 1973; Hanson, 1981; Parrott, 1983; Bornstein, 1985; and many earlier works. These books include surveys of earlier works and many references. The following is based mostly on Berliner, 1976; Amann and Cooper, 1982, Ch. 1; and Hanson, 1981, Ch. 4, which is a concise summary of the main issues.

innovation can be readily internalized and no information or patent-protection barriers would prevent rapid introduction and diffusion. Indeed, many market or mixed Western economies are taking similar measures of government intervention to avert market failure, albeit very selectively.

Of the above list of a priori or assumed advantages, many were actually realized: First, a vast institutional infrastructure for science, R&D, and diffusion of innovation was built, usually generously and consistently funded and staffed. Today the Soviet Union probably outspends the United States on R&D (as a fraction of GNP) and employs a larger workforce of technicians and scientists Bergson, 1983b, pp. 53-56; Nolting and Feshbach, 1979, 1981; Nimitz, 1974; Zaleski et al., 1969).

A second realized advantage is what Berliner terms *mission-oriented projects*, which are major investments decided on and executed by the center on a top-priority basis. This occurs mainly in new plants, which are thus shielded from the disruption of ordinary production activity and intervention by lower-level authorities (Berliner, 1976, pp. 504-518). Many of the Soviet technological achievements, notoriously in the military and space sectors, are outcomes of such mission-oriented projects.² However, only about a quarter of all projects involving major new technologies are directed from the center proper, and the rest are left in the hands of ministries and lower-echelon authorities (Hanson, 1981, Ch. 4).

Finally, it is also generally agreed that Soviet science as such works at a high level in several fields (Graham, 1984, pp. 124-127); however, the danger in a dictatorship of Stalin's type is that science comes to a dead end when dictators decide on the "right" direction of scientific advance. In the Soviet case this happened on a large scale at least twice, once when Stalin forbade the use of mathematical methods in planning and economics (Leontief, 1960), and again when Stalin and Khrushchev drove biology into an impasse (Medvedev, 1969). These are just two notorious examples of a general tendency.

Despite the advantages, many R&D efforts fail to achieve the desired result because they are frustrated by a multitude of weaknesses and drawbacks. The combination of bureaucratic planning and command, of a flawed reward system, and of pressure for short-term production outcomes helps create an inhospitable environment at all stages of the innovation cycle.

²Hanson (1981, p. 67) is right in proposing "that the design of the Soviet system was aimed, in part, precisely at carrying through large investment projects, and at facilitating a process of technological change in which the construction of new plants played a dominant role."

The discussions of innovation in the Soviet Union concentrate on three areas: the R&D sector itself, the separation between the R&D and the production sectors, and the problems of introducing and diffusing innovations within the production sector.

THE R&D SECTOR

Traditionally, basic and applied research, development, and even much prototype production and testing in the Soviet Union are confined to special research institutes belonging either to the various academies of science or to production ministries. Each has its own projects and reports upward within its own institutional hierarchy. A comparison of the main characteristics and needs of R&D everywhere and the major attributes of the Soviet production system discussed above indicates many conflicting features. R&D needs reserves and slack, but the system is very tight and operates on the basis of shortages. R&D requires flexible supply lines, free-form plans, and open time horizons and does not always have clear results; but the supply system is rigid and plans are routine, bound by time, and expected to be strictly met. R&D requires organic and flexible modes of organization and free multidimensional (especially lateral) interaction and connections; but it faces rigidly structured, hierarchically directed organizations. R&D needs autonomy as one condition for initiative and creativity; but it is restricted by discipline, regimentation, and conservatism. R&D needs challenge and competition; but it operates in a seller's market where low prices are not always a virtue. Many R&D projects are by nature small-scale, but the Soviet system is geared to deal with large-scale routine production. R&D needs a free flow of information; but the system is both highly departmentalized and shrouded in a dense screen of secrecy that extends far beyond what is usually considered state security, to say nothing of interaction with the outside world. R&D needs to be rewarded by the end result of its efforts, not by the number of projects or papers completed; this, however, is very difficult to accomplish, and the Soviet reward system is indeed based on such less meaningful "production" assignments. In short, R&D works best with flexibility, autonomy, change, slack, and free interaction in all directions, all of which are in extremely short supply and very costly under the Soviet system.³

³The literature offers innumerable examples on problems of the R&D sector and on difficulties resulting from short-term considerations, including, among others, Berliner, 1976, Ch. 4; Hanson, 1981, Chs. 3 and 4; Bornstein, 1985, Ch. 2; Parrott, 1983; Zaleski et al., 1969; Ofer, 1980b.

INTERACTION BETWEEN R&D AND PRODUCTION

According to the traditional organizational methods, Soviet R&D institutes have been separated almost completely from production enterprises. Whether they belong to the Academy of Sciences or to a production ministry, their formal connection with enterprises is through the ministerial hierarchy. This separation is considered by many observers inside and outside the Soviet Union to be a major obstacle to the introduction and diffusion of innovations (Bornstein, 1985, p. 33). The difficulties created by this separation are easy to see: Research institutes follow their own goals and plans, which are detached from those of enterprise managers; they have only partial information on the client's needs, and there is no unified system of responsibility for an innovation from its inception to its introduction and use. Enterprise managers complain that many innovations are too expensive, that prescribed inputs are not available, and that introduction is not followed up by the R&D staff.

INTRODUCTION AND DIFFUSION OF INNOVATIONS

While separation is a real handicap, it may well be considered less so when compared with the alternative of incorporating R&D into production units. Given the heavy pressure exerted on managers to fulfill short-term production plans, little attention is paid to R&D and in many cases R&D capabilities are used to meet production quotas (see below). Since 1973 several new organizational schemes ("production-technology" and "science-production" associations) have attempted to bring R&D and production under one managerial umbrella. The results of this compromise have been mixed, at best, and many of the previous problems still prevail (Berliner, 1983c; Hanson, 1981, pp. 56-57). The main problem, and probably the cause of the preference for separation, lies in the difficulty of focusing the rewards for innovation solely on its direct economic benefits. In reality, separation's potential benefits to innovation do not materialize because of exogenous disruptive interferences such as problems of supply and of prices being fixed too low.

