ECONOMIES IN TRANSITION: STATISTICAL MEASURES NOW AND IN THE FUTURE
Proceedings of the Sochi International Forum October 1990

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with the assistance of

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Foreword

This collection of papers includes contributions by Eastern and Western experts from the fields of statistical analysis and comparative economics. This international group met to present and discuss their work at the International Forum entitled **Economies in Transition: Statistical Measures Now and in the Future**, which was held in Sochi, USSR, from 15 to 17 October 1990. The Forum was organized and co-sponsored by the International Institute for Applied Systems Analysis (IIASA) and the Academy of Sciences of the USSR. Due to a lack of time and space only a portion of all papers received for the meeting is actually published in this volume; of course, the remainder can be obtained from the organizers upon request.

The overall theme of the Forum was an investigation of meaningful socio-economic measurements for transitional economies. Two main topics were at the focus of attention. The first was the construction and development of statistics needed to more accurately monitor an economy in transition from one system to another, particularly from a centrally planned command-type to a market-style economic system. The second was international, especially East–West, socio-economic comparisons based on traditional (insofar, as these still continue to be relevant and useful), as well as on non-conventional measures. The purpose of the Forum was to bring together both experienced "users" and statisticians. Our belief is that only their union can help overcome current shortcomings of Eastern European statistics and explicate (and subsequently facilitate possible implementation of) measures which are capable of truly reflecting the transitional character of the former centrally planned economies.

Recently, the problem of reforming the statistical systems of these countries has become increasingly popular. Several international conferences have been devoted to this subject, including those organized by the OECD in Paris and the IIASA in Sochi. However, the inherent bias of statisticians is usually an emphasis on the implementation of the United Nations System of

National Accounts (SNA). Although the relevance of this goal should not be understated, the peculiarities of transitional economies call for the adjustment of this system as well as for the introduction of special indicators. The obvious examples of such distinctions that require special attention are price distortions and the development of a barter system, which make monetary data much less valuable. Presentations by Soviet colleagues illustrated the true expanse of the complexity and enormity of the restructuring task of statistical accounts and methodology to be useful to an economy in transition from a previously centrally planned system. Unfortunately, ideas on how to monitor economies in transition are in short supply. In spite of this, the Sochi forum proved to be a fruitful ground for discussion that provided an exceptional opportunity to review numerous new approaches to analyze economies in transition. The comments of SNA or new methodological origin were, to say the least, revealing and interesting, and are contained herein.

Appropriate statistics and methodologies (both internationally recognized and comparable) must be available to reflect the course and pace of transition. Conventional measures do not always immediately reflect true economic changes, although some of these may be of crucial importance for monitoring the progress and potentially influencing the direction of the transition from central planning to market allocation. The enduring fundamental political, social and institutional transformation of Eastern Europe is forcing a general renewal and reshaping of the structure, concepts, classifications, definitions, and status of statistics in this region.

Many experts suggest the SNA, or some modified version of it, as the most appropriate method for analyzing and evaluating the behavior of a market oriented economy. The main advantages of the SNA lie in its potential to serve as a framework for integrating various additional types of statistical measures relating to the economy, and to provide greater comparability with the statistics of western countries and international statistical agencies. The construction of a comprehensive national accounting system for the nations in transition to a market economy is extremely complex and involves strategic decisions about the kinds of information that would be required. This complexity may incline some statistical offices to seek a simpler approach. It is argued that a system of core accounts with modules for special activities would be simpler and more flexible than alternative approaches and, even more importantly, it can provide for better integration between macro and micro data.

As a result of attempts to accelerate economic modernization, the Soviet Union and other formerly centrally planned economies have experienced very

significant structural transformations. Comparative studies of structural transformation have identified the existence of various uniform features of the development process, commonly known as "stylized facts". These studies have also been useful in indicating the main reasons for departures from the uniform trends. Unfortunately, the lack of adequate measures and shortcomings of the Eastern European statistics as related to the availability of information, its reliability, comparability and interpretation, has resulted in a deficiency of East–West quantitative comparative studies. Their number is significantly inferior to the number of relevant studies done not only for developed, but also for developing countries. Irrespective of the problems associated with the supply and quality of information, some analysts have ventured into East–West comparative economic studies that have provided very interesting results; a sample of these were presented at the Sochi Forum.

The accomplishment of East–West socio-economic comparisons and the development of relevant methodology are among the research priorities of the IIASA Economic Transition and Integration (ETI) Project. In this field of study, we concentrate our efforts on the definition, compilation and analysis of new, "non-traditional" indicators that cannot be directly derived from available statistics. However, new measures produced by research frequently prove to be purely theoretical: these cannot be computed (at least on a regular basis) because the necessary data cannot be collected. Therefore, statisticians and "users" must pool their efforts in the elaboration of new measures: to deliberately exaggerate, one may say that the latter know the needs of research, while the former assess the availability of information. The combination of the two was exactly the goal of the Sochi Forum.

The structure of this collection of papers directly reflects the distinction between the topics of "statistics" and "comparisons."

The four papers included in *Part One* are devoted to the implementation of the System of National Accounts, its possible extension and also to the introduction of GDP estimations in Eastern European countries. In the first paper, Richard Ruggles does a thorough job in developing a strategy for implementing the UN SNA for the Soviet Union, particularly in light of two questions: (1) which version of the SNA should be implemented, and (2) what is involved in deciding to implement such a version? Professor Ruggles' contribution also includes very helpful background material on the nature and content of the UN System of National Accounts in terms of (a) its origins and developments, (b) its revision in 1968, and (c) the background of its current review. Carsten Stahmer focuses on the discussion regarding adjustments of the aggregates of national accounts in order to

account for the environmental deterioration by economic activities. He proposes an approach to integrating a cost-oriented concept to satisfy the need for welfare-oriented measures of economic development. The third paper, by Arye Hillman, is devoted to a description of problems associated with the measurement of variable fundamental to economic activity in the course of transition from planned socialism to market economies. In the final paper of Part I, János Árvay summarizes the results of his investigation concerning the present stage and availability of GDP estimations in the Central and East European Countries, which serves as a logical lead in to Part II of this book.

The five papers of *Part Two* are related to "non-traditional" measures and their use in international comparisons. Angus Maddison, author of the first contribution of the second section, reviews the problems of measurement of non-residential reproducible tangible fixed capital stock. His calculations are on the basis of the perpetual inventory method that is preferred because it produces figures with clearer meaning, particularly since all the calculations and hypotheses are transparent and consistent. The study also includes a revealing comparison of the selected countries' standardized and official estimates of total non-residential fixed capital stocks. Petr Aven and Il'dar Karimov follow with an international comparison of personal consumption. The results of their typological analysis facilitate the identification and evaluation of key peculiarities of personal consumption in the early 1980s and identify historical perspectives for the catch-up of less developed countries of Eastern Europe. In the third paper, Moshe Syrquin draws on much of the work he has done with Hollis Chenery to analyze the structural change in formerly centrally planned countries as it pertains to modern economic growth. He comments on both the statistical and the computable general equilibrium model approaches and concludes that there may be a significant amount of slack in the planned economy which could become an easily available source of growth once a more efficient and rational economy emerges from the transition. In the next essay, Andrey Netschayev proposes the utilization of intercountry comparisons as a measurement, analytical and forecasting tool for the long-term evaluation and prediction of economic development and structural change of countries like the Soviet Union. In the final paper of Part II, by Petr Andrukovich, the importance of "human factor" for the transition to a market economy is compared for the countries of East Europe. The author demonstrates that the decreasing rate of growth and the stagnation of industrial development in Eastern Europe and the

USSR can be mainly accounted for by inadequate development and even exhaustion of manpower resources.

Appendix A contains a special contribution that focuses on the practical case of using statistical measurements to trace the importance of research and development in the post-war transition of Japan. Fumio Kodama emphasizes, by example, the need to vary the methodology and indicators to appropriately analyze a particular phase of the transition period.

Finally, *Appendix B* includes a list of collaborators involved with the ETI Project in this particular area of socio-economic comparisons and statistical analysis.

Professor Robert Eisner from Northwestern University (USA) played a special role in enlisting participants and in the creation of the Forum's program. Academician Valery Makarov and Professor Alexei Shevyakov from the Central Economic Mathematical Institute in Moscow were both not only valuable participants, but also extremely cordial hosts. We thank Shari Jandl, administrative assistant to the ETI Project, for attending to all the organizational matters so conference participants could concentrate on the work to be done, and Sabine Malek for diligently and cheerfully typing numerous versions of the manuscript.

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Contents

Part I

On the Introduction and Extension of the System of National Accounts in Transitional Economies

Statistical Measurements for Economic Systems in Transition: Strategy for Implementing the UN System of National Accounts (SNA)

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Introduction: The United Nations System of National Accounts

In developing statistical measurements for economies in transition, it has been proposed that the United Nations System of National Accounts (SNA) should be implemented for the Soviet Union. Not only would the UN System of National Accounts be more appropriate than the Material Product System for analyzing and evaluating the behavior of a market oriented economy, it could also serve as a framework for integrating other types of statistical measures relating to the economy, and provide greater comparability with the statistics of other western countries and international statistical agencies.

If the implementation of the United Nations System of National Accounts involved merely the construction of estimates for a few macro ag-

gregates such as gross national product and gross domestic product, such a task might be accomplished relatively easily. However, the development of a complete national accounting system suitable for understanding the behavior of the Soviet economy in its transition to a market oriented transactions system is far more complex and involves strategic decisions about the kinds of information that would be required. The United Nations System of National Accounts consists of a logically consistent framework for economic accounts based on internationally agreed concepts, definitions, conventions, classifications and accounting rules.

Prior to examining just what strategy might be adopted by the Soviet Union for implementing the United Nations System of National Accounts, it will be useful, as background, to examine briefly the nature and content of the UN System of National Accounts in terms of (a) its origins and development, (b) its revision in 1968, and (c) the background of its current review.

The Origins and Development of the SNA

Although national income measurement has had a long and honorable history that has been chronicled by Paul Studenski and others, national accounting is relatively a recent development. In 1940 Ragnar Frisch, in Norway, wrote about constructing national accounts for the purposes of macro economic analysis, and in the Netherlands, Jan Tinbergen had used national accounting concepts in his development of econometric models. In England Richard Stone and James Meade, under the guidance of Keynes, developed for the UK Treasury an analysis of national income and expenditures that put into operational form the concepts laid out in Keynes's *General Theory;* this was published in a White Paper in April 1941.

It was clear that national accounting was an idea whose time had come. The ideas presented in the British White Paper were also being developed in the United States. As early as 1942 the two sides of a national income and expenditure account were developed and considerable use was made of this account in analyzing the inflationary gap resulting from the financing of war expenditures.

In the fall of 1945, Richard Stone prepared a report for the League of Nations on *The Measurement of National Income and the Construction of Social Accounts.* In this report, he advocated setting up a system of accounts to record the money flows and related bookkeeping transactions between different sectors in the economy. Although by now these basic principles of

national accounting are well recognized, in 1945 they were a major innovation and were not easily accepted. Kuznets, for example, viewed national accounting as "a dubious addition to the theoretical equipment by aid of which we define national income and reckon its distribution."

Nevertheless immediately after World War II, the U.S. Economic Cooperation Administration and the Organization for European Economic Cooperation (OEEC) agreed that national income accounts should be used as the framework for planning and monitoring European Economic Recovery. Richard Stone was called on to set up a national accounts research unit, and to develop a "Standardized System of National Accounts." The resulting six account system, which appeared in 1952, was far simpler that the system outlined in the 1947 League of Nations report, and bears a striking resemblance to the present national income accounting system used by the United States. It consisted of the following accounts:

(1) National product and expenditure account
(2) National income account
(3) General government appropriation account
(4) Household and non-profit institution appropriation account
(5) Consolidated capital transactions account
(6) Rest of world transactions account.

The United States national accounts combine the national product and expenditure account and the national income account into a single national income and product account, but the other accounts are essentially similar to those of the 1952 SNA.

During this period, Stone also chaired an Expert Group that was drawing up a System of National Accounts for the United Nations. Understandably, the UN SNA which appeared in 1953 was quite similar to the OEEC "Standardized System." The major differences were that rudimentary capital reconciliation accounts were shown for households, government and the rest of the world. The latter were intended to show the impact of saving and investment on assets and liabilities, but they were very consolidated and summary in nature.

An additional feature of the first UN SNA was that standard tables were appended to the accounts that gave alternative or more detailed breakdowns of the data in the accounts and provided standard classifications. With this first SNA as a basis, the United Nations Statistical Office developed a national accounts questionnaire which it sent out to countries to collect national accounting data. In the late 1950's the United Nations began publication of the Year Book of National Account Statistics.

The 1968 Revision of the SNA

At the same time as the national income accounts were being developed, there were developments in related fields of economic accounting. Wassily Leontief had been working on input-output analysis since the 1930's. By analyzing inter-industry requirements and the destination of industry outputs, Leontief was able to show how the industrial structure of the economic system could be expected to change with changes in the final demand for goods and services. In the period after World War II many countries undertook the construction of input-output tables, and in some countries, including Norway, Denmark and the Netherlands, input-output tables were integrated with their national accounts.

Over these years, work was also being carried out on monetary and financial statistics. In the United States, Morris Copeland developed sources and uses of funds accounts for recording a comprehensive system of money flows. At this same time, Raymond Goldsmith was estimating national wealth and national balance sheets using a perpetual inventory method. This involved cumulating the capital formation data in the national income accounts over long periods to obtain estimates of the stocks of tangible assets. These were then combined with financial transactions data in the flow of funds to obtain balance sheets.

It gradually became apparent that all of these economic accounting systems should be integrated into a single framework, and that the 1952 SNA was not sufficiently comprehensive in its scope to serve as such a framework. In the early 1960's, as a consequence, Stone was again called on to head an effort to create such an integrated system. Although the development of the revised SNA involved the cooperation of statisticians from many national statistical offices, the basic SNA Blue Book[1] was primarily the product of Richard Stone working with Abraham Aidenoff, the Director of the United Nations National Accounts Office.

The revised SNA was complete in 1968 and, as intended, it provided a comprehensive and detailed framework for recording the stocks and flows in the economy. It brought together, in an articulated coherent system, data ranging in degree of aggregation from the consolidated accounts of the old SNA to detailed input-output and flow of funds tables.