The reluctance of enterprise managers to introduce new methods and products is a major obstacle to technological change and one reason there is a preference for directing much innovation to new enterprises at the expense (as previously discussed) of high costs in terms of investment funds and a high proportion of construction in total investment. The resistance of managers to innovation stems largely from the bias imposed on them from above in favor of short-term production.

Most activities connected with innovation involve some sacrifice of present performance, such as changing sources of supply (a high-risk proposition), retraining, and a period of experimentation and quality adjustments. New materials or equipment needed may be in short supply, the limited quantity produced being earmarked for military or other top-priority claimants. Because the introduction of a new method is usually part of a plan, there is always the danger that plan targets will be adjusted upward to more taxing levels. The strong seller's market and the lack of real competition reduce the pressures on managers to improve their products. In this respect the absence of the "kicking foot" of competition is, according to Berliner (1976, pp. 526-530), a more serious obstacle to innovation than that of the "invisible hand." In such an atmosphere, the rewards to managers for introducing innovations are rarely big enough. These rewards have recently been raised, but apparently still not sufficiently to offset the overwhelming dominance of the output target. Providing stronger incentives to innovation is hindered by defects in the price system and by the danger of development of undesirable side effects—spurious innovations and false "new" products. Berliner (1976, Ch. 17), who analyzed the innovative activity in terms of a balance between risks and rewards, concluded that under the Soviet system both are lower in comparison with the situation in a market economy. Rewards, however, are much lower, thus causing poor outcomes. Can a socialist system offer the kind of material incentives in both income and wealth needed to encourage innovations from below? Finally, resistance to innovation is based on complaints about the quality and effectiveness of proposed innovation by the R&D sector itself, not always without some justification.

One major consequence of the problems listed above is that both in new projects and in existing enterprises, lead times for introducing new innovations are usually very long. As a result, large investments remain pending for long periods, and technologies sometimes become obsolete even before their introduction (Hanson, 1981, pp. 65-73).

This discussion reflects the literature's evaluation of Soviet R&D activity in the civilian sector. In almost all cases, an exception is made for military R&D where, as most scholars agree, performance is far more successful and achievements are impressive.⁴ Students agree that Soviet military R&D consists of top-priority, mission-oriented projects run and directed from the center. In addition to the priority allocation

⁴This is even pointed out by Sutton (1973, p. 361), who probably takes the most critical view in the West of Soviet technological abilities. For a discussion of this issue see Holloway, 1977, 1982, 1983; Berliner, 1976; Becker, 1986; Alexander, 1978; Nimitz, 1974; Parrott, 1983; Ofer, 1980b.

of highest-quality manpower, funds, and facilities; smooth supply lines; more lucrative incentives; and more flexible organizational modes, military R&D is also isolated from the problems of ordinary bureaucratic planning. Priority treatment is by definition selective, and the benefits it awards translate into costs to the excluded sectors, in this case especially civilian R&D. One aspect of the above-mentioned isolation, combined with the heavy secrecy screen, is that the military allows almost no spin-off of innovations to the civilian sector. Recognizing its weakness, the military developed the capacity to self-supply, and aims all its requirements in-house. In the short or medium run this policy secures military needs at a heavy cost to the civilian sector. In the longer run, including the past 10-15 years, the military is bound to grow more dependent on the level and infrastructure of civilian R&D. The price of impatience and haste is being paid now, with civilian R&D unable to support expanded military needs.

There is some disagreement in the literature on the extent to which military R&D is immune to most of the system's ills and about the true quality of Soviet-developed military technology, about the level of efficiency of military R&D when both inputs and the technological content of new weapon systems are appropriately measured, and, finally, about the extent of real tradeoffs between military and civilian R&D activity. But even here, the inability of the system to generate new technology across a wide spectrum of military and civilian projects at the same time is underscored by most scholars.⁵

There are two rational economic responses to comparative disadvantage in technological change, or to the undue expense of R&D: One is to import technology, the other is to economize on the use of R&D by substitution with other inputs. Both courses of action have been followed in the Soviet Union.

Importing Western technology was a main tool of technological advance all along; only the method shifted in the early 1960s from "borrowing" and reverse engineering to commercial purchases of equipment, entire plants, and technological know-how, as described above. Sutton (1973, p. 370), who reviewed the Soviet technological advance in hundreds of technologies over 1917-65, found it was almost all due to importation, with only a very small Soviet indigenous contribution in a small section of all technologies. While imported technology clearly contributed to the Soviet economy, the success was less than expected or hoped for and very little indigenous capability was generated by it. This is testimony to the fact that not only the R&D sector but also the production sector, with its problems of introduction and diffusion of

⁵See references cited in the preceding footnote.

innovation in existing and new plants, share responsibility (Hanson, 1981, p. 53).

The discussion in this section has not made the distribution between technological changes of a leading country consisting mostly of major new innovations at the world frontiers, and technological changes of an essentially follower country that consist of borrowing, adapting, and improving such innovations. The Soviet Union clearly aims at joining the leaders, at least in some (e.g., military) fields; however, the discussion so far, including that on technological transfer, should have made it clear that the Soviet Union faces increasing difficulties even in sustaining its position as an effective follower.

The second response to the high cost of R&D is the conservative nature of such activity—military and civilian alike. Conservatism shows up in the marginal-improvement approach to innovation and in the maximum use of off-the-shelf parts and components. It was first introduced in the 1930s, when the decision was made to concentrate R&D effort on “replication, modification and scaling up of existing Western models” (Amann, 1982, p. 19)⁶ and was incorporated into the system as one of its conditioning elements, making it difficult to abandon later (Amann, 1982, pp. 23–24).⁷ Hanson clearly reflects the accepted view in stating that “Soviet systemic weaknesses in innovation extend quite widely and are by no means confined to innovation and diffusion at existing enterprises” (Hanson, 1981, p. 74).⁸

Hanson further concludes that “there appears to be something approaching a Soviet conventional wisdom which, by implication, also holds that the USSR has major relative weaknesses in technological performance” (1981).

⁶On the decisions on R&D policies in the 1930s see also Parrott, 1983, Ch. 2.

⁷Conservatism sometimes helps create the false impression that R&D is more productive than it really is. The fact that lower R&D content is embodied in seemingly similar products is sometimes overlooked. See Alexander, 1978; and Ofer, 1980b.

⁸Sutton's conclusion, at the end of a three-volume study of the history of Soviet technological activity, is that “the system cannot develop technically across a broad front without outside assistance; internal industrial capacity can be expanded only in those sectors suitable for scaling-up innovation and duplication of foreign techniques” (Sutton, 1973, p. 419). A less extreme but similar conclusion was reached by a group of researchers in Birmingham, after completing a large comparative study of Soviet technological capabilities (Amann, Cooper, and Davies, 1977; Amann and Cooper, 1982). Amann writes that the study confirms earlier Western accounts of the negative systemic effect on Soviet innovation processes: “These systemic features appear to apply equally to all case studies in our sample with the exception of the military sector” (Amann, Cooper, and Davis, 1977, p. 18). And a final conclusion, five years later, formulated a “rough hypothesis that successful innovation appears to be associated with a high level of government support, preferably of a longstanding and stable kind, low cost, average or below average research intensity and low level of ‘complexity’ in the sense of interdisciplinarity of research fields or close dependence on other industries” (Amann, 1982, p. 7).

VII. WHY DID GROWTH RATES DECLINE? PRODUCTION FUNCTION ESTIMATES

The discussion of growth strategy and the economic system sheds light on the systemic sources of growth, on its structural patterns, and, among other things, on possible reasons for the secular decline in growth rates. Three major explanations for this decline emerge: First, extensive growth is by nature exhaustible, as manifested in the unavoidable decline in the growth rates of inputs. Second, technological change and improved efficiency failed to replace input growth; in fact, the contribution of technology declined over the years, reflecting the increased difficulty of borrowing Western technologies cheaply. Finally, the decline in growth was accelerated by the strategy of haste. Haste not only made the growth curve decline more steeply but has also been partly responsible for the difficulties encountered by the Soviet economy in shifting to an intensive path. Haste has contributed to the present low rates of growth mainly by accelerating the exhaustion of extensive growth and by accumulating numerous bottlenecks in the production system, creating backlogs in needed investments—all of which must be paid for now. Haste makes change difficult because it has a negative effect on R&D and because it limits the feasibility and prospects of economic reform.

The literature discusses several other factors that contribute to the downward trend. The first is the growing complexity of the economy. This argument maintains that planning from the center was reasonably simple in a more primitive economy, which produced a more limited number of products and had a clearer vision of how to translate goals and priorities into production plans. But as an economy becomes more advanced and complex, the options and variations multiply, the amount of required information and coordination grows at a much faster rate than the economy itself, and it becomes more and more difficult to cope in spite of technological and theoretical advances in data management and planning. While in the early stages learning and improving the system may have been dominant, most students feel that at some point in recent decades, greater complexity turned the balance (Bergson, 1983b; Levine, 1982b).

Second is the persistent and increasing drag on growth caused by the large and rising size of defense spending. As we have seen, the share of defense spending in GNP has been increasing slowly since 1959 (Tables 1 and 3). Numerous studies have attempted to estimate

the functional relationship between growth (through investment) and defense, and between consumption and defense, but the tradeoffs correspond fairly closely to the amount of resources engaged. None of the studies discovered either special windfalls coming from the transfer or particular obstacles that might limit the tradeoff to less than one ruble for each ruble taken from defense. It seems to me, however, that the emerging one-to-one relationship in most studies is built into the models through assumptions.¹ Even the evidence gathered over the past decade, when the real rate of growth of defense was drastically cut—mostly through a near freeze on the growth of procurement—is far from conclusive (Kaufman, 1985). It is reasonable however, to assume that lower defense burdens and slower defense growth rates could (in the past) have brought, and may (in the future) bring, some small measure of relief to overall growth and consumption (Becker, 1985; Kaufman, 1985).

A third factor contributing to the decline of growth is the weakening of the material incentive system as a result of the inability to fulfill the production targets for consumer goods. Declining growth cuts first into consumption increments, a low-priority target, which in turn has negative effects on work motivation and efforts, thus further reducing growth. If, to avert these effects, the wage bill is kept higher than the realized consumption bill, repressed inflation emerges to add another source of frustration. A "second economy" developing alongside the public sector takes another bite from the effectiveness of the public sector but must be tolerated because of its beneficial effect on work motivation. Heavy drinking is another refuge from dissatisfaction. In the Soviet context, where material incentives fail to meet their target, efforts can be redirected to disciplinary actions about which there have been some recent reports.²

The effects on Soviet growth rates of most of the factors mentioned so far were defined in qualitative terms, and many will have to remain

¹Thus Sovmod, the leading macro model of the Soviet economy, yields the finding that the transfer of 1 percent of the growth rate of defense (= 0.14 percent of GNP) to investment, at 12 percent annual return, can add about 0.018 percent to annual GNP growth. Because marginal capital/output ratios are rising (see below), this is not a very productive tradeoff. Alternatively, Sovmod students as well as M. M. Hopkins and Michael Kennedy, Hildebrandt, and others studied the tradeoff between defense and consumption and found that, at most, after a few years, the resources released from defense could be transferred, ruble per ruble, to consumption: approximately 0.33 percent growth in household consumption per each percent drop in defense spending (Bond and Levine, 1982; Hopkins and Kennedy, 1984; Hildebrandt, 1982b; Becker, 1982, 1986; Calmfors and Rylander, 1976; and others; see references in Becker, 1986).