The revised SNA, like the old SNA, was designed to provide international guidance to national statistical offices wanting to improve, elaborate and

[1] United Nations Statistical Office, *A System of National Accounts*, Series F, No. 2, New York, 1968.

extend their national accounts and their system of basic statistics. It was recognized that many countries would not be able to compile all the data in the full system, but it was felt that the new SNA would establish goals for advancing national accounting and systems of basic statistics for the foreseeable future.

Paradoxically, although the well known SNA Blue Book was recognized as the basic document describing the SNA, there was no agreement about what actually constituted the SNA. It was not unlike the three blind men describing an elephant. The SNA theorists cited the Blue Book's presentation of the extended matrix as the embodiment of the SNA, but SNA practitioners were quick to point out that the extended matrix was merely used to illustrate the general nature of a complete system that it was never intended to be implemented. Instead, SNA practitioners argued that the heart of the SNA was contained in Chapter VIII of the Blue Book where examples of standard accounts and tables were presented.

But even the standard accounts and tables were of an illustrative nature and never were fully implemented by any country. As a consequence, users of SNA national account statistics held the view that the SNA consisted of the data published in the United Nations National Accounts Questionnaire. Although the National Accounts Questionnaire was conceptually related to the standard accounts and tables contained in the Blue Book, it omitted many accounts and tables and differed from others in important respects. In 1979 there was a major revision and extension of the UN National Accounts Questionnaire that broke new ground and introduced new kinds of information not contemplated by the Blue Book.

The Background of the Current Review of the SNA

In the early 1970's, before countries had an opportunity to implement the revised SNA, the values implicit in the traditional measures of economic progress began to be questioned. Specifically, it was argued that national income accounting measures did not adequately reflect the deterioration of the environment, the using up of resources and the disamenities of modern society. Some viewed GNP as standing for gross national pollution, and urged that small was beautiful, and that happiness was learning to do without. Even those who did not take such extreme positions were forced to recognize that the data reported in the national accounts did not ade-

quately measure the quality of life. Furthermore, there was an increasing concern with the distribution of well-being; it was argued that an increase in aggregate output might be accompanied by a worsening in the distribution of that output.

In the United States, the government programs of the "Great Society; were intended to address these concerns, and the statistical information required for their planning administration, and evaluation was very different from that envisaged by the SNA. What was needed was information about the demographic, social and economic characteristics of the population, so that programs could be designed to help those who needed help. Although the revised SNA recognized the topic of income distribution, preliminary guidelines on this subject were not published until almost a decade later—and these guidelines were in direct conflict with the SNA as presented in the Blue Book. Little attention was devoted to cost/benefit analysis or measurement of the effects of government programs on the distribution of total consumption of the population.

Perhaps the greatest blow to the use of national income accounting as a basis for analyzing the behavior of the economy came from the stagflation which developed in the 1970's. Keynesian economists held the view that inflation and recession could not occur simultaneously. With the fuel crisis of 1973 and subsequent double digit inflation and recession, this view was largely discredited. Those advocating supply side or monetarist economic policies felt that income determination models based on the national accounts were largely irrelevant.

The inflationary process of the 1970's, of course, involved changes in relative prices, and revaluations of assets and liabilities that produced both capital gains and capital losses. Although the revised SNA did in principle make provisions for balance sheets and even proposed revaluation accounts, these were not implemented in detail in the 1968 Blue Book. As in the case of income distribution statistics, provisional guidelines for balance sheets and reconciliation accounts were not published until almost a decade later.

The concerns of the 1970's and the dissatisfaction with the existing national accounting framework led in the variety of directions. Some investigators undertook to adjust the existing national account aggregates in order to obtain better measurements of economic welfare. Others sought to introduce additional imputations in order to increase the comprehensiveness of the national accounts and improve their usefulness for a wider range of economic analysis. Still others focused on the social demographic and other informa-

tion which lay outside the framework of national accounts, and sought ways in which to link this information with the accounts.

National accounting aggregates have always contained some imputations. Traditionally, imputations have been made for non-market agricultural production, the services of owner occupied housing, and services provided by financial intermediaries. Many economists have argued that the national accounts should be extended to embrace all non-market activity, and that it should include intangible and human capital as well as tangible capital.

National statistical offices looked outside of the national accounts for social indicators which could be used to monitor social conditions, formulate goals for social policy, and evaluate the social change taking place. In this context, Richard Stone developed for the United Nations a System of Social and Demographic Statistics (SSDS). This system set up social and demographic accounts that could be linked to the national accounts.

For development planning, a number of investigators constructed Social Accounting Matrices that introduced social and demographic breakdowns into the SNA national accounting matrix presentation. In France "Satellite Accounts" were developed to augment the national accounts by providing more detailed or more comprehensive information relating to specific activities in the national accounts. Finally, with computerization and the increased availability of micro data, many investigators were pursuing the analysis of micro data or developing microanalytic modeling quite independently of the national accounts.

In the late 1970's a review of the 1968 SNA was proposed. The initial reaction of the representatives of the national statistical offices and the international statistical agencies was that since the 1968 revision was in the process of being absorbed and was still unimplemented by most countries any significant revision would merely confuse matters further. By 1982, however, it was agreed that there should be a SNA Review that should clarify and simplify the SNA concepts, harmonize them with other related systems of statistics, and update the system to fit new circumstances.

Despite the general consensus that the SNA should not be altered significantly, the SNA Review has turned into a thorough and detailed examination of the SNA. From 1982 through 1985 the basic issues to be reviewed were identified and studies on these issues were prepared by international organizations and national statistical offices. These studies were then circulated to experts and to regional meetings where national statistical offices were represented. During the period from 1986 to 1988 expert groups were convened to discuss specific topics such as the structure of the accounts, the public

sector accounts, external transactions, the household sector, price and quantity measures, production accounts and input-output tables, and financial flows of the system.

Since 1988, Peter Hill, under the direction of the United Nations Statistical Office, has been engaged in drafting *A Revised System of National Accounts* that incorporates the revisions resulting from the review of the SNA. The OECD, EUROSTAT, the International Monetary Fund, the World Bank, United Nations Regional Commissions and other international organizations have actively participated in contributing to and reviewing preliminary drafts of this manuscript. A final draft of the proposed revision is expected to be submitted to the United Nations Statistical Commission in 1992.

Strategy for the Implementation of the UN System of National Accounts

In developing a strategy for implementing the United Nations System of National Accounts for the Soviet Union, two questions need to be considered: (1) which version of the SNA should be implemented?—the 1968 version or the present revision that is expected in 1992—and (2) what is involved in deciding to implement either the 1968 SNA or the current revision?

First, with respect to the choice between the 1968 SNA and the proposed revision, it should be noted the SNA revision is not as yet available in its final form and it may not be available for several years. On the other had, many of the changes anticipated in the proposed revision consist of incorporating material already included in UN manuals that have been issued since the 1968 Blue Book was published. Similarly, there has been attempt to harmonize the 1968 SNA with the statistics published by other major international organizations. It would seem most reasonable to adopt those changes that are clear improvements or bring the SNA more in line with other international statistics. Other changes which are primarily extensions of the SNA into new areas of statistics might be postponed until such time as the basic SNA system has been implemented.

Secondly, the question as to what is involved in implementing the SNA needs clarification. It was already noted in the discussion of the 1968 SNA that there has been considerable confusion as just what actually constitutes the SNA—the SNA matrix, the standard accounts and tables shown in Chapter VIII of the Blue Book or the UN National Accounts Question-

naire. Recently, the United Nations Statistical Office in its discussion paper for the 1990 Regional Commission meetings on the SNA has clarified this question with respect to the current revision of the SNA with the following statement:

> "It should be emphasized that the revised system is foremost a theoretical construct which has been elaborated in all of its detail in order to give guidance to countries with different types of economies and provide a basis for different types of specialized analysis. This implies that the system should not be looked at from the point of view of immediate and/or comprehensive implementation, but from a broader viewpoint of its applicability to a wide range of countries in the long run. A further consequence of this is that the tables, matrices and accounts included in the system are designed to explain the features of the SNA and not for compilation of data at a national or international level."[2]

Given these considerations it becomes important for Soviet statisticians to examine the central features of both the present SNA and its proposed revision with reference to their appropriateness for monitoring the Soviet economy and analyzing its transition to a market-oriented transactions system. The central features required for constructing an appropriate system of national accounts can be classified into four categories. *First,* an appropriate sectoring will be required to show the interaction of different parts of the economic system. *Second,* an accounting structure will need to be erected to provide a framework for showing the transactions that take place between sectors of the economy. *Third,* specific imputations or attributions will need to be made in order to supplement the transactions information contained in the sector accounts. *Fourth,* economic constructs will need to be built up from the sector core transaction accounts and imputation modules.

Sectoring the Economy

In the present SNA, the institutional sectoring of the economy consists of:
(1) Corporate and quasi-corporate enterprises
(2) General government
(3) Non-profit institutions serving households
(4) Unincorporated enterprises and households
(5) (de facto) Rest of the World

[2]United Nations Statistical Office, *System of National Accounts (SNA) Review Issues,* Future ST/ESA/SER.F/2/Rev. 4, February 1990.

For the revised SNA, it is proposed non-profit institutions serving households be eliminated as a major sector and included as part of the household sector, thus reducing the number of major sectors by one. Since, in general national statistical offices have not implemented the SNA recommendation of treating non-profit institutions as a separate sector of the economy, it is quite reasonable that such sectoring be abandoned.

The preference of many national accounts for including non-profit institutions in the household sector has been primarily based on the lack of adequate data. The estimates for final consumption for households have usually been derived residually—and often still are. Reliable data on the final consumption of non-profit institutions are usually not available, so it has not been possible to separate them from household final consumption. Since households were considered to be the consumers of the goods and services provided by non-profit institutions, the most appropriate solution has been not to distinguish separately such goods and services.

In reality, the current SNA proposal for creating a combined household and non-profit institution sector is confirmation of the present macro statistical approach of treating the household sector as a residual. It is doubtful whether many countries will attempt to produce the more detailed separation of the sector into sub-sectors of non-profit institutions and types of households.

Non-profit institutions in many countries now represent a significant part of the economy, and may become more important in the foreseeable future. They consist of schools, universities, hospitals and associations as well as religious and charitable organizations. They cover a broad variety of research, educational, health, recreational, and other activities—and they exist along side profit making organizations and public enterprises engaged in the same activities.

Combining households and non-profits institution transactions in the same sector runs counter to the spirit of both the transactor/transaction approach and the integration of macro and micro data that are being emphasized in the SNA revision. The transactions for the combined account would have little analytic meaning for use; they could not be partitioned into size distributions of income or used as control total for household micro data.

Since the revised SNA requires a complete sub-sectoring of non-profit institutions, a preferable solution to classify non-profit institutions with other similar profit making or public enterprises. Thus, they would be public enterprises irrespective of their legal form or organization or whether or not they

are of a profit making nature. The argument is made that putting non-profit institutions into the enterprise sector would destroy its homogeneity—and hence its analytic usefulness. This argument neglects the obvious point that the SNA enterprise sector is already extremely heterogeneous. It embraces public non-profit enterprises, private non-profit organizations serving business, mutual organizations and cooperatives as well as private profit making enterprises. For economies in transition, it would be particularly important to sub-sector the enterprise sector in a manner such that it would be possible to monitor the behavior of market-oriented enterprises.

Both the existing and revised SNA distinguish between quasi-corporate enterprises that are included in the corporate sector and unincorporated enterprises that are included in the household sector. The stated criterion is that in order for an enterprise unit to be included with corporate enterprises as a quasi-corporate enterprise, it should have a complete set of accounts. In contrast, it is argued where the accounts of unincorporated enterprises are not distinguished from household accounts, these enterprises should be relegated to the household sector.

Although conceptually this approach might appear reasonable, it is not easily applied on a case by case basis and does not conform to normal reporting unit information. For farming, for example, it is more reasonable to treat all farms that sell farm products as being in the same sector, rather than including some in the enterprise sector and relegating others to the household sector. If distinctions are to be made, farms might be classified by size and type of farm within the enterprise sector rather than relegating different farms to separate sectors on the basis of subjective accounting criteria.

Thus, the classification of the economy into major sectors would be as follows:

(1) Enterprises (public, private, profit and non-profit)
(2) Government and governmental units
(3) Households
(4) Rest of the World

The Accounting Structure

The 1968 SNA Blue Book presents a relatively simple accounting structure consisting of accounts for:

(1) Production
(2) Consumption expenditure

(3) Income and outlays
(4) Capital Formation
(5) Capital Finance

However, this accounting structure was not to be applied to all sectors. Accounts 1, 2, and 4, (production, consumption expenditures and capital formation) were to be drawn up for those industries and sectors directly involved in production or consumption. These accounts were to serve the basis for the make and use matrices underlying input-output tables.

Accounts 3 and 5 (income and outlays, and capital finance) were to be implemented for institutional sectors. The omission of production and capital formation accounts for institutional sectors has made it difficult to analyze the relation of saving, capital finance and capital formation in the economy. Although the SNA matrix recognized the existence of balance sheets, these accounts were not specifically included in the accounting structure shown in Chapter VIII of the UN Blue Book.

United Nations manuals on balance sheets and on tangible assets did not appear until 1977 and 1979 respectively.[3] The 1980 revision of the SNA national accounts questionnaire did make provision for a full set of accounts, including balance sheets for all institutional sectors,[4] and the current proposed SNA revision has not only incorporated a full set of accounts for institutional sectors, it has gone considerably further and presents an elaborate and complex set of inter-linked cascading accounts for each institutional sector showing:

(1) Production
(2) Generation of income
(3) Appropriation of primary income
(4) Entrepreneurial income
(5) Appropriation of other primary income
(6) Secondary distribution of income
(7) Redistribution of income in kind
(8) Use of disposable income account
(9) Use of adjusted disposable income

[3]United Nations Statistical Office, *Provisional International Guidelines on National and Sectoral Balance-Sheet and Reconciliation Accounts of the SNA*, Series M, No. 60, New York, 1977, and United Nations Statistical Office, *Guidelines on Statistics of Tangible Assets*, Series M, No. 68, New York, 1979.

[4]United Nations Statistical Office and O.E.C.D. Department of Economic and Statistics, *Instructions and Definitions for the National Accounts Questionnaire*, New York and Paris, 1980.

(10) Capital transactions
(11) Financial transactions
(12) Other changes in assets
(13) Revaluations
(14) Neutral revaluations
(15) Real holding gains/losses
(16) Opening balance sheet
(17) Changes in balance sheet
(18) Closing balance sheet

As the proposed revision notes, these sets of accounts are designed to answer "Who does What by means of What for What purpose with Whom in exchange for What with What Changes in stocks?"[5]

One of the major virtues of the national accounting systems used by most countries is that they do provide a relatively simple macro–economic overview of the economic system. There is considerable danger that in elaborating the SNA this important function will be lost. Serious reconsideration should be given to implementing the proposal made by the Netherlands Statistical Office for a simpler set of "core" accounts.[6]

Considering the present analytic needs of detailed information about the economic system and the capabilities of modern computers, the national accounts should be constructed so that they are capable of integrating and accessing micro data bases derived from administrative sources and large samples. The SNA accounting structure was not designed to meet these needs. It has been and still is conceptually and statistically a set of aggregate accounts designed to be presented as tabulations. The proposed revision of the SNA has not been designed to take advantage of recent developments and anticipated future changes in both data needs and data technology.

The basic accounting structure underlying the revised SNA needs to be built around the task of integrating the macro sector accounts and aggregates with the underlying micro data. From an analytic point of view such integration is essential if meso data consistent with the national accounts are to be developed from existing micro data and if microsimulation modeling is to be successfully related to macro economic analysis. For these purposes,

[5]United Nations Statistical Office, *Revised System of National Accounts: Preliminary Draft Chapters—Chapter II, An Overview of the System,* page 11, Future ST/ESA/-STAT/SER.F/2/Rev. 4, February 1990.

[6]C.A. Van Bochove and H.K. Van Tulinen, "Flexibility in the Next SNA: The Case for an Institutional Core," *The Review of Income and Wealth,* Series 32, No. 2, June 1986 pp. 127–154.

it is recommended that the following core accounts be established for each of the major sectors of the economy.
(1) Current receipts and outlays
(2) Capital transactions
(3) Balance sheets
These core accounts would be on a consolidated basis and would provide the framework for recording all the actual transactions taking place between enterprises, governments, households, and the rest of the world. They represent the basic accounts used for business purposes by enterprises and for budgeting by governments and households. Harmonization of the concepts used for national accounts and related micro data sources would be required, and the familiar problems of data reconciliation would need to be resolved, but the core accounts would provide the framework for both recording all of the transactions contained in the United Nations System of National Accounts, and making it possible to relate them to micro data.

It is recognized that core balance sheet accounts pose many problems and are difficult to implement. There are questions of how assets and liabilities are to be valued and revalued. Few national statistical offices will be capable of providing complete balance sheet accounts within the immediate future. However, for some sectors and for some types of assets and liabilities data on the stock held may be available, and it will be useful if the information on current receipts and outlays and on capital transactions can be related to the information of the existing stock of specific assets and liabilities.

Imputations and Rerouting of Transactions

The national accounts have always taken account of certain non-market activity. As already noted, imputations have been made for the food and fuel produced and consumed on farms, the rental value of owner occupied housing and the provision of financial services by banks. The valuation of imputations is often difficult and in some cases quite arbitrary. Imputed values do not have the same significance as actual transactions. Despite such considerations, both the current SNA and its proposed revision combine market transactions and imputations for non-market activity in the same account.

1. Food and Fuel Consumed on Farms

In the same case of food and fuel consumed on farms, the problem of imputation is relatively simple. By providing a separate module in the national

accounts for imputations, it is possible to clearly distinguish between the actual market transactions taking place in the economy and the imputations for non-market activity. In the case of countries where subsistence agriculture is particularly important, this separation would be very useful for monitoring the shift from a subsistence to a market economy.

2. Owner Occupied Housing

The treatment of owner-occupied housing is somewhat more complex. In order to record the services of owner-occupied housing, households owning their homes are considered to be renting their dwellings from themselves as real estate owners. Their activities as owners are considered to be those of unincorporated enterprise. These fictitious unincorporated enterprises own the dwellings and pay all the costs associated with them. To offset these outlays, the unincorporated enterprises receive an imputed space rental from the households as occupiers. The difference between the space rental and the current costs of providing the housing services is returned to households as imputed rental income.

The actual costs of owner-occupancy, including maintenance expenditures, property taxes, insurance, mortgage interest, imputed interest on the owner's equity and capital consumption appears in the SNA as outlays and gross saving by the fictitious unincorporated enterprise.

Although this method of imputation does get the services of owner-occupied housing in both output and final consumption, it does so by distorting the accounts of both households and unincorporated enterprises. In fact, it is households that pay property taxes, interest on mortgage debt, and expenses of repair and upkeep, not unincorporated businesses in the real estate industry, and it is households that do the gross saving reflected in depreciation charges.

For measuring both the total housing consumption of individual households and to provide comparability between owned and rented housing, it is recognized that some type of imputation for the use of owner-occupied housing would be desirable. Such an imputation can, however, be made separately from the household core transactions account both as an income and consumption without the necessity of rerouting all the related transactions through a fictitious unincorporated enterprise. By following the transactor/transaction approach, the current costs of owner-occupied housing would be recorded in the core account as actual outlays by households. A separate imputation could then be made in the imputation module for the difference

between such costs and the imputed space rental value of the owner-occupied housing.

3. Financial Services

The imputation for the provision of financial services arises from the treatment of interest in the national accounts as a transfer rather than as a payment for a financial service. Nevertheless, it is also true that depositors in a financial institution often accept a rate of interest on their deposits that is below the market rate in exchange for receiving financial services—this suggests that they are receiving an imputed return on their funds in the form of financial services. One of the further consequences of treating interest as a transfer is that consumer interest on installment debt for durables such as automobiles is not considered to be part of the cost of purchase or use of automobiles and therefore is not included as a consumer expenditure. In any case, it would be possible to show imputations for financial services separately from the core accounts in the imputation module.

4. Services of Consumer Durables

One of the more obvious omissions in both the present SNA and the proposed revision is the failure to impute the non-market services provided by household durable goods. Although the SNA revision is very much concerned with expanding the definition of enterprise and government capital formation to include research and development, computer software and even intellectual property, it does not recognize household capital formation. But other purchases of durable goods by households are considered to be current expenditures.

Much of the consumer credit extended to households relates to the purchase of automobiles and other consumer durables. Both households and financial institutions recognize that such purchases do not represent merely consumption in the current period, but that the good purchased continues to have value and provide services over a period of years. It is appropriate that the national accounts should also recognize consumer durables as capital formation. As is done for owner-occupied housing, an imputation needs to be made for the services of consumer durables so that total consumption and its change over time can be more accurately measured.

5. Household Non-Market Activity

Most national accountants have been reluctant to extend imputations to such household market activities as household services, education and leisure activities. They argue that such imputations are so large that it is very difficult to impute an economically meaningful figure for them. Including imputations of this magnitude would tilt the balance of the system away from monetary transaction and greatly reduce its usefulness for the analysis of markets and for purposes of policy making.

Insofar, as imputations are combined in the national accounts with actual transactions, the argument against introducing imputations for household non-market activity is quite valid. On the other hand, if core accounts contain the actual transactions taking place between the major sectors, and separate modules exist for presenting imputations, it may be found useful to expand the range of imputations beyond what is currently anticipated. Imputations for household non-market activity based on time use studies of households have the advantage that they can reveal the substitution taking place between household market activity and non-market activity, and show how households allocate their total resources.

6. Benefits in Kind

In the present SNA, benefits in kind received by households from the government are treated as part of household income and household final consumption expenditures. Under the proposed SNA revision transfer in kind by the government will not be included in either household primary income or in household consumption expenditures. Instead, a redistribution of income in kind account will show those social benefits in kind. This separation of final consumption expenditures from benefits in kind is quite appropriate for analyzing consumer behavior on the one hand and the total consumption of households on the other. Although the introduction of a redistribution in kind account can accomplish this separation, the use of a module for imputations accomplishes the same purpose without increasing the complexity of the accounting structure.

With respect to benefits in kind provided by employers to employees—such as medical services and day care services provided by employers—both the present SNA and the proposed SNA revision either (1) omit such benefits entirely by considering them to be part of producer's intermediate costs or (2) include such benefits as part of the compensation received by em-

ployees and as imputed household expenditures. Both of these treatments are clearly inconsistent with the proposed treatment accorded to benefits in kind provided by government.

7. Employers' Pensions and Insurance

Another major rerouting of actual transactions relates to the handling of employers' payments to life insurance, private pension and welfare funds on behalf of their employees. Both the present SNA and the proposed revision attributes such payments as part of the current compensation received by employees, and therefore as part of household income. Income earned by the pension and insurance funds is also attributed to households as part of their current income. The portion of the contribution which represents the costs of operating the insurance companies and pension funds—called the service charge—is treated as personal consumption expenditures.

As a consequence of these attributions, the full increase in the reserves held by insurance companies and pension funds, therefore, is attributed to personal saving. Households are thus considered to own the reserves of the insurance companies and pension funds. The net equity of these funds appears on the household sector balance sheet, and interest earned on the reserves is attributed as current income to households, although of course they do not receive it.

As a corollary to this treatment in the SNA, pension benefits and life insurance annuities actually paid to households do not appear as part of household income because such treatment would involve double counting. It would be included as income initially when the employers' contribution is paid to the insurance company or pension fund and subsequently when the benefit is paid to the household. As a consequence, the receipt of such benefits are considered to represent only a change in the form of the assets held by the household, from net equity in life insurance and pension funds to cash.

Household survey micro data usually reverse this treatment. Pension and annuity benefit payments received by households are included in household income and employer's payments of contributions to pension funds and insurance are not. Interest on pension and insurance reserves is not attributed to the household, and the household balance sheet does not include equity in employer-financed pension and insurance reserves.

In the United Nations guidelines on income distribution statistics, the household survey treatment of pensions and insurance is recommended

rather than that of the SNA.[7] Where the focus is on the distribution of income, it is clearly undesirable to treat pensioners as having zero income—that would not contribute much to an understanding of the position of the aged in the economy. Conversely, entitlement of younger persons to benefits that will become available only on retirement or death are substantively different from cash income received in the present period. Furthermore, employers' contributions for insurance and pensions and earnings of insurance and pension funds are a poor and unstable measure even of the present value of those future rights.

By modifying the current SNA treatment of pensions and insurance, it is possible to adhere more closely to the transactor/transaction principle and provide better integration with micro data concepts. Employers' contributions to pension and insurance funds would be treated as funds held in escrow for future payment to employees. Pension benefits would be considered as income when they are actually paid out to individuals. Such an approach would also be more in accordance with the treatment of public social security pensions and unfunded private pension systems.

Implementation of Core Accounts, Imputations and Economic Constructs

In order to provide a better understanding of the strategy of developing core accounts and imputation modules for a system of national accounts, it will be useful to demonstrate how actual core accounts and imputation modules can be created for the United States. These core accounts and modules can then be used to create the major economic constructs and accounts of the United Nations System of National Accounts.

Although the present United States national accounts do not provide the elaborate structure of either the 1968 United Nations SNA or its current proposed revision, it does resemble the UN 1952 SNA and by adding sector accounts for enterprises it can be converted quite easily to the more recent versions of the UN SNA. Furthermore, unlike the UN SNA, the United States provides separate information on the specific imputations that have been included in the accounts, thus making it possible to construct core sector accounts of the actual transactions taking place in the economy.

[7] United Nations Statistical Office, *Provisional Guidelines on Statistics of the Distribution of Income, Consumption, and Accumulation of Households,* Series M, No. 61, New York, 1977.

A form of such core sector accounts have been drawn up and published in an issue of the *Survey of Current Business* published by the Bureau of Economic Analysis of the Department of Commerce.[8] The implementation of the core accounts in the following sections draws on the material in that study using a software system PRTAB2 developed by Prospect Research Corporation for the handling of national accounting systems on personal computers.

Sector Core Accounts

Core sector accounts delineate the actual transactions taking place between the major sectors of the economy. In this presentation core accounts will be developed for (1) enterprises, (2) households, (3) government, and (4) gross saving and capital formation. The accounting system is articulated in the sense that each transaction flow appearing in a sector account is matched by a corresponding transaction flow in another sector account. Thus, the receipt of one sector is matched by the outlay of another sector. The gross saving and capital formation accounts contain the residual saving entry in each of the sector accounts and their capital transactions. These sector core accounts are as follows:

- Table 1: ENTCUR - Enterprise Current Receipts and Outlay Account
- Table 2: HHCUR - Household Current Market Income and Outlay Account
- Table 3: GOVCUR - Government Current Receipts and Outlay Account
- Table 4: ROWCUR - Rest of the World Current Account
- Table 5: SICAP - Gross Saving and Capital Formation Account

[8] Richard Ruggles and Nancy D. Ruggles "Integrated Economic Accounts for the United States, 1947–1980," *Survey of Current Business*, Volume 62, No. 5, May 1982.

The Enterprise Core Account - Table 1.1

The enterprise sector is defined as embracing not only corporate and unincorporated businesses, but also public enterprises, non-profit organizations and self-employed including domestic servants. It thus covers all market oriented production. The enterprise core account shown in Table 1.1 is on a consolidated basis; this means that the current receipt and current outlays of enterprises for goods and services used in intermediate production are consolidated out of the account. At the most detailed level of entries in the account, the name of the sector account and the line number are given where the corresponding entry can be found.

The major source of enterprise receipts are its sales of goods and services. These are shown as:

Sales to enterprises	(line 2)
Sales to households	(line 9)
Sales to government	(line 15)
Net sales to rest of world	(line 18)

In addition enterprises receive funds in the form of:

Interest	(line 21)
Income from rest of the world	(line 24)
Transfers received	(line 28)
Receipts from withheld employer pension contributions	(line 32)

The outlay and gross saving side of the account shows how the enterprise sector distributed the funds it has received and how much has been retained in enterprises on a gross basis. Unlike the United States national accounts and the UN SNA, the compensation of employees (line 37) is not treated as all being paid to households. The enterprise core account recognizes that employer social security taxes (line 39) are paid to the government, employer contributions to pension funds and employee benefits in kind (lines 40 and 41) are withheld, and only actual wage and salary payments (line 38) are disbursed to households. On the other hand, the payment of employee pensions (line 60) and the net income retained by employee pension funds (line 65) are shown explicitly.