²On repressed inflation, the second economy, and alcoholism as disrupting efforts and motivation see Grossman, 1982a, 1982b; Kontorovich, 1985b; Kushnirsky, 1984; Birman, 1981; and many others. On causes for declining growth see also Levine, 1982.

so until ways of quantification are developed. Nevertheless, some effort has been made to quantify the more elusive elements in the Soviet growth equation beyond the common division into growth of inputs and the "residual" of output per unit of input. The quantitative study of the residual proceeded along two lines: The first follows Denison, which peels away the residual, layer by layer, and accounts for a long list of factors that were not included earlier as "inputs" (Denison, 1967, 1974, 1979). The second consists of alternative estimates of production functions. Denison's method was first used by Kaplan, 1969, who was also the first to show that the decline in GNP growth was due not only to lower input growth but also to declining productivity. Denison's method was then used extensively, mainly by Cohn, 1970, 1976a, 1976b; and Bergson, 1973, 1983b. In a recent work, Bergson, concentrating on both GNP and the material production sectors only (GNP *less* most services), starts from a "basic" residual, after capital, annual labor hours, and land are taken into account against output. To isolate the part of the residual that most closely measures technological progress proper (TPP), Bergson (1983a, pp. 41-49) adjusts the basic residual to take out the following:³

- a. Rising quality and productivity of labor resulting from increased levels of education and decline in work hours.
- b. Depletion of natural resources and declining quality of farmland.
- c. Productivity gains from the movement of labor from farming to nonagricultural employment and from economies of scale.
- d. The effect of planning reforms and other organizational changes. Here Bergson speculates that the increased complexity of the system offsets any gains emerging from such reforms.
- e. The substantial negative effect of bad weather over 1970-75.

A summary of the resulting calculations for the material sectors over 1950-75 is presented in the following table (rounded percentages of average annual growth; Bergson, 1983a, p. 49).

Calculations of TPP for 1975-85 would most likely produce similar results to those for 1970-75 even though the residual is eliminated altogether (see Table 1). Bergson collects further qualitative evidence in support of the result of the calculation that the technological performance of the Soviet Union is indeed inferior, especially for a country that still has considerable catching up to do.

³Cohn also makes adjustments for changes in age and sex composition but they turn out to be small. He also divides capital into residential, nonresidential, and inventories (Cohn, 1976b, pp. 53-54).

Period	Basic		TPP
	Residual	Adjustments	
1950-60	3.6	0.7	2.9
1960-70	1.8	0.8	1.0
1970-75	0.3	0.1	0.2

The big challenge to this method of analysis and its conclusions came with an article by Martin Weitzman in 1972. He challenged the entire "trinity" concept consisting of Bergson's method and findings, the CD production function, fixed input shares, and declining residual, and presented estimates of a CES production function for Soviet industrial output. These, he claims, achieve a better fit to the data than the CD function and yield the following findings and conclusions.

First, the elasticity of substitution of capital to labor was estimated at about 0.4, rather than the assumed 1, and the residual, the indicator of technological change, was estimated at a constant rate of about 2 percent annually. Weitzman's conclusions were: "By this time [the late 1960s], a low elasticity of substitution seems to imply that capital accumulation has outstripped labor growth by a wide enough margin that the drag due to diminishing returns is significantly cutting into output growth" and "The present emphasis on diminishing returns is very different from the somewhat more usual factor productivity approach. Accordingly, the sharply diminished growth of factor productivity usually emerges as the main reason for the Soviet slowdown" (p. 685). Over ten years later, after many more production function estimates by Weitzman and others, the same conclusion is reasserted in even stronger terms: "If we are to believe this approach [the CD method], the growth of the residual has declined rather dramatically from 5 to 6 percent [*sic*] in the early fifties to about 1 percent in the late seventies. Such a conclusion is a bit difficult to absorb in its entirety . . . [among other reasons because] far greater attention is paid to questions of economic efficiency in more recent years than in the past" and "An alternative historical explanation to the Soviet industrial slowdown is not to make the residual take all the blame, but to allow a low elasticity of substitution to share some of it" (1983, pp. 185-186). Weitzman's CES estimates offer an alternative interpretation to the end of the extensive model. It came about not only when the share of investment in GNP hit the ceiling, but also because the marginal product of capital declined, where capital is the only growing input.

The real disagreement is about what caused the slowdown and therefore about how to try to reverse it. One must first spell out the technical aspects of the two interpretations. We do so in a world where capital is growing much faster than labor, just as in the Soviet Union. When the elasticity of substitution is smaller than one, the share of capital declines with time (the same capital series multiplied by a declining rate of return), causing the rate of growth of combined inputs to decline as well, leaving a higher residual. Because the declining capital share is monotonic, it almost "replaces" the decline of the residual under a constant-shares assumption. In this way, the same data support both versions.⁴ While several papers over the last 15 years claim statistical superiority for the CES interpretation (Desai, 1976; Rosefield and Lovell, 1977; Gomulka, 1977; Toda, 1979), I tend to agree with Weitzman's most recent statement on this matter: "without further information we do not know how to decide on statistical grounds alone between the two alternatives" (1983, p. 187).⁵

More important than the debate over econometrics is the question of to what extent the two interpretations tell two mutually exclusive stories about the reasons behind the observed phenomena. A point, occasionally made in the literature, is that a declining marginal productivity of capital, as in the CES theory, can result as much from weaknesses in and misdirection of R&D activities as from problems of investment policy. Similarly, a small and declining "residual" can stem both from unsuccessful R&D and from suboptimal investment policies. Previous discussion provided many reasons for the productivity of capital to decline. But under conditions of labor shortage it is also the

⁴This conclusion must be qualified, as it is based on the unlikely assumption of Hicks neutrality of the technological change assumed in the CES estimates. A capital using bias in the technological change, as is most likely the case, would mitigate the pace of decline of the marginal productivity of capital and of its share, and as a result the residual may now decline also under the CES estimates. This criticism of conventional CES estimates made by Abramovitz and David (1973) applies to many estimates and aims to show that technological change is embodied in the capital series in addition to its presence in the residual. This criticism may also be relevant, in principle, to the Soviet Union, except that the declining rates of growth do not allow too much capital using technical change *along with* a 2 percent growth of productivity. The low R&D content of investment may limit the extent of capital using technical change. See, for example Kontorovich, 1985a, the discussion in Sec. VI, and also below.

⁵There have also been extensive arguments on the types of data used, the modes of aggregation, and the plausibility of the results. One example is that it follows from Weitzman's CES estimates that the capital share in Soviet industry reached 80 percent in 1950 and declined to 27 percent by 1978 (Weitzman, 1983, p. 187), or that the return to capital reached levels of 38-199 percent in 1950, but declined to 6 percent in 1969 (Bergson, 1979, pp. 117-120). It is reasonable that the rate of return of capital should fall under the circumstances, but not as sharply, and not to such an extremely low level. Surveys of this literature are presented by Bergson, 1979; and Brada, 1985. Challenges to Weitzman's 1972 paper were offered by Brubaker, 1972; and Kumar and Asher, 1974.

responsibility of R&D to provide the right kinds of labor-saving innovations that can make the absorption of new capital more efficient and avert its declining productivity. This point is stressed by Kontorovich, 1985a, who claims that lack of labor-saving innovation in new capital is responsible for the continued creation of labor-intensive workplaces with no workers to man them (see also Brada, 1985, p. 126). The two different production function interpretations provide little help in resolving the real issue.

Weitzman (1983, p. 187) seems to agree, at least in part, with the above when he states that both suboptimal investment policy and unsuccessful R&D must share the blame for low growth. More important, he also says that whatever the diagnosis, the only way to reverse the trend of declining growth rates is by much heavier reliance on technological change. If Weitzman was willing to compromise, so was Bergson. In his latest contribution on this issue Bergson also included, in the variants of residual analysis to be considered, estimates with an underlying CES production function with elasticities of substitution of 0.5. With 12 and 6 percent return on capital he obtains the following results for the material sectors (annual average growth rates of the residual; Bergson, 1983b, p. 38):⁶

	r = 0.12		r = 0.06	
	ES = 1.0	ES = 0.5	ES = 1.0	ES = 0.5
1950-60	3.6	1.4	4.5	2.4
1960-70	1.8	1.1	2.6	2.0
1970-75	0.3	0.5	0.9	1.1

In both CD and CES estimates reported above, technological change is presented as neutral and/or disembodied. Some of the literature,

⁶While Weitzman could not justify a breakdown of the period into significant sub-periods, Cameron (1981) and Gomulka (1977) did find significant divisions, but in both cases the trend in productivity was not declining (Gomulka) or it was even rising (Cameron). Other similar results for the 1950s and 1960s were obtained by Rosefielde and Lovell, 1977, Desai, 1976. None of these estimates include data for the early 1980s, when growth rates were still lower.

Much of the evidence advanced by Wiles, Nove, and Hanson in support of their argument about hidden inflation in the capital series (Sec. III) can be added here as further support for the low and declining efficiency of capital formation. The rise in the costs of capital formation due to such inefficiencies contributes to a rise in the price of capital relative to the general price level; and this increase in the relative price of capital should be added to the proper measure of capital inputs because it reflects the heavier burden of capital cost on the economy (Hildebrandt, 1985b).

however, assumes embodiment of technological change in capital (Gomulka and Sylwestrowicz, 1976; Brada, 1985, pp. 120-122, 126-127).⁷ Two outcomes emerge: First, with embodiment, more of the decline in the rates of growth is charged against the decline in the rate of growth of capital and less to systemic problems of R&D or of efficiency. Second, if embodiment is important, the intended reduction in the future rate of capital growth may hamper rather than improve Soviet growth prospects (Brada, 1985, p. 127). As to the interpretation of past performance, if embodiment were a dominant factor in Soviet growth then, with normal R&D performance and given the large investments, one would expect a much larger contribution of technology to growth in conventional growth-accounting calculations that neglect embodiment. That this did not occur is additional evidence of poor R&D performance in the past. While embodiment is clearly part of reality, what the Soviets lacked in the past, and what they have to worry about in the future in this connection, is the embodiment of additional new technology per unit of investment. Merely raising the level of investment will not solve this problem, but raising the weight of new technology in well-planned incremental investment might do so. This is just another part of the cluster of dilemmas facing Soviet planners in the key sphere of investment policy.

⁷On embodiment in modern economic growth see Maddison, 1982, pp. 21-25.

VIII. EVALUATION AND CONCLUSION—OR, CAN THE TREND BE REVERSED?

The evaluation of the Soviet growth record and strategy in this section concentrates on the question of future prospects. Under what conditions might the present trend of low and declining growth rates be reversed? In a broader view, can sustained growth be assured under the present system? If not, what changes are needed in the system and what strategy will make it feasible?

A comprehensive attempt to project the future is given by the Sovmod econometric model (Bond 1983). The projections for 1980–2000 range between 3.3 and 2.3 percent of annual growth of GNP; the baseline projection is 3.1 percent, and the main differences among the various estimates are assumptions about productivity growth. Under the baseline assumptions, total factor productivity is estimated to grow 1.1 percent annually while under less favorable conditions it would grow 0.33 percent (Bond and Levine, 1983). In conventional calculations, both rates are above the average record for the past 15 years, when total factor productivity was negative (see Table 1).