Table 1.1. ENTCUR

Enterprise Current Receipts and Outlay Account
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	TOTAL ENTERPRISE CURRENT RECEIPTS	Sum L(2,9,15, 18,21,24,28,32)		2563.4
2	*Sales to Enterprises*	L3+L6		435.4
3	Current purchases (net)	L4+L5		104.6
4	*Employee benefits in kind*	ENTCUR	L41	55.8
5	*Non-profit benefits in kind*	ENTCUR	L62	48.8
6	Capital purchases	SICAP	L9	330.8
7	*Structures and durables*	SICAP	L10	335.6
8	*Change in stocks*	SICAP	L11	−4.8
9	*Sales to Households*	L10+L11		1348.8
10	Current consumption expenditures	HHCUR	L18	1036.8
11	Capital purchases	SICAP	L15	312.0
12	*Owner-occupied housing*	SICAP	L16	85.2
13	*Consumer durables*	SICAP	L17	211.9
14	*Change in stocks*	SICAP	L18	14.9
15	*Sales to Government*	L16+L17		318.3
16	Current purchases (net)	GOVCUR	L21	272.3
17	Capital purchases	SICAP	L13	46.0
18	*Sales to Rest of the World (net)*	L19−L20		−4.4
19	Exports	ROWCUR	L18	247.0
20	Less: Imports	ROWCUR	L3	251.4
21	*Interest Received*	L22+L23		199.7
22	From households	HHCUR	L20	125.6
23	From government	GOVCUR	L40	74.1
24	*Income Received from Rest of World*	L25+L26+L27		81.0
25	Interest	ROWCUR	L23	42.7
26	Dividends	ROWCUR	L25	22.5
27	Retained corporate profits	ROWCUR	L26	15.8
28	*Transfers Received*	L29+L30+L31		57.8
29	Household contribution to non-profits	HHCUR	L28	39.9
30	Government grants to non-profits	GOVCUR	L36	10.9
31	Subsidies	GOVCUR	L37	7.0
32	*Employer Pension Fund Reserves*	L33+L34+L35		126.8
33	Enterprise withheld pension contributions	ENTCUR	L40	76.3
34	Government withheld pension contributions	GOVCUR	L28	6.0
35	Interest on pension fund reserves	ENTCUR	L49	44.5

Table 1.1. Continuation

Enterprise Current Receipts and Outlay Account (Billions of Dollars—Current Year Prices)			
Line	Acct	Line	1980
36 TOTAL ENTERPRISE CURRENT OUTLAYS & GROSS SAVING	Sum L(37,43..45,50, 54,55,58,59,62,63)		2563.4
37 *Compensation of Employees*	Sum L38..L42		1327.8
38 Wage and salary payments to households	HHCUR	L3	1116.4
39 Employer social security taxes	GOVCUR	L3	78.8
40 Withheld pension fund contributions	ENTCUR	L32	76.3
41 Employee benefits in kind	ENTCUR	L4	55.8
42 Wage and salary payments to rest of the world	ROWCUR	L7	0.5
43 *Entrepreneurial and Self-employed Income*	HHCUR	L6	124.3
44 *Rental Income*	HHCUR	L7	19.8
45 *Interest Paid*	SUM L46..L49		289.4
46 To households	HHCUR	L8	165.5
47 To government	GOVCUR	L6	50.3
48 To rest of the world	ROWCUR	L8	29.1
49 To pension reserve funds	ENTCUR	L34	44.5
50 *Dividends Paid*	L51+L52+53		57.3
51 To households	HHCUR	L9	51.8
52 To government	GOVCUR	L7	1.6
53 To rest of the world	ROWCUR	L9	3.9
54 *Retained Corporate Profits by Rest of the World*	ROWCUR	L10	3.2
55 *Taxes Paid*	L56+L57		268.0
56 Indirect taxes	GOVCUR	L4	185.7
57 Corporate profit taxes	GOVCUR	L5	82.3
58 *Surplus of Government Enterprises*	GOVCUR	L8	6.4
59 *Transfer Payments to Households*	HHCUR	L10	58.3
60 Employee pension payments	HHCUR	L11	49.4
61 Non-profit and other transfer payments	HHCUR	L12	8.9
62 *Non-profit Benefits in Kind*	ENTCUR	L5	48.8
63 *Gross Enterprise Saving*	SICAP	L2	360.1
64 Gross retained earnings by enterprises	SICAP	L3	283.4
65 Net income retained by employee pension funds	SICAP	L4	77.4
66 Statistical discrepancy	SICAP	L5	−0.7

The Household Core Account—Table 1.2

The household core account corresponds conceptually to a micro data household survey view of household transactions. On the income side, wages and salaries (line 2) and actual money transfer payments—including employee pension payments—(line 10 and 11), are shown as income received, but withheld compensation and benefits in kind provided by government and employers are excluded. On the outlay side, consumer expenditures on durables and imputed expenditure on owner occupied housing are excluded from current consumption expenditures (line 17).

Table 1.2. HHCUR

Household Current Market Income and Outlay Account
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	TOTAL HOUSEHOLD CURRENT MARKET INCOME	Sum L(2,6..10,13)		1999.0
2	*Wages and Salaries Received*	L3+L4+L5		1337.6
3	From enterprises	ENTCUR	L38	1116.4
4	From government	GOVCUR	L26	220.8
5	From the rest of the world	ROWCUR	L21	0.4
6	*Entrepreneurial and Self-employed Income*	ENTCUR	L43	124.3
7	*Rental Income*	ENTCUR	L44	19.8
8	*Interest Income*	ENTCUR	L46	165.5
9	*Dividends*	ENTCUR	L51	51.8
10	*Transfers Received From Enterprises*	ENTCUR	L59	58.3
11	Employee pension payments received	ENTCUR	L60	49.4
12	Non-profit and other transfers received	ENTCUR	L61	8.9
13	*Transfers Received From Government*	GOVCUR	L32	241.7
14	Social security payments	GOVCUR	L33	118.7
15	Other transfer payments	GOVCUR	L34	123.0
16	TOTAL HOUSEHOLD CURRENT OUTLAYS & GROSS SAVING	Sum L(17,20, 21,27,30)		1999.0
17	*Current Consumption Expenditures*	L18+L19		1052.7
18	Paid to enterprises	ENTCUR	L10	1036.8
19	Paid to rest of world	ROWCUR	L5	15.9
20	*Interest Payments*	ENTCUR	L22	125.6
21	*Tax Payments*	Sum L22..L26		453.1
22	Employee social security taxes	GOVCUR	L10	87.9
23	Personal income taxes	GOVCUR	L11	296.0
24	Estate and gift taxes	GOVCUR	L12	8.8
25	Property taxes	GOVCUR	L13	27.8
26	Other taxes and non-taxes	GOVCUR	L14	32.6
27	*Transfers Paid*	L28+L29		41.1
28	Contributions to non-profits	ENTCUR	L29	39.9
29	Remittances to rest of world (net)	ROWCUR	L14	1.2
30	*Household Gross Saving*	SICAP	L7	326.5

The Government Core Account—Table 1.3

The government core account shows on the receipts side, the payments to government by enterprises (line 2), by households (line 9) and by governmental units for social insurance taxes and benefits in kind withheld from the compensation of government employees (line 15). On the outlay side, the current consumption expenditure by government is constructed from a number of different transaction flows. Specifically, the government net current expenditures from enterprises and rest of the world (lines 21 and 22) must be added to the compensation of government employees (line 25) less that portion that is considered to constitute government capital formation (line 30).

Table 1.3. GOVCUR

Government Current Receipts and Outlay Account
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	TOTAL GOVERNMENT CURRENT RECEIPTS	Sum L(2,9,15,18)		903.6
2	*Payments by Enterprises*	Sum L3..L8		405.1
3	Employer social security tax	ENTCUR	L39	78.8
4	Indirect taxes	ENTCUR	L56	185.7
5	Corporate profit taxes	ENTCUR	L57	82.3
6	Interest	ENTCUR	L47	50.3
7	Dividends	ENTCUR	L52	1.6
8	Surplus of government enterprises	ENTCUR	L58	6.4
9	*Payments by Households*	Sum L10..L14		453.1
10	Employee social security taxes	HHCUR	L22	87.9
11	Personal income taxes	HHCUR	L23	296.0
12	Estate and gift taxes	HHCUR	L24	8.8
13	Property taxes	HHCUR	L25	27.8
14	Other taxes and non-taxes	HHCUR	L26	32.6
15	*Payments by Governments*	L16+L17		42.6
16	Employer social insurance taxes	GOVCUR	L27	37.0
17	Employee benefits in kind	GOVCUR	L29	5.6
18	*Interest Payments by Rest of the World*	ROWCUR	L24	2.8

Table 1.3. Continuation

Government Current Receipts and Outlay Account (Billions of Dollars—Current Year Prices)			
Line	Acct	Line	1980
19 TOTAL GOVERNMENT OUTLAYS & GROSS SAVING	Sum L(20,31,39,42)		903.6
20 *Current Consumption Expenditures*	L(21+22+25−30)		506.5
21 Current net purchases from enterprises	ENTCUR	L16	272.3
22 Current net purchases from rest of world	L23−L24		3.8
23 *Government purchases from rest of world*	ROWCUR	L4	12.5
24 *Less: Government sales to rest of world*	ROWCUR	L19	8.7
25 Compensation of government employees	Sum L26..L29		269.4
26 *Wage and salary payments*	HHCUR	L4	220.8
27 *Employer social security taxes*	GOVCUR	L16	37.0
28 *Employer pension contributions*	ENTCUR	L34	6.0
29 *Employee benefits in kind*	GOVCUR	L17	5.6
30 Less: Compensation of government employees engaged in capital formation	SICAP	L14	39.0
31 *Transfer Payments*	L32+L35+L38		264.5
32 Payments to households	HHCUR	L13	241.7
33 *Social security payments*	HHCUR	L14	118.7
34 *Other transfer payments to households*	HHCUR	L15	123.0
35 Payments to enterprises	L36+L37		17.9
36 *Grants to non-profits*	ENTCUR	L30	10.9
37 *Subsidies*	ENTCUR	L31	7.0
38 Payments to rest of world (net)	ROWCUR	L13	4.9
39 *Interest Paid*	L40+L41		86.6
40 To enterprises	ENTCUR	L23	74.1
41 To rest of world	ROWCUR	L11	12.5
42 *Gross Government Saving*	SICAP	L6	46.0

The Rest of the World Current Account—Table 1.4

The rest of the world current account quite simply shows the receipts and payments by the rest of the world. In this account, however, the balancing item is considered to be net foreign investment (line 15) rather than foreign saving. The rationale of this treatment is that if the gross saving of domestic sectors is related to their gross capital formation, it would seem appropriate that any excess of saving should be considered to be foreign investment.

Table 1.4. ROWCUR

Rest of the World Current Account
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	CURRENT RECEIPTS BY REST OF THE WORLD	Sum L(2,6,11,12,15)		339.9
2	*Imports*		L3+L4+L5	279.8
3	By enterprises	ENTCUR	L20	251.4
4	By government	GOVCUR	L23	12.5
5	By households	HHCUR	L19	15.9
6	*Income Paid to Rest of the World by Enterprises*		Sum L7..L10	36.7
7	Wages and salaries paid	ENTCUR	L42	0.5
8	Interest	ENTCUR	L48	29.1
9	Dividends	ENTCUR	L53	3.9
10	Retained corporate profits by the rest of the world	ENTCUR	L54	3.2
11	*Interest Paid to Rest of the World by Government*	GOVCUR	L41	12.5
12	*Transfers Paid to Rest of the World*		L13+L14	6.1
13	By government (net)	GOVCUR	L38	4.9
14	By households (net)	HHCUR	L29	1.2
15	*Net Foreign Investment*	SICAP	L19	4.8
16	CURRENT PAYMENTS BY REST OF THE WORLD		L17+L20)	339.9
17	*Exports*		L18+L19	255.7
18	By enterprises	ENTCUR	L19	247.0
19	By government	GOVCUR	L24	8.7
20	*Income Received from Rest of the World*	Sum L(21,22,25,26)		84.2
21	Wages and salaries received	HHCUR	L5	0.4
22	Interest received		L23+L24	45.5
23	*By enterprises*	ENTCUR	L25	42.7
24	*By government*	GOVCUR	L18	2.8
25	Dividends received	ENTCUR	L26	22.5
26	Retained rest of the world corporate profits	ENTCUR	L27	15.8

The Gross Saving and Capital Formation Account—Table 1.5

The gross saving and capital formation account draws together the gross saving appearing on the outlay side of the enterprise, household and government sector accounts and the capital formation carried out by these sectors. As already indicated, the difference between the gross saving of these sectors and their capital formation is equal to the net foreign investment. (line 19)

Table 1.5. SICAP

Gross Saving and Capital Formation Account
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	GROSS SAVING	Sum L(2,6,7)		732.6
2	*Enterprise Gross Saving*	ENTCUR	L63	360.1
3	Gross retained earnings by enterprises	ENTCUR	L64	283.4
4	Retained income by pension funds	ENTCUR	L65	77.4
5	Statistical discrepancy	ENTCUR	L66	−0.7
6	*Government Gross Saving*	GOVCUR	L42	46.0
7	*Household Gross Saving*	HHCUR	L30	326.5
8	GROSS CAPITAL FORMATION	Sum L(9,12,15,19)		732.6
9	*Enterprise Gross Capital Formation*	L10+L11		330.8
10	Gross fixed capital formation	ENTCUR	L7	335.6
11	Change in stocks	ENTCUR	L8	−4.8
12	*Government Gross Capital Formation*	L13+L14		85.0
13	Capital Purchases from enterprises	ENTCUR	L17	46.0
14	Compensation of government employees engaged in capital formation	GOVCUR	L30	39.0
15	*Household Gross Capital Formation*	L16+L17+L18		312.0
16	Owner occupied housing	ENTCUR	L12	85.2
17	Consumer durables	ENTCUR	L13	211.9
18	Change in stocks	ENTCUR	L14	14.9
19	*Net Foreign Investment*	ROWCUR	L15	4.8

Sector Financial Accounts—Table 1.6

Finally, it is possible to present in the same sector framework, financial accounts showing the financial transactions taking place in the economy. These accounts show the changes in the assets and liabilities held by the various sectors. For many countries these financial transaction data are provided by banking and monetary authorities rather than by the national accounting or statistical offices. In the United States, for example, these data are published in the flow of funds statistics issued by the Federal Reserve Board rather than by the National Accounts Division of the Department of Commerce. Nevertheless, both the 1968 SNA and the current SNA revision quite appropriately integrate such financial data with national income accounting data. Such data can, furthermore, serve as the basis for developing sector and national balance sheets using perpetual inventory methods of cumulating assets, liabilities and their revaluations.

It should be recognized that for financial analysis, the enterprise sector needs to be disaggregated into sub-sectors along the lines recommended in the proposed revision of the SNA. The primary splitting of the enterprise sector for the purposes of financial accounts would consist of a non-financial sub-sector and a financial sub-sector. Further sub-sectoring of the financial sub-sector would also be needed in order to differentiate among the varieties of financial institutions such as the central bank, other banking, other financial intermediaries, and pension and insurance funds.

Financial accounts, unlike the sector transaction accounts, are not articulated in the sense that the transactions taking place between sectors and sub-sectors are shown explicitly. Instead, each type of financial asset held by all sectors should be equal to the corresponding type of liability for all sectors.

Table 1.6. FINACCT

Sector Financial Accounts—United States, 1980
(Billions of Dollars—Current Year Prices)

Line		1 Enterprises	2 Government	3 Households	4 Rest of World	5 Total
1	TOTAL ASSETS	901.1	142.1	497.8	30.1	1571.1
2	*Gross Capital Formation*	330.8	85.0	312.0	4.8	732.6
3	Structures and durables	335.6	78.3	297.1	0.0	711.0
4	Change in stocks	−4.8	6.7	14.9	0.0	16.8
5	*Land*	(NA)	(NA)	(NA)	(NA)	
6	*Gold and SDRs*	0.0	−1.1	0.0	0.0	−1.1
7	*Financial Assets*	570.3	58.2	185.8	25.3	839.6
8	Currency and deposits	23.8	−6.1	175.0	1.9	194.6
9	Securities other than shares	147.1	14.4	19.0	−4.5	176.0
10	Loans	215.1	20.7	4.3	1.3	241.4
11	Shares and other equities	44.2	11.1	−19.6	16.2	51.9
12	Insurance technical reserves	77.4	0.0	0.0	0.0	77.4
13	Other accounts receivable	62.7	18.1	7.1	10.4	98.3
14	TOTAL LIABILITIES & GROSS CURRENT SAVING	901.1	142.1	497.8	30.1	1571.1
15	*Liabilities*	569.1	109.0	109.3	30.1	817.5
16	Currency and deposits	194.7	1.3	0.0	0.0	196.0
17	Securities other than shares	73.1	103.7	0.0	0.8	177.6
18	Loans	118.1	0.8	105.8	22.3	247.0
19	Shares and other equities	51.9	0.0	0.0	0.0	51.9
20	Insurance technical reserves	77.4	0.0	0.0	0.0	77.4
21	Other accounts receivable	53.9	3.2	3.5	7.0	67.6
22	*Statistical discrepancy*	−28.1	−12.9	62.0	0.0	21.0
23	GROSS CURRENT SAVING	360.1	46.0	326.5	0.0	732.6

Imputation Modules

The imputation modules present information on non-market activity that is considered to be useful in the construction of national accounts. There is, however, no clear agreement as to what activities are to be covered or how these activities are to be valued. The current revision of the UN System of National Accounts is attempting to clarify these issues, and although some guide lines are being developed many problems remain. The imputation module shown in Table 1.7 has been drawn up for the major kinds of imputation that are conventionally included in the national accounts. For the most part, the valuations represent the estimates reported in the United States national accounts.

Farm income in kind—Line 1

Farm income in kind is relatively unimportant for the United States. This is in part due to the small percentage of the population engaged in farming, and the extent to which farming is a commercial enterprise rather than one involving subsistence farming. One cannot help but speculate, however, whether this imputation might not have been larger if food provided by household gardens had been included.

Residential housing income in kind—Line 2

Residential housing for the household sector refers to owner occupied housing. Instead of imputing space rental value, which would include actual transactions relating to maintenance, property taxes, etc., the approach here has been to impute the use of owner occupied housing in terms of capital consumption allowances and imputed interest. The estimates for the book value of capital consumption allowances are based on the depreciation of historical costs and the revaluation estimates take into account the change in the housing prices. The imputed interest is based on the current market value of owner occupied housing.

In the case of enterprises and government, residential housing consists of non-profit and government housing used for students, low income groups or others. The same method of estimating imputed income in kind is used as that used for owner-occupied housing.

Non-residential structures in kind—Line 7

Non-residential structures primarily represent office buildings. Imputations for the services of such buildings are not currently included in the United States national accounts, but are recommended for inclusion in the UN SNA.

Table 1.7. IMPUTE

Imputation Module for United States, 1981				
Line		Enterprise Sector 1	Government Sector 2	Household Sector 3
1	*Farm income in kind*	.2	.0	.2
2	*Residential housing income in kind*	11.5	5.0	152.2
3	Capital consumption allowances	6.5	4.0	45.9
4	*Book value*	.5	.1	19.0
5	*Revaluation*	1.5	.3	26.9
6	Imputed interest	5.0	1.0	106.3
7	*Non-residential structures in kind*	8.0	89.0	0.0
8	Capital consumption allowances	2.8	31.9	0.0
9	*Book value*	1.0	11.4	0.0
10	*Revaluation*	1.8	20.5	0.0
11	Imputed interest	5.2	57.1	0.0
12	*Equipment and durables in kind*	5.9	44.0	233.2
13	Capital consumption allowances	4.0	30.0	180.8
14	*Book value*	2.5	18.6	140.2
15	*Revaluation*	1.5	11.4	40.6
16	Imputed interest	1.9	14.0	52.4
17	*Financial services in kind*	18.2	68.6	260.4
18	TOTAL IMPUTED INCOME IN KIND	43.6	206.6	645.8
19	*Total Capital Consumption*	243.1	65.9	226.7
20	Book value	152.7	31.0	159.2
21	Revaluation	90.4	34.9	67.5

Equipment and durables in kind—Line 12

Consumer durables in both the United States National Accounts and in the UN SNA are treated as current expenditures, but in the core accounts they have been considered to be capital formation. It is, therefore, necessary to impute the services provided by consumer durables if the conventions of the core accounts are to be followed. The estimates for the services of consumer durables follows the method described for owner–occupied housing.

Equipment and durables income in kind for non-profit institutions, government and households are estimated on the same basis as other durables.

Financial services in kind—Line 17

Imputation for financial services in kind is the consequence of the decision to treat interest as a transfer rather than as the provision of a service. The estimates of financial services in kind shown in Table 1.7 are those provided by the Bureau of Economic Analysis of the Department of Commerce. In this connection it is interesting to note that enterprises received an equivalent of $ 286.9 billion in interest from pension funds, government, households, and the rest of the world. This compares with an imputed interest of $ 260.4 billion shown in Table 1.7.

Capital consumption—Line 19

Capital consumption allowances do not represent actual transactions. Rather they are important internal bookkeeping entries that play an important role in determining the measurement of profit for tax reporting and other purposes. Depreciation rates used in calculating capital consumption do not necessarily reflect actual depreciation taking place, but may be in accord with what is permitted by the taxing authorities. Furthermore, with changing prices in the economy, measures of capital consumption based on original book value costs may not be relevant. The revaluation of capital consumption estimates may therefore be desirable to correct the depreciation rates used and to revalue them for price changes taking place in the economy.

The Development of Economic Constructs

As has been indicated, the sector core accounts and the imputation module are basic to the construction of more comprehensive systems of national accounts and economic constructs. The separation of market transactions from imputations for non market activity, makes it possible to analyze more clearly what is taking place in the market sector of the economy. On the other hand, by including the imputations shown in the imputation module more

comprehensive measures of income and consumption can be constructed that take into account non-market activity.

Gross National Income and Product Account (Market Transactions)—Table 1.8

The major function of a gross national income and product account is to show: (1) how the total production of the nation is divided between consumption and gross capital formation, and (2) how economic activity has generated flows of income for different sectors of the economy. Focusing on the actual market transactions that take place in the economy, provides a clear understanding of how the different sectors of the economy are involved in these processes.

In those instances where national income and product accounts reflect primarily aggregate estimates of consumption, capital formation, and income flows, the role that is played by the different sectors of the economy is obscured. It is often difficult to disaggregate the aggregate estimates of consumption or capital formation into their appropriate sector detail. One of the advantages of creating a national income and product account from core sector accounts is that consumption and capital formation and the generation of income is easily delineated in sector terms. The gross national income and product account shown in Table 1.8 is built up from the core sector accounts and is fully articulated with them.

On the product side of the account the transaction flows relating to consumption, gross capital formation and international trade are shown. On the income side, the income originating in each sector of the economy is shown. In the case of the enterprise sector, it has been necessary to deduct from the payments enterprises make to other sectors, the receipts that do not constitute the sale of goods and services. Thus, when an enterprise receives a subsidy, that subsidy provides funds which augment the amount that can be distributed in the form of production costs and profits.

Table 1.8. GNP-M

Gross National Income and Product Account: Market Transactions
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	*Total Consumption (market transactions)*	L2+L3+L6		1663.8
2	Household current expenditures	HHCUR	L17	1052.7
3	Benefits in kind provided by enterprises	ENTCUR	L41	104.6
4	*Employee benefits*	ENTCUR	L4	55.8
5	*Non-profit benefits*	ENTCUR	L5	48.8
6	Government current expenditures	GOVCUR	L20	506.5
7	*Gross Capital Formation*	L8+L11+L15		727.8
8	Enterprise gross capital formation	SICAP	L9	330.8
9	*Structures and durables*	SICAP	L10	335.6
10	*Change in stocks*	SICAP	L11	−4.8
11	Household gross capital formation	SICAP	L15	312.0
12	*Owner-occupied housing*	SICAP	L16	85.2
13	*Consumer durables*	SICAP	L17	211.9
14	*Change in stocks*	SICAP	L18	14.9
15	Government gross capital formation	SICAP	L12	85.0
16	*Capital purchases from enterprises*	SICAP	L13	46.0
17	*Own force capital formation*	SICAP	L14	39.0
18	*Sales to Rest of the World (net)*	L19−L22		−24.1
19	Exports	L20+L21		255.7
20	*Enterprises*	ENTCUR	L19	247.0
21	*Government*	GOVCUR	L24	8.7
22	Less: Imports	L23+L24+L25		279.8
23	*Enterprises*	ENTCUR	L20	251.4
24	*Households*	HHCUR	L18	15.9
25	*Government*	GOVCUR	L23	12.5

Table 1.8. Continuation

Gross National Income and Product Account: Market Transactions
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
26	GROSS DOMESTIC PRODUCT (MARKET TRANSACTIONS)	L1+L7+L18		2367.5
27	Income received from Rest of World	ROWCUR	L20	84.2
28	Less: Income paid to Rest of World	ROWCUR	L6	36.7
29	GROSS NATIONAL PRODUCT (MARKET TRANSACTIONS)	L26+L27−L28		2415.0
30	GROSS INCOME ORIGINATING IN ENTERPRISES	Sum L31..L42		2098.1
31	Compensation of Employees	ENTCUR	L37	1327.8
32	Entrepreneurial and Self-employed Income	ENTCUR	L43	124.3
33	Rental Income	ENTCUR	L44	19.8
34	Interest	ENTCUR	L45	289.4
35	Dividends	ENTCUR	L50	57.3
36	Retained Corporate Profits by the Rest of World	ENTCUR	L54	3.2
37	Taxes Paid	ENTCUR	L55	268.0
38	Surplus of Government Enterprises	ENTCUR	L58	6.4
39	Transfer Payments to Households	ENTCUR	L59	58.3
40	Gross Enterprise Saving	ENTCUR	L62	48.8
41	Compensation of Employees	ENTCUR	L64	360.1
42	Less: Adjustments for Income Received	Sum L43..L46		465.3
43	*Transfers received by enterprises*	ENTCUR	L28	57.8
44	*Interest received by enterprises*	ENTCUR	L21	199.7
45	*Income received from rest of world*	ENTCUR	L24	81.0
46	*Receipts of employer pension funds*	ENTCUR	L32	126.8
47	INCOME ORIGINATING IN GOVERNMENT	L48		269.4
48	Compensation of Government Employees	GOVCUR	L25	269.4
49	GROSS DOMESTIC INCOME (MARKET TRANSACTIONS)	L30+L47		2367.5
50	INCOME ORIGINATING IN REST OF WORLD	L51−L52		47.5
51	Income received from Rest of World	ROWCUR	L20	84.2
52	Less: Income paid to Rest of World	ROWCUR	L6	36.7
53	GROSS NATIONAL INCOME	L49+L50		2415.0

Gross National Income and Product Account (Market and Non-Market)—Table 1.9

Imputations for non-market activity can easily be added to the market transactions accounts in order to provide more comprehensive measures of both consumption and gross income originating in specific sectors. Since no imputations were made for non-market activity related to capital formation, the capital formation data will not be affected. For households, imputations have been included for consumer durable services, owner occupied housing services and financial services. For non-profit enterprises and government, imputations have been included for services of buildings, the service of durables and financial services.

The imputations increase total consumption in the United States economy for the year 1980 from $ 1,663.8 to $ 2,559.8 billion dollars—an increase of 53.8%. It may be argued that the magnitude of these imputations is due in part to the treatment of consumer durables as capital goods rather than as current consumption, but the imputed services for consumer durables account for only $ 233.2 million dollars (25%) of the total imputations. If the expenditure on consumer durables for 1980 had been used instead of the imputation, it would have added $211.9 million to consumption expenditures.