This means that even the more pessimistic Sovmod estimates must, in effect, assume some future improvement in the system's performance. As things stand now, there seems to be little chance of exogenous factors contributing to such improvement. The factors exhausting further extensive growth are all there: Bottlenecks are cumulating and payments for past haste are due. In addition, the favorable external trade conditions of the 1970s have turned unfavorable with the sharp decline in energy and gold prices (Hewett, 1985; Hewett et al., 1986; Hanson, 1985). The possibility of better weather conditions over the next five years is sometimes mentioned, but there is no talk of a future favorable trend.

According to Sovmod, a shift of resources away from defense, from a baseline growth rate of 4.5 percent per year to zero growth, will produce only a 0.12 percentage point increment in overall growth, to a growth rate of 3.27 percent (Bond, 1983, pp. 18–19). As pointed out above, this may be an underestimate, and it may be assumed that at least under reduced defense spending a productivity rise of 1 percent may be more likely. But recent Soviet experience with low growth rates of defense is not very promising. All these should also be weighted against the prospects of long-term cuts in defense. Other possible shifts in resource allocation are treated later.

While some studies do not rule out the possibility of a continuous decline in growth down to 2 percent per year or less, with almost no productivity growth, most seem to believe that future growth can be somewhat higher, around the baseline projection of 3 percent. It is held that such a rate would allow the Soviet Union to "muddle through" just above the critical political and consumption incentive thresholds, and it would even qualify as acceptable sustained growth for a fairly mature economy such as that of the Soviet Union (Berliner, 1983a, pp. 42-44; Hunter, 1979; Schroeder, 1983; Bialer, 1983). Berliner, for example, foresees the Soviet Union permanently lagging behind the world leaders in technology, a position that, while it has its disadvantages, also has some benefits and may in any case be "appealing to R&D people operating in a risk-averse bureaucratic structure" (Berliner, 1983a).

In terms of the distinction between a technological leader and a follower, Berliner seems to advocate a follower position. It may be true that the Soviet Union has been striving to reach the technological frontiers, but as we have seen, it is finding it very difficult to be an efficient follower.

"Muddling through" may be attained with the help of what the literature calls "moderate" (Colton, 1986, Ch. 4) or "liberal" reform (Berliner, 1983a, 1983b), as distinct from no reform or minor changes on the one hand, or radical systemic change on the other. But even if muddling through with some reforms is feasible, it is much less than what the present Soviet leaders consider acceptable. They have gone on record demanding substantially higher growth rates. Gorbachev has publicly insisted on at least 4 percent growth instead of the existing 3 percent, and the new plans unveiled late in 1985 call for GNP increases of 4-5 percent and more in 1986-2000 (Hanson, 1985; Hewett, 1985; Bush, 1986). While such goals are more modest than earlier unrealized plans, and catching up with the West is not mentioned as a major goal, it must be considered that all increments above 2-2.5 percent growth must come from rising efficiency. Given the perceived internal and external needs and aspirations, the Soviet leaders cannot accept the "slow-growing mature economy" argument even if growth rates in many industrial countries have recently declined. This is utterly unacceptable at a GNP per capita level of just one-half of that of the USA. Nor can one accept for the long run a 2-2.5 extensive growth rate without productivity growth as "sustained" in the real, Kuznetsian meaning.

It has been clear for some time that without some fundamental changes the Soviet system cannot resume more dynamic growth. Theoretical analysis of possible reforms was a permanent element of

economic analysis in the West all along. Over the last five years this discussion was joined by much more active reform efforts by Andropov and lately Gorbachev. The discussion that follows on changes that may reverse the trend combines some of the abstract discussion with actual measures that are being taken or that are in a planning stage.

Three lessons of past reforms should be mentioned. First, the growth record of the past generation was accompanied by a permanent stream of reforms, some of which were considered quite radical in their day. It is difficult to estimate their net effect but they were not enough to stop the declining trend of growth (Berliner, 1983a; Schroeder, 1979, 1982; Colton, 1986, Chs. 1-2). Second, the partial or marginal reforms often had side effects that offset at least some of the benefits. A shift in the incentive structure in one direction may harm other goals and may cause superfluous activity in the direction of the new incentives. Moreover, most attempts at partial reform did not live up to expectations because they conflicted with the unaltered principles of the system in other sectors or activities. An exaggerated metaphor for partial reform is a gradual shift of traffic from one side of the road to the other, a bit at a time.

Finally, reforms suffer from the haste factor: The leadership is too impatient and is reluctant to pay the necessary short-term introduction costs for long-term benefits. As rates of growth decline and pressures to perform routine tasks grow, this reluctance becomes even more entrenched. The outcome is that the more a reform is needed, the more difficult it becomes to implement. This may eventually lead to a crisis where drastic reform becomes indispensable.

The possible economic reforms designed to encourage faster growth, discussed in the literature, range, to use Berliner's and Colton's terms, from reactionary reform, through conservative-marginal, to moderate or "liberal" and to a radical far-reaching reform (Berliner, 1983b; Colton, 1986, Ch. 4). The reactionary model calls for tightening central control, improving the system of central planning, and the reinstatement of various disciplinary and coercive measures as the major means to raise efficiency. More resources can thereby be devoted to investment (defense) and to growth. A comprehensive application of such reforms is ruled out by most observers except under acute conditions of international crisis. Nor do specialists believe in their effectiveness at this stage; however, partial implementation of stronger disciplinary measures, work discipline, more responsibility by administrators, and anti-alcohol campaigns are part of the changes introduced by Andropov and reemphasized by Gorbachev. They serve as part of the proposed reform and as stopgap changes while other reforms are being contemplated.

At the other end of the range is a "radical" reform whose essence is the conversion of central planning into a system of market socialism in which central planning would be phased out in favor of decentralization and market mechanisms, possibly like the "new management mechanism" of Hungary since 1968 (Kornai, 1986). Such a change involves, of course, a shift in resource allocation toward higher rates of growth of consumption and more slack in the economy, as well as major ideological and power-structure shifts. In a way, the prospects of such a radical change are of minor interest here because when implemented they will draw the Soviet system much closer to the present-day mixed economies; the prospects for sustained growth of a Soviet type of socialist system from the present stage is thus left untested. So far, Gorbachev has strongly rejected the possibility of introducing market socialism of the Yugoslav or Chinese style (Bialer and Afferica, 1986, pp. 608-613).