Table 1.9. GNP-T

Gross National Income and Product Account
Total Market and Non-Market
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
1	*Total Consumption*	L2+L7+L10		2559.8
2	Household consumption	L3+L4+L5+L6		1698.5
3	*Household current expenditures*	HHCUR	L17	1052.7
4	*Services of consumer durables*	IMPUTE	L12C3	233.2
5	*Services of owner-occupied housing*	IMPUTE	L2C3	152.2
6	*Financial services*	IMPUTE	L17C3	260.4
7	Enterprise consumption	L8+L9		148.2
8	*Enterprise expenditures on benefits in kind*	ENTCUR	L3	104.6
9	*In kind services received by non-profits*	IMPUTE	L18C1	43.6
10	Government consumption	L11+L12		713.1
11	*Government current expenditures*	GOVCUR	L20	506.5
12	*In kind services received by government*	IMPUTE	L18C2	206.6
13	*Gross Capital Formation*	L14+L17+L21		727.8
14	Enterprise gross capital formation	SICAP	L9	330.8
15	*Structures and durables*	SICAP	L10	335.6
16	*Change in stocks*	SICAP	L11	−4.8
17	Household gross capital formation	SICAP	L15	312.0
18	*Owner-occupied housing*	SICAP	L16	85.2
19	*Consumer durables*	SICAP	L17	211.9
20	*Change in stocks*	SICAP	L18	14.9
21	Government gross capital formation	SICAP	L12	85.0
22	*Capital purchases from enterprises*	SICAP	L13	46.0
23	*Own force capital formation*	SICAP	L14	39.0
24	*Sales to Rest of the World (net)*	L25−L28		−24.1
25	Exports	L26+L27		255.7
26	*Enterprises*	ENTCUR	L19	247.0
27	*Government*	GOVCUR	L24	8.7
28	Less: Imports	L29+L30+L31		279.8
29	*Enterprises*	ENTCUR	L20	251.4
30	*Households*	HHCUR	L18	15.9
31	*Government*	GOVCUR	L23	12.5
32	GROSS DOMESTIC PRODUCT (MARKET TRANSACTIONS)	L1+L13+L24		3263.5
33	Income received from Rest of World	ROWCUR	L20	84.2
34	Less: Income paid to Rest of World	ROWCUR	L6	36.7
35	GROSS NATIONAL PRODUCT (MARKET TRANSACTIONS)	L32+L33−L34		3311.0

Table 1.9. Continuation

Gross National Income and Product Account Total Market and Non-Market (Billions of Dollars—Current Year Prices)			
Line	Acct	Line	1980
36 GROSS INCOME ORIGINATING IN ENTERPRISES	(Sum L37..L48)−L49		2141.7
37 Compensation of Employees	ENTCUR	L37	1327.8
38 Entrepreneurial and Self-employed Income	ENTCUR	L43	124.3
39 Rental Income	ENTCUR	L44	19.8
40 Interest	ENTCUR	L45	289.4
41 Dividends	ENTCUR	L50	57.3
42 Retained Corporate Profits by the Rest of World	ENTCUR	L54	3.2
43 Taxes Paid	ENTCUR	L55	268.0
44 Surplus of Government Enterprises	ENTCUR	L58	6.4
45 Transfer Payments to Households	ENTCUR	L59	58.3
46 Non-profits Benefits in Kind	ENTCUR	L62	48.8
47 Gross Imputed Income of Non-profits	IMPUTE	L18	43.6
48 Gross Enterprise Saving	ENTCUR	L63	360.1
49 Less: Adjustments for Income Received	Sum L50..L53		465.3
50 *Transfers received by enterprises*	ENTCUR	L28	57.8
51 *Interest received by enterprises*	ENTCUR	L21	199.7
52 *Income received from rest of world*	ENTCUR	L24	81.0
53 *Receipts of employer pension funds*	ENTCUR	L32	126.8
54 GROSS INCOME ORIGINATING IN HOUSEHOLDS	L55+L56+L57		645.8
55 Gross Income from Consumer Durables	IMPUTE	L12C3	233.2
56 Gross Income from Owner-Occupied Housing	IMPUTE	L2C3	152.2
57 Imputed Financial Services Income	IMPUTE	L17C3	260.4
58 GROSS INCOME ORIGINATING IN GOVERNMENT	L59+L60		476.0
59 Compensation of Government Employees	GOVCUR	L25	269.4
60 Gross Imputed Income of Government	IMPUTE	L18C2	206.6
61 GROSS DOMESTIC INCOME (MARKET AND NON-MARKET)			3263.5
62 INCOME ORIGINATING IN REST OF WORLD	L63−L64		47.5
63 Income received from Rest of World	ROWCUR	L20	84.2
64 Less: Income paid to Rest of World	ROWCUR	L6	36.7
65 GROSS NATIONAL INCOME (MARKET AND NON-MARKET)	L61+L62		3311.0

Net Economic Constructs—Table 1.10

By applying the imputed estimates for capital consumption it is possible to derive net measures of capital formation, net national product and national income. These economic constructs are shown in Table 1.10. With respect to net capital formation, it can be seen that the capital consumption allowances are quite large relative to gross capital formation, and thus net capital formation is relatively small.

The concept of capital consumption poses a number of problems. In the case of structures, the decline in their value over time depends to a major degree on their repair and maintenance. Although repair and maintenance are not considered to be part of gross capital formation, they can result in preventing a decline in the value of a building and can even improve it over time. For some types of equipment that actually wear out, such as motor vehicles, it is possible to determine their physical life, and in these cases capital consumption measures are meaningful. In other cases where obsolescence is the major factor determining economic life, the use of capital consumption is more questionable.

From a micro point of view, the allocation of durable equipment over its useful economic life is appropriate for calculating profit and for computing the value of an asset at a given moment of time. However, from a macro point of view, obsolescence may arise from rapid technological change reflecting the increased productivity of new equipment over older equipment. A faster rate of technical change in an economy will result in faster obsolescence, but it would not be appropriate to reduce the real output of the economy by deducting the resulting increase in capital consumption.

For these reasons, economists primarily concerned with the behavior of the economic system prefer gross measures of production and capital formation. However, economists attempting to study real measures of output and economic welfare will find it necessary to adjust the gross measures of output and capital formation for the using up of capital.

Table 1.10. NNP-T

Net National Income and Product Total Market and Non-Market (Billions of Dollars—Current Year Prices)			
Line	Acct	Line	1980
1 *Total Consumption*	L2+L3+L4		2559.8
2 Household Consumption	GNP-T	L2	1698.5
3 Enterprise Consumption	GNP-T	L7	148.2
4 Government Consumption	GNP-T	L10	713.1
6 *Net Capital Formation*	L7+L12+L17		192.1
7 Enterprise net Capital Formation	L8−L9		87.7
8 *Enterprise gross capital formation*	GNP-T	L14	330.8
9 *Less: Capital consumption*	IMPUTE	L19C1	243.1
10 Book value	IMPUTE	L20C1	152.7
11 Revaluation	IMPUTE	L21C1	90.4
12 Household net Capital Formation	L13−L14		85.3
13 *Household gross capital formation*	GNP-T	L17	312.0
14 *Less: Capital consumption*	IMPUTE	L19C3	226.7
15 Book value	IMPUTE	L20C3	159.2
16 Revaluation	IMPUTE	L21C3	67.5
17 Government net Capital Formation	L18−L19		19.1
18 *Government gross capital formation*	GNP-T	L21	85.0
19 *Less: Capital consumption*	IMPUTE	L19C2	65.9
20 Book value	IMPUTE	L20C2	31.0
21 Revaluation	IMPUTE	L21C2	34.9
22 *Sales to Rest of World (net)*	GNP-T	L24	−24.1

Table 1.10. Continuation

Net National Income and Product
Total Market and Non-Market
(Billions of Dollars—Current Year Prices)

Line		Acct	Line	1980
23	NET DOMESTIC PRODUCT (MARKET AND NON-MARKET)	L1+L6+L22		2727.8
24	Income received from Rest of World	GNP-T	L33	84.2
25	Less: Income paid to Rest of World	GNP-T	L34	36.7
26	NET NATIONAL PRODUCT (MARKET AND NON-MARKET)	L23+L24−L25		2775.3
27	NET INCOME ORIGINATING IN ENTERPRISES	L28−L29		1898.6
28	Gross Income Originating in Enterprises	GNP-T	L36	2141.7
29	Less: Capital consumption	IMPUTE	L19C1	243.1
30	*Book value*	IMPUTE	L20C1	152.7
31	*Revaluation*	IMPUTE	L21C1	90.4
32	NET INCOME ORIGINATING IN HOUSEHOLDS	L33−L34		419.1
33	Gross Income Originating in Households	GNP-T	L54	645.8
34	Less: Capital consumption	IMPUTE	L19C3	226.7
35	*Book value*	IMPUTE	L20C3	159.2
36	*Revaluation*	IMPUTE	L21C3	67.5
37	NET INCOME ORIGINATING IN GOVERNMENT	L38−L39		410.1
38	Gross Income Originating in Government	GNP-T	L58	476.0
39	Less: Capital consumption	IMPUTE	L19C2	65.9
40	*Book value*	IMPUTE	L20C2	31.0
41	*Revaluation*	IMPUTE	L21C2	34.9
42	NET DOMESTIC INCOME MARKET AND NON-MARKET)	L27+L32+L37		2727.8
43	INCOME ORIGINATING IN REST OF WORLD	GNP-T	L62	47.5
44	NET NATIONAL INCOME (MARKET AND NON-MARKET)	L42+L43		2775.3

Summary and Concluding Observations

Summary

The United Nations System of National Accounts consists of a logically consistent and integrated set of macro-economic accounts which conform to a set of internationally agreed concepts, definitions, classifications and accounting rules. Although the system contains certain aggregates such as Gross Domestic Product that are considered to be important, these aggregates are not the major reason for compiling national accounts. The national accounts provide a comprehensive framework for integrating data required for a wide variety of different analytic and policy purposes. As such a framework, it is directly relevant to the problem of monitoring the transition of the Soviet system to a market economy.

Despite the acknowledged desirability of adopting many of the definitions, classifications and concepts developed by the United Nations System of National Accounts, implementation of a formal system of accounts poses many problems. On the one hand, implementation of the 1968 version would present the problem of integrating various alternative parts of the 1968 Blue Book with over 50 manuals and guides published by the United Nations on the SNA since 1968 and with the United Nations National Accounts Questionnaire. On the other hand, with respect to the current revision of the SNA which is in progress, it is recognized that the tables, matrices and accounts that are included in the system are designed to explain the features of the SNA and are not intended for the compilation of data at a national or international level. Countries are urged to selectively draw upon the SNA principles, concepts, and accounts to provide a system that will meet their analytic and policy needs.

The SNA as outlined in both the 1968 Blue Book and the current draft of the *Review of the SNA* is large and complex. This has caused some statistical offices to seek a simpler approach. It has been proposed that "core" accounts that would record the actual market transactions for the major sectors of the economy be implemented. These core accounts together with modules containing the imputations for non-market activity and rerouting of transactions could furnish the basis for developing the more complex and elaborate SNA accounts and economic constructs. It is argued that such a core account system would be simpler and more flexible than alternative approaches and, even more importantly, it can provide for better integration between macro and micro data.

Before such sector core accounts can be implemented, however, a number of issues relating to the sectoring of the economy, the general accounting structure, and the nature of imputations need to be evaluated. The evaluation in this paper has concluded that some changes would be required in the SNA definition of major sectors, accounting structure, and treatment of certain imputations and rerouting.

After determining the requirements for sector core accounts, these have been implemented for the United States economy for the year 1980. The basic data source for these core accounts and imputations module is the official United States national income accounts. Sector financial accounts were also constructed using United States flow of funds data. The core accounts were then used to construct national income and product accounts that reflected market transactions. By introducing imputations, a more comprehensive national income and product account and a net national income and product account were constructed.

It is argued that this system of core accounts and imputations not only introduces simplicity and flexibility, but that is also provides information that is analytically more useful and is more capable of being integrated with micro data.

Additional Information Requirements

For developing input-output tables, both make and use matrices of products made and used by establishments classified by industry are needed. This requires data at the enterprise-establishment level on materials used and products produced by industry. Price indexes are needed to deflate the current price data in both the input-output tables and the national income accounts in order to develop real output and consumption data. Employment data that are matched with production data are needed for measuring changes in labor productivity. If national balance sheets are to be constructed, information will be required on the holdings of assets and liabilities by different sectors of the economy and the revaluation of these over time.

Disaggregation of the various sectors and aggregate transaction flows will also be needed. The breakdown of the enterprise sector into industries for the measurement of output, and into non-financial and financial sub-sectors for financial analysis has already be mentioned. However, for the Soviet Union, regional breakdowns may also be of central importance. Government needs to be sub-sectored by level of government, and a functional breakdown of government outlays is needed. For the household sector a breakdown of

consumer expenditures is important and a sub-sectoring of households by size of income would be useful.

Sources and Methods

In any country, the sources for constructing statistical systems consist of (1) administrative data, (2) complete censuses, and (3) sample surveys. On a current basis, most countries are coming to rely to a large extent on administrative data supplemented by sample surveys. Complete censuses are primarily useful for developing more exhaustive and reliable benchmark estimates for specific periods, providing sampling frames, and evaluating the completeness of administrative sources.

Among administrative sources, data files relating to employment and taxes are often the most comprehensive and if computerized are capable of being classified into categories relevant to statistical analysis. In instances where these files are too large to be easily utilized, sampling may be appropriate. To a considerable extent, the classifications systems used for statistical data may need to be adapted to the form in which the data are available.

In some instances, the administrative sources can be used to establish the main control totals in the system, and sample surveys can be used to provide the desired detail, breakdowns, or supplementary data. For these reasons, it is important that the link between micro data and the macro concepts used in aggregate data be preserved as much as possible. Registers of enterprises, governmental units and other types of reporting units and demographic sampling frames are needed not only for the collection of data but of the evaluation of the completeness and representativeness of specific sets of data.

In developing micro data files that underlie the macro statistical data, it will often be found that it is necessary to introduce adjustments for missing data. These adjustments may be required because certain respondents were missing from the micro data set or because specific information was not reported or incorrectly reported by existing respondents. In both of these instances, adjustments will need to be made to bring the macro data up to the appropriate level. It is of central importance that the adjustments be made at the level of the micro-unit so that when the micro data are aggregated they will yield consistent macro aggregates. It is only by following this procedure that the micro data sets can successfully be used to generate consistent alternative disaggregations of the macro data.

Finally, although the United Nations System of National Account does not use longitudinal data, it will be found that linking of observations at the micro data level on a longitudinal basis will be analytically very useful. The United States Bureau of the Census currently maintains the *Census of Manufactures* and the *Annual Survey of Manufactures* on a longitudinal basis. The household sample *Survey of Income and Program Participation* is also designed to yield longitudinal data. These types of data make it possible to analyze behavior at the level of the micro reporting unit; if the macro national accounts are designed to be compatible with such micro data improved understanding of the processes of aggregate structural change and the behavior of individual units in the economy will be possible.

Cost- and Welfare-Oriented Measurement in Environmental Accounting

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Introduction

Some theories have been doomed for obscurity several times; nevertheless, they appear to flourish in spite of their predicted demise. A good example for this seems to be the welfare theory and its application in the measurement of the development of economic welfare. The discussion surrounding the proposals of Nordhaus–Tobin and the Japanese NNW committee has identified a variety of weak points.[1] Nonetheless, the present discussion on adjustments of the aggregates of national accounts in order to account for the environmental deterioration by economic activities has revealed the need for welfare-oriented measures of economic development. The purpose of this paper is to contribute to this consideration. It presents an approach to integrating a cost-oriented concept. It should be stressed that the following considerations focus only on the welfare aspects of the interrelationship between the economy and the natural environment and therefore neglect other important welfare components of economic development.

[1] Nordhaus, Tobin (1973), NNW-Committee (1973) and the critical comments of R. Stone in United Nations (1974) and Chr. Saunders in United Nations (1977). See also Drechsler (1976).

The possible future use of the System of National Accounts (SNA) of the United Nations in the USSR will raise the question to what extent environmental problems should be reflected in the future accounting system. It seems useful to apply the conventional concepts of the SNA in a first step and to consider modifications of this system for analyzing economic-environmental interrelationships in a second phase. In any case, the urgent need for a suitable data base for environmental policy seems to necessitate conceptual considerations in this field already at an early stage of the work.

Cost-Oriented Measurement of the Economic-Environmental Interrelationship

The system of national accounting has—as many models in theoretical economics—a *dual* concept. It describes both the costs of production and the use of the products. The description of the costs of production focuses on the *value added* of the different producing industries, whereas the main purpose of analyzing the use of products lies in identifying the *final demand* (final consumption of households and government, capital accumulation, exports); which is often used with or without corrections for measuring the economic welfare development. The accounting identities of national accounts guarantee the identity of value added (plus imports) and final demand.

Cost-oriented measures of the economic impacts on the natural environment could be based on an *extension* of the *capital* concept of national accounting. The costs of using man-made capital are taken into account in the traditional national accounts as depreciation and valued at the costs necessary to maintain the level of the capital during the reporting period. The imputed costs of using natural capital could be introduced in a similar way. The costs of maintaining natural capital comprise the depletion costs of exhaustable and renewable resources and the costs of degrading the natural assets by discharging wastes, waste-water and air pollution or by deteriorating the landscape and ecosystems (by cultivation, development, restructuring, etc.). These costs could be estimated by the amount necessary to avoid negative impacts of the economic activities on the natural environment or to restore the natural environment already deteriorated.

The first three columns of Table 2.1 show a numerical example of the proposed extensions of the national accounts' cost concepts.[2] The exam-

[2]Further information on the cost approach and on the numerical example is given in Bartelmus, Stahmer, van Tongeren (1989).

ple implies not only an extension of the asset boundary (including natural capital), but also of the ***production boundary.*** The concept of household production has been introduced to show the environmental impacts of household activities in a similar way as those of the production activities of enterprises and government sectors. All environmental protection activities (sold on the market or for internal purposes only) are shown in a separate sector.[3] The *output* of environmental protection services amounts to 67.9, that of the other industries to 481.2 and that of households to 331.3 (see rows 4.1 to 4.3). The value of household production is estimated by its total costs.

The *intermediate consumption* of industry and households is shown in the rows 1.1 and 1.2. The *gross value added* (34.1; 259.3; 184.3) of the producers can be computed by subtracting intermediate consumption from gross output. The gross value added of the cost-oriented approach is not affected by the imputed environmental costs because these costs are interpreted as capital depreciation and, therefore, are only taken into account in the context of the transition from the gross to the net concept of value added. The *use of assets* comprises the use of economically produced assets (i.e. buildings, machinery and equipment), which is included in the traditional national accounts under the item "consumption of fixed capital," and the use of non-produced natural assets (like wild biota, land, subsoil assets, water and air). The use of produced assets also comprises the use of consumer durables (22.3). The use of nonproduced natural assets contains the depletion of exhaustable and renewable assets (0.7; 16.8; 0.7), the degradation of land (landscape, ecosystems) by restructuring, development and cultivation (0.2; 8.8; 0.8) and the degradation of land, water and air by unwanted residuals of the production processes (10.0; 23.3; 12.8). Degrading effects of the produced assets (i.e. pollution of controlled landfills) are recorded in connection with the capital accumulation (column (10): 5.1 and column (11): 2.8) and shifted in a second step to the producers who have used the assets (i.e. establishments disposing wastes in controlled landfills) (3.9; 1.2; 2.8). The deterioration of natural assets could be estimated by using the avoidance or restoration costs.

[3]This implies an additional output of the internally produced environmental protection services (valued at their total costs) and an additional intermediate consumption of these services in the industries which have produced them for own purposes.

Table 2.1. Cost- and welfare-oriented description of the economic-environmental interactions.

1.1 USE/VALUE ADDED	Domestic production				
	Industries		Households	Environmental services	
	Env. protection activities	Other		Disposal services	Consumptive services
	(1)	(2)	(3)	(4)	(5)
1 Use of products					
1.1 Env. protection activities		54.1	8.8		
1.2 Other products of industries	33.8	167.8	138.2		
1.3 Household products					
1.4 Environmental services					
1.5 Adjustments of final demand					
1.5.1 Env. protection services				+43.0	
1.5.2 Actual damage costs					+12.7
Env. adjusted gross value added	34.1	259.3	184.3	17.7	−88.0
2 Use of assets					
2.1 Produced assets	6.1	20.2	22.3		
2.2 Non-Produced natural assets					
2.2.1 Depletion of exhaustable or renewable resources	0.7	16.8	0.7		
2.2.2 Degradation of landscape ecosystems etc. (except by residuals)	0.2	8.8	0.8		
2.2.3 Degradation by residuals					
2.2.3.1 Current production prod. assets	10.0	23.3	12.8		
2.2.3.2 Produced assets (adjustments of final demand)	3.9	1.2	2.8		
3 Env. adjusted net value added	13.2	189.0	144.9	17.7	−88.0
3.1 Net value added	28.0	239.1	162.0	−43.0	−12.7
3.2 Eco margin	−14.8	−50.1	−17.1	60.7	−75.3
1.2 SUPPLY					
4 Supply of products					
4.1 Env. prot. services	67.9				
4.2 Other products of industries		481.2			
4.3 Household products			331.3		
4.4 Environmental services				60.7	−75.3
5 Origin of residuals					

Table 2.1. (Continuation.)

1.1 USE/VALUE ADDED

Final consumption				Net capital accumul.			Rest of world	
		Environmental services		Produced assets				
Households	Government	Disposal services	Consumptive services	Industries	Households	Non-produced natural assets	Export/import of goods and services	Residual flows
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	5.0							
	37.5			76.7	28.0		73.7	
331.3								
		60.7	−75.3					
−21.4	−2.6			− 9.3	−1.9		−7.8	
−12.7								
				−26.3	−22.3			
				− 0.9		−17.3		
				− 0.9		− 9.8		
	−5.0			5.1	2.8	−45.9		−4.7
				− 5.1	− 2.8			

1.2 SUPPLY

							74.5	
								−1.5

The possibilities and problems of this estimation concept are discussed further in Bartelmus, Stahmer, van Tongeren (1989). The total costs for using the produced (48.6) and non-produced (82.0) assets are subtracted from the gross value added to obtain environmentally adjusted net value added (13.2; 189.0; 144.9). These values could be further subdivided according to the traditional net value added and to the necessary environmental adjustments which are called eco-margin (−14.8; −50.1; −17.1).

The environmentally adjusted net value added reflects the income which would have originated in production if the producers had taken care to maintain the man-made and natural capital used in production processes. This concept corresponds with the idea of *sustainability* which has increasingly gained in importance and popularity in the international discussion of economic development.[4] A risk-averse strategy of economic development which takes into account the irreversibilities of economic impacts on the natural environment and the uncertainties with regard to the economic-environmental interactions has to imply that the quantities and qualities of the natural capital should at least be maintained for the next generations. Furthermore, the environmental costs are associated with the economic activities which have caused the environmental depletion or degradation. This treatment seems to create a suitable information source for political measures ("polluter pays principle," etc.).

The introduction of values for the use of natural assets measured in terms of their depletion and degradation costs implies an extension of the concept of capital accumulation and some minor changes of final consumption and exports. In Table 1.1, *net capital accumulation* (columns (10) to (12)) comprises not only the gross capital formation of produced assets (industries: 76.7; households: 28.0) and their consumption in the reporting period (−26.3 and −22.3), but also the value of the deterioration of natural assets (depletion: −0.9 and −17.3; degradation of landscape, ecosystems, etc.: −9.8; degradation by residuals: −45.9). As far as the residuals of domestic production are transported to the rest of the world, a value for "*exports*" of residuals is included (−4.7). This corresponds with "*imports*" of residuals (−1.6). Environmental protection activities of the government which have restored the natural assets are treated as gross capital accumulation of natural assets and therefore shifted from *final consumption* to capital accumulation (−5.0).

[4] See Pearce, Markandya, Barbier (1989) and (1990); Bartelmus (1989).

Environmental Services

The cost-oriented approach, discussed in the preceding section of this paper, does not provide a suitable welfare measure for the environmental impacts of economic activities. This approach only shows the necessary additional costs for maintaining certain standards of environmental quality without valuing the welfare losses of the population due to a deteriorated natural environment.

In the following, an approach is discussed to establish a linkage between the cost-oriented and the welfare-oriented approach. In my opinion, this could be done by further extending the *production boundary* of the national accounting system and introducing the concept of services (functions) of the natural environment.[5]

The environmental media (land, water and air) have different *functions*, that are often in competition with one another. The most important examples of such competition is the use of the natural environment for disposing of unwanted residuals from economic activities (disposal services) and for consumptive purposes (i.e. land for recreation, water for drinking, air for respiration). The abuse of the natural environment for storing residuals could lead to losses of the consumption functions of nature.[6] The cost-oriented approach takes into account functions of the natural environment which are connected with degrading the environmental quality, like disposal services or the spatial function of land for economic purposes, which is often connected with a degradation of landscape and ecosystems due to restructuring and cultivation. If these services were treated as production activities in an extended framework, they could be valued at their avoidance or restoration costs.[7] In Table 1.1, these services are introduced in column (4). The output value corresponds to the value of degradation by residuals and degradation of landscape, ecosystems, etc. in the rows 2.2.2, 2.2.3.1 and 2.2.3.2 (63.8). The only correction which has been made refers to the "foreign trade" with residuals. The disposal services of the domestic environment (60.7) comprise the disposal of domestic residuals as far as they are not "exported" (63.8 minus 4.7) and the disposal of "imported" residuals (1.6). The disposal (and the mentioned spatial) services of the natural environment are treated as non-market production and shown as final domestic consumption (60.7).

[5]See Hueting (1980) and Peskin (1989).
[6]See especially Hueting (1980), Chapter 4.1.
[7]See Peskin (1989).

It seems impossible to estimate the total value of the environmental functions in as far as they deliver consumptive services for the population. The different valuation concepts which have been proposed should be applied for measuring at least the quality *change* of the consumptive environmental services (the losses of functions) during the reporting period.[8] The methods of non-market valuation of these services comprise especially the different types of contingent valuation (willingness-to-pay approach, etc.). The discussion on the usefulness of these approaches has been very controversial in the past. They seem to be the only suitable methods if the welfare aspects of the environmental-economic interrelationship are to be analyzed. Furthermore, the approaches have been improved substantially and have overcome several weak points which have been criticized.[9] In the example (Table 1.1), the decrease of the environmental services for the population's consumption has been estimated at -75.3. This change of non-market services is treated as value of gross output which is used as final consumption.

It should be mentioned that the value of the disposal services and the value of the consumptive services of the environment are *not directly comparable*. The disposal services are measured at the moment at which the residuals of the economic activities enter the natural environment. The impacts of these residuals on the environmental media might be spread over a longer period of time. A time lag can also be observed between the immediate impacts of the (deteriorated) natural environment on the population and the resulting diseases or other ailments. Nevertheless, a comparison between the hypothetical costs of avoiding (or restoring) decreases in environmental quality and the amount of money the population would be willing to pay for the avoidance activities could give an impression of the possible proportion between costs and benefits for avoiding activities. In our example, the necessary avoidance costs for maintaining the level of environmental quality amounts to 60.7, whereas the population would be willing to pay 75.3.

Two further *corrections* of final demand are in order to attain a more welfare-oriented measure of economic welfare in the context of environmental accounting.

One of the corrections refers to the *environmental protection activities* which are directly or indirectly part of the final demand. If the development of environmental quality is directly measured as a decrease (or increase) of environmental services, it does not seem necessary to include the value of en-

[8] See especially OECD (1989) and Pearce, Markandya, Barbier (1989).

[9] See OECD (1989) and Schulz, Schulz (1989).

vironmental protection services as an indirect welfare indicator of decreasing (or increasing) environmental quality as part of final demand. The costs of environmental protection activities could be treated as "defensive expenditures" and subtracted from final demand.[10] This subtraction is not a trivial task because the protection costs are often of intermediate character and only indirectly part of the final demand. Using an input-output model, it is possible to identify the value added of environmental protection services as an indirect component of the different categories of final demand.[11] In our example, the environmental protection part of final demand categories (43.0: 21.4; 2.6; 9.3; 1.9; 7.8) has been shifted to the disposal services of the natural environment and treated as intermediate consumption with a corresponding negative correction of net value added. This treatment might facilitate a comparison of the actual environmental protection costs and the additionally necessary hypothetical environmental protection costs to meet certain sustainability standards.

The second correction of final demand refers to the *"actual damage costs"* caused by environmental deterioration (i.e. health expenditures of households). These costs also have the characteristics of "defensive expenditures" and could therefore be subtracted from final demand if the accounting framework was aimed at more welfare-oriented measures. In the extended framework, the value of the decrease of environmental consumption services is used as a welfare indicator instead of the development of the actual damage costs. In this context, further considerations are necessary regarding possible double accounting could appear if both the actual damage costs and imputed damage values were subtracted from final demand. It might be necessary to calculate a lower decrease of consumptive environmental services to avoid double counting.