The middle ground of the range is occupied by "moderate" reform in which the basic authoritarian regime and central planning system are assumed to persist, but several important changes in them are contemplated and the distance traveled in each direction may vary. Many of the steps listed below under "moderate" reform are in fact included in what is emerging now in the package of reforms initiated by Gorbachev.

The "Gorbachev reforms" have been formulated as a complete strategy only very recently, at the meeting of the plenum of the Communist Party last June (Gorbachev's speech, and the main document approved, "Basic Provisions for Radical Restructuring of Economic Management," *Pravda*, June 26, 1987, pp. 1-5, and June 27, 1987, pp. 2-3, respectively). Only a small part of the reform provisions have been put into effect so far, and most of it awaits detailed formulation and implementation. The main effort of the reform is in "restructuring" the economic mechanism so as to achieve, in Gorbachev's words, "the union of centralism and independence of economic organization" (quoted by Berliner, 1986, p. 8). It is an attempt to create the entrepreneurship, dynamism, creativity, and flexibility of the market economy in a more decentralized but still centrally directed environment. This effort includes radical streamlining of the top administrative and planning bodies and relieving them from much of the burden of the short-term operational direction of enterprises. A considerable part of the supply of materials and goods will be turned to wholesale trade network where voluntary deals will be struck. Following a major price reform, many prices will be determined by the contracting parties. Much of the previously central financial allocation and control system will be turned to newly established banks that will offer regular

credits. Enterprises, with much more freedom of action over plans, the use of funds, investments, wages, bonuses, sources of supply and sales, and even prices will be run according to the principle of "self-financing." All costs, including taxes, will come out of earned revenues; thus profits and sales will be the main success criteria and the source of remuneration. Losing enterprises will eventually be forced to close and the workers will be transferred. Liberalization is being extended also to international trade, where some freedom of action has been granted to individual enterprises and ministries, and joint ventures with Western companies are permitted. The exact division of power between the central administration and market-like mechanisms will determine how radical the reform will be in the core of the economy. With limited free action the system will not be very different from the present one, but with considerable reduction in the role of administrative measures it could border on the radical. (See discussion on this issue in Kornai, 1986, pp. 1699-1700.)

The second direction of the proposed reform is in enlarging the role and scope of the legal private and cooperative sector, where real markets and market prices and motivations prevail. The Soviet system has probably been the most extreme among the socialist countries in limiting private economic activity all along. In addition to legal private agricultural plots and more or less free farmers' markets for their produce, very limited urban private activity was allowed. The proposed reform enlarges the scope of private food production and of the production and provision of many services and some products—by private people or cooperatives (as approved by the new law of individual activity that went into effect in May 1987) and by allowing some private-market types of activities in collective farms and public sector enterprises, such as permission to sell above-quota or above-contract production on the free market or to contract out to private people or cooperatives segments of production (*kolkhozi* running a computer system for a factory, or developing and introducing an innovation for it). Finally, privatization could mean more liberal policies with respect to the import of technology, even to the point of allowing direct investment of foreign capital in some joint ventures (as under another of the new reform laws).

The increased role of the private sector under such reforms is designed to raise efficiency in spheres where central planning is especially weak, to reduce the burden of central planning, and, probably most important, to increase the supply of consumer goods and services in key sectors, thereby raising the population's level of work motivation. If the supply of privately produced business services to the public sector is also allowed, it may help ease key bottlenecks and make

supply response more flexible. Finally, privatization of service activities may raise the share of services in the national product and move the industrial structure of the Soviet economy closer to a "normal" pattern of growth, in which rapid growth of the share of services is a main feature.

The third direction of the reform is the "democratization" of the cultural, social, and political spheres.

A key question relates to the expected effect of reform on Soviet R&D. Final judgment must be left to the future, but whatever the possible effects, some observers believe that present and future technological frontiers impose even tougher obstacles on the Soviet system than earlier ones did. The main Soviet industrialization drive took place when the dominant technological advance was concentrated in heavy industry and machinery, energy, and raw materials. In a way, this suited the goals and structure of the Soviet system. But the technological frontier has shifted to electronics, computers, and communications—toward an "information-intensive economy." There are many reasons to assume that the Soviet system is less suited for this revolution. Among other problems, Heymann suggests the following:

Soviet society—as is now beginning to be recognized by the new Gorbachev leadership—is handicapped by a socio-political organization ill suited to the adoption and assimilation of an information-intensive culture: its highly centralized approach to management and decision-making; its dearth of reliable data bases and the wall of secrecy with which it surrounds them; the poor quality and availability of its telecommunications links; its discouragement of entrepreneurship and risk taking (uncoordinated small-team, competitive ventures do not exist); its tradition of ignoring the needs and wishes of customers and users; and its abhorrence of the wide-open, chaotic marketplace, where a staggering variety of profit-motivated buyers and sellers contend—these and other features hamper and constrain the society's ability to adjust to and benefit from the information revolution. (Heymann, 1985, pp. A-1, A-2)

Three specific problems of introducing the information revolution into Soviet society must be emphasized. First, the process of innovation is hampered by the fact that the use of the new developments must be diffused across the entire economy and not concentrated in a well-defined branch. Second, its main uses in production are antagonistic to long-established traditions of management and control. Finally, possibly most important, in a society and culture based on monopolization of information, secrecy, and the denial of basic freedoms the benefits of the information revolution are limited. A society that severely limits the use of photocopying machines and mass communications systems has little taste for the information revolution

(Colton, 1986, p. 170; on the general theme see also Graham, 1984, pp. 129-132; Judy, 1986).

Gorbachev's "openness" (*glasnost*) reform of partly lifting the veil of secrecy on social and economic information, of calling for open criticism, of more freedom of expression in the arts and culture, and even some democratization of political structures and processes is motivated among other reasons, by a desire to raise the level of efficiency of the economic mechanism and to contribute to the "human factor," the key element in reconstructing the economy and society. These can be seen as responses to the problems mentioned above. Time will show how much openness will ultimately be tolerated and how far it will go to meet these problems.

It is difficult to evaluate theoretically how extensive the changes must be to generate the needed turnabout in growth rates. It is no less difficult and much too early to say whether the present reforms contain a critical mass of the ingredients of autonomy, flexibility, incentives, motivation, and freedom needed for enhanced efficiency and more dynamic technological advance. What we *can* state is that these reforms, as described above, and the recent patterns observed so far in the Soviet Union appear to be less radical in most respects than their Hungarian, Yugoslav, or Chinese counterparts.

It is also difficult to determine in advance whether the changes that may bring the Soviet economy back to more rapid growth will or will not move the system away from its "socialist" character. Can they be effective without giving up public ownership of most means of production? Or without opening up income and wealth differentials larger than are ideologically acceptable? Or without giving up too much of the central political authority?

Another question with an uncertain answer is whether the minimum reform needed for economic recovery can be pushed through the Soviet political establishment and social structure. There is evidence and open discussion of internal opposition to reforms on academic, ideological, political, and self-interest grounds (Hanson, 1985; Zaslavskaya, 1984; Colton, 1986, pp. 166-176). Zaslavskaya's 1983 report, secret at the time, is a bold description by an insider of the extent of expected opposition by vested-interest groups that stand to lose power and income. Whether or not a "moderate" reform is strong enough to effect the necessary change, it is certainly considered quite radical by many Soviet and non-Soviet observers (Hanson, 1985, p. 307).

In addition to reforms in the economic mechanisms and institutions, economic reforms also include changes in resource allocation. Three such general changes seem to be in prospect, also part of a scheme of moderate reform. First, moderate reform calls for a stronger reliance

on material standard-of-living incentives. This translates into more resources earmarked for consumption, including services. Second are changes in the sphere of investment, which are engulfed by many difficulties. A severe resources constraint requires a proper volume of investment that will cover the needs of hitherto neglected infrastructure, depleted natural resources, embodied technology in machine building, and replacing antiquated equipment (even according to Soviet norms). All that must be done while dealing with the mounting stock of unfinished projects and over-long lead times. One manifestation of these hard choices is the zig-zag pattern of Soviet investment policies since the late 1970s and early 1980s. In this period we have witnessed, first, attempts to lower the overall growth rate of investment and to divert it from machine and metal production toward agriculture and energy. These attempts had to be abandoned and reversed during the early 1980s. Then in the 12th FYP, on one side is a modest growth of overall planned investment for 1986-90, but on the other is an exceptionally high rate set for 1986, with renewed reemphasis on investment in the machine-building sector (Schroeder, 1985; Hewett, 1985; Hanson, 1985; Hewett et al., 1986; Bergson, 1986; Colton, 1986, Ch. 4). Time will tell whether these efforts prove successful in raising the marginal productivity of capital.

Third is an effort to reduce, if possible, allocations to defense. The feasibility of such a move depends considerably on the development of a favorable international environment, especially in East-West relations. Arms reduction, lower pressure on military R&D, and more opportunities for Western credits and technology are favorable to the internal efforts. The Soviet leadership should be interested in promoting such an environment.

Internal policy dilemmas, external uncertainties, including those related to the future terms of trade, and uncertainties connected with the nature and outcome of reforms, all found expression in both the many revisions of the 12th FYP and the many apparent inconsistencies remaining in it. These inconsistencies raise some doubts about the feasibility of achieving even the modest targets of consumption (Bush, 1986).

Oscar Lange, in his treatise on socialism (Lippincott, 1938), concluded that one of the system's major potential economic advantages is in the field of technological innovation. He considered the ability of one center to sponsor, direct, and then diffuse new technologies to be the answer to the failure of the market economy to yield a constant stream of innovations. As it turned out, Lange was wrong: The flexibility of the market economies, aided by a mixed strategy including some degree of government regulation and intervention, proved able to

generate continued innovation. Technological change only by command proved much less successful.

George Orwell and others viewed the development of modern communications and information technologies as the ultimate weapon of control, brainwashing, and repression at the hands of authoritarian regimes. They may be right, but these inventions also carry a great economic potential for a free society that can put them to use in a different way, on a much wider scale, for far greater social benefit.

In his five-and-a-half-hour report to the 27th Congress of the Soviet Communist party (and in many speeches before and since), Gorbachev acknowledged the problem of decelerating growth rates, blamed it among other things on the failure to move from extensive to intensive methods of production, criticized most past reforms as mere rhetoric, and pledged to reverse the trend by introducing the scientific and technological revolution and carrying out a "truly revolutionary change" (Gorbachev, 1986, pp. 29-33)—a total "economic and social reconstruction" of Soviet society.¹ There is some debate among experts as to whether Gorbachev has the right picture in view, the correct prescription for redirecting Soviet society and its economy toward sustained economic growth, and the energy and ability to push it through. For the time being the skeptics dominate, and their reasons are strong (see Hewett, 1986; Schroeder, 1986; Hough, 1986; Hanson, 1986); but we all have to bear in mind that it is rare for analysts to foresee radical changes or sudden shifts in long-established trends. Only time will tell whether the present Soviet leadership possess the attributes necessary to effect such a sweeping change.

¹"Perestroika," ("reconstruction") together with "glasnost" have become the two main catchwords symbolizing Gorbachev's reform drive. Gorbachev's speech last June to the plenum of the Central Committee of the Communist party repeated similar themes in even stronger language (*Pravda*, June 26, 1987, pp. 1-5).

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