In the numerical example, the actual damage costs are only identified as part of final consumption of households (12.7). They are shifted to the column "consumptive environmental services" as intermediate consumption with a corresponding negative correction of the net value added.

Welfare-Oriented Measurement of Final Demand

The introduction of non-produced natural assets and of environmental services would substantially change the categories of final demand.

[10] See Leipert (1989).

[11] See Schäfer, Stahmer (1989).

In comparison with the traditional concept, *final consumption* has been modified with respect to four conceptual changes:

- The final consumption of households has been increased to give a complete picture of household production (traditional value of 175.0 minus purchases of consumer durables (28.0) plus consumption of consumer durables (22.3) plus net value added (162.0) equals 331.3).
- The government final consumption has been reduced by the environmental restoration costs (−5.0).
- The introduction of environmental services increase the final consumption by the value of disposal services (60.7) and diminishes this aggregate by the value of the decrease of environmental consumptive services (−75.3).
- The shift of actual "defensive expenditures" from the final demand to the intermediate consumption decreases the final consumption by 36.7 (21.4; +2.6; +12.7).

These changes result in an increase of final consumption from 217.5 to 317.5. The main reason for this change (+100.0) is the introduction of household production (156.3). The different environmental adjustments have reduced final consumption by 56.3.

Net capital accumulation has been modified regarding three aspects:

- The concept of household production modifies the net capital accumulation by the net capital formation of consumer durables (5.7: 28.0 minus 22.3).
- The introduction of the concept of non-produced natural assets and the measurement of the depletion and degradation of the natural assets reduces the net accumulation by 73.9 (0.9; 17.3; 45.9; 9.8).
- The shift of "defensive expenditures" to intermediate consumption diminishes the net capital formation of produced assets by 11.2 (9.3 plus 1.9).
- The additional costs of produced assets with respect to their degrading effects on the natural environment (51 and 2.8) are first added and in a second step shifted to intermediate consumption. Therefore, they do not affect the total net capital accumulation.

The total net capital accumulation has been substantially reduced in this framework (50.4 to −29.0). The main reason is the introduction of the value for depleting and degrading the natural assets (−73.9). Minor changes are

the net accumulation of consumer durables (+5.7) and the shift of defensive expenditures (−11.2).

The economic interactions with the *rest of the world* are modified because of two conceptual changes:

- The "exports" and "imports" of residuals (−4.7 and −1.6) and
- the correction of the export of goods and services by the content of environmental protection services (−7.8).

The total of the balance of exports and imports has changed form −0.8 (73.7 minus 74.5) to −11.7 (61.2 minus 72.9).

Cost-Oriented and Welfare Oriented Macro-Economic Indicators

The *cost-oriented* concepts of this framework which have been described in section 2 of this paper result in the following macro-economic aggregates:

	Traditional gross domestic product (GDP) (259.3 + 34.1)	293.4
+	Gross value added of Household production	184.3
=	Cost-oriented GDP	477.7
−	Consumption of produced assets	
	Industries (traditional concept)	26.3
	Household production	22.3
−	Depletion of natural assets	18.2
−	Degradation of natural assets	63.8
=	Cost-oriented Net domestic product (NDP)	347.1
=	Traditional NDP (28.0 + 239.1)	267.1
+	Net value added of household production	162.0
−	Depletion and degradation of natural assets	82.0

These cost-oriented indicators could also be calculated using the corrected final demand aggregates:

	Traditional final consumption (private 175.0, government 42.5)	217.5
+	Correction of household production (162.0 + 22.3 − 28.0)	156.3
−	Shift of restoration costs	5.0
+	Traditional net capital accumulation (76.7 − 26.3)	50.4
+	Net capital accumulation of households (28.0 − 22.3)	5.7
−	Depletion and degradation of natural assets (0.9 + 17.3 + 45.9 + 9.8)	73.9
+	Traditional balance of exports minus imports	− 0.8
+	Balances of "exports/imports of residuals" (− 4.7 + 1.6)	− 3.1
=	Cost-oriented NDP	347.1

The *welfare-oriented* macro-indicators differ from the cost-oriented indicators as follows:

	Cost-oriented GDP	477.7
+	Environmental disposal services	60.7
+	Environmental consumptive services (only changes)	− 73.3
−	Defensive expenditures	
	environmental protection services	43.0
	actual damage costs	12.7
=	Welfare-oriented GDP	407.4

The transition from the gross to the net concept of the domestic product is the same for both cost and welfare concepts:

	Welfare-oriented GDP	407.4
−	Consumption of produced assets	48.6
−	Depletion and degradation of natural assets	82.0
=	Welfare-oriented NDP	276.8

The corrections of final demand for deriving welfare-oriented measures have already been described:

	Welfare-oriented GDP	276.8
=	Corrected final consumption	317.5
+	Corrected net capital accumulation	− 29.0
+	Corrected balance of exports and imports	− 11.7

Comparing the *environmental adjustments* of the cost-oriented and welfare-oriented NDP in relation to the unadjusted NDP (only with corrections of household production), the following different points of view could be revealed:

	Environmentally unadjusted NDP (28.0 + 239.1 + 162.0)	429.1
−	Depletion of natural assets	18.2
−	Degradation of natural assets	63.8
=	Cost-oriented NDP	347.1
+	Environmental disposal services	60.7
+	Environmental consumptive services	− 75.3
−	Defensive costs	55.7
=	Welfare-oriented GDP	276.8

The corresponding Corrections of the GDP are:

	Environmentally unadjusted NDP (= cost-oriented GDP)	477.7
+	Environmental disposal services	60.7
+	Environmental consumptive services	− 75.3
−	Defensive costs	55.7
=	Welfare-oriented GDP	407.4

This synopsis of the environmental adjustments indicates that three important indicators could be used with regard to different aims of analysis:

(1) For analyzing the cost development of the economy and the sustainable income, the cost-oriented NDP could be used, reflecting the income that could be maintained if both man-made and natural capital should be kept intact.

(2) For analyzing the different services of the environment, the welfare-oriented GDP could be used, which allows a comparison between the benefits and disbenefits of the environmental services.

(3) For welfare analysis, the welfare-oriented NDP seems to be the suitable aggregate. In comparison with the cost-oriented aggregates, the welfare-oriented NDP does not reflect additional costs of production, but actually the impacts of the environmental deterioration on the population.

The different measures proposed in this paper correspond with proposals of Peskin (1989) and Pearce, Markandya, Barbier (1989). The welfare-oriented GDP is similarly defined in Peskin (1989) as option 3, the welfare-oriented NDP as Option 1. Option 1 is originally a proposal of Olson (1977). Peskin prefers Option 3 because this aggregate could be used as a starting point for macro-economic cost-benefit analysis. Pearce, Markandya, Barbier (1989) propose the following environmentally adjusted NDP (see p. 108):

	Sustainable income
=	Measured income
–	Household defensive expenditures
–	Monetary value of residual pollution
–	Depreciation of man-made capital
–	Depreciation of environmental capital (ecosystem function damage, renewable capital, exhaustable capital)

This aggregate corresponds to the welfare-oriented NDP:

	Measured income = environmentally unadjusted GDP	(477.7)
–	Household defensive expenditures = defensive costs	(55.7)
–	Monetary value of residual pollution = environmental consumptive services	(75.3)
–	Depreciation of man-made capital = Consumption of produced fixed assets	(48.6)
–	Depreciation of environmental capital = Depletion of natural assets	(18.2)
–	Difference of degradation of natural assets and disposal services (= balance of export and import of residuals)	(3.1)
=	Welfare-oriented GDP	(276.8)

Further Work

The framework presented in this paper is intended to be a contribution to the international discussion on environmentally adjusted national accounts. There are still many conceptual questions which cannot be answered in this field. Furthermore, the current statistical data base for such calculations appears to be insufficient. Nevertheless, the urgent environmental problems seem to advocate at least a stepwise realization which should start as early as possible. This work could be done parallel with further conceptual improvements and with constructing an improved data base.

This is not a proposal for a fundamental change of the traditional national accounting system. This system has many applications for short-term and medium-term economic analysis. The possible environmental adjustments should be realized in an additional data system-a *"satellite system,"* which could be closely linked with the traditional "core system."[12]

[12]See Teillet (1988); Schäfer, Stahmer (1990).

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Some Problems of Statistical Measurement of Economic Activity in the Transition from Planned Socialism

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Introduction

As an economy such as that of the Soviet Union undergoes transition from central planning to market allocation, it is desirable that statistics be available that reflect the course and pace of economic change; since, perhaps somewhat ironically, it may be necessary to plan the transition, or at least monitor and direct the manner in which change takes place. The framework for compilation of statistics that is standardized and enables international comparability is the conventional System of National Accounts (SNA). This requires that information be available on costs of production, sources of income, the value of final consumption of households and government, imports and exports, and other economic variables. This paper reviews problems that arise in seeking to measure the economic activity underlying these variables in the course of transition from planned socialism to a market economy.

Sequencing of Data and Economic Activity

In principle the SNA is applicable to planned and market economies. The SNA does not ask whether intermediate and final consumption of enterprises and households was centrally planned or the outcome of market allocation. The accounts are, in principle, also independent of whether the state or private individuals own the capital that is consumed (or depreciated) in the course of production.

Ownership of enterprises, which can take various organizational forms (see Branko Milanovic, 1989), is less of a problem for application of the SNA than planning. Statistics (without making observations on accuracy) could be generated for the "market-socialist" economic systems of Yugoslavia and Hungary, reflecting the decentralized (but often not) economic activity of the enterprises. In the centrally planned economy there is, however, no need for measurement of economic activity, since the central planner in principle provides the statistician with the requisite data *before* economic activity takes place. Values of the economic variables have been planned in advance.

In contrast, in a market economy, the values of economic variables do not predate economic activity. Economic statistics are derived from ex-post measurement (subject to observation and recording error) of the value of the market transactions that have taken place.

In practice, this categorization between ex-ante specification of economic statistics in a planned economies and ex-post measurement in market economies is not mutually exclusive. Market economies have non-market allocation and government consumption, and planned economies have economic activity that is not in accord with or encompassed by the plan. External to the plan, there are often secondary markets that are tolerated if not legal, but often legal as well. Random events also lead ex-post realizations to differ from ex-ante plan specifications. Deviations from the plan could take place, and indications were provided on success with "plan fulfillment".

However, of importance for measurement of economic activity in the course of transition, there were sereptitious markets wherein enterprises and individuals engaged in illegal economic activities. There is a substantial literature on the nature and scope of these activities—for example, Grossman (1979), Simis (1982), Hillman and Schnytzer (1986). Because of illegality, the income and the output associated with these activities were not reported, and were certainly not planned, and hence would not be encompassed by the official statistics. Enterprises would hoard "hidden resources" to facilitate supply, and depending on the degree of official tolerance and the identity

of the individual, consumption that would reveal income beyond acceptable norms also had to be "hidden". The official statistics would not record the value of output of the hidden resources and the associated value of final consumption. Even with ex-post revisions of the planned statistics, the statistics of the planned economic system could therefore not be overly reliable as measures of economic activity. This is quite independent of the additional sources of inaccuracy of the planned economy's statistics, that are derived from quality differentials between similar goods produced in planned and market economies and from the political discretion that could influence the reported statistics.

The Economy in Transition

Free market activity requires the specification of legal claims that establish ownership rights and allow goods (and assets) to be bought and sold. Because expansion of private ownership has lagged behind the increase in the scope of market transactions, there has been an increase in transactions of the type associated with illegal economic activity that took place outside of the plan. The change in the transitionary economy is that the transactions are not overtly illegal. The cost in terms of detection and punishment of engaging in this activity has declined—thus, the extent of such activity has increased.

In the transition, official and "free" markets exist side by side. Because free market prices exceed official prices by many multiples for many goods, enterprises have an incentive to supply the free market distributors rather than the state. So the state stores, where goods are cheap because of the low official state prices, are empty of merchandise; and when merchandise does arrive, the low prices make long waits in queues worthwhile. But for the right number of rubles, or preferably by payment in convertible currency, the shortages and queues can be avoided.

Can one introduce into this type of economy the measurement that is required for a system of national accounts to describe costs of production and value of output in final use?

Costs of Production

As long as Gosplan continues to allocate inputs to the enterprises, which in principle remain the property of the state, little meaning can be attached

to the notion of costs of production. The enterprise is allocated inputs and has a legal obligation to deliver output to the state for inputs that are not distributed at market values in any sense that reflects opportunity costs of the resources and raw materials.

Resources and produced intermediate inputs that can be hidden from the center can be traded in secondary markets among the enterprises themselves in transactions that will, in general, not be divulged to the state, and which will not be recorded for measurement. Measurement of the value of output is further hindered because the enterprises may engage in barter, although among enterprises the scope for barter in intermediate goods is limited by the opportunities for mutually beneficial exchange in vertical production relationships. The official statistics will reflect how the enterprise was planned to behave in its dealing with the state, rather than actual economic activity.

Rents

The discrepancy between the low official input prices and the higher unofficial output prices is a source of rents. For example, an enterprise diverts one unit of output from the state to an alternative market distributor who is willing to pay double or three times the official state price: this good may change hands a number of times with profit margins being added at each transfer, and reaches the unofficial market at five or ten times the official price. Scarcity rents have been allocated among the enterprise and the layer of distributors. Costs of production of the enterprise have little to do with value in use in final consumption. Between the "cost of production" (if this is at all known to the enterprise) and the value in use for final consumption are the rents associated with access to goods.

Rents arise because there is excess demand at the official price. Under conditions of excess demand, every supplier becomes a monopolist: the seller and the buyer know that alternative sources of supply are not readily available. In particular, there is no assurance of supply at the official price. Under such circumstances, resources are attracted into distribution, which can be more profitable than following the state directives in production.

Price Discrimination

Since there is not one market price in the free market, although perhaps a conception of what the price "ought to be" or was in a prior transaction,

there is price discrimination. Price discrimination exists in western market economies. In general, in the western market economy, price discrimination is associated with services that are not transferable, as for example supplied by a dentist, plumber or lawyer. The incomes of these and like practitioners can be measured to encompass the different valuations of services provided that are reflected in the different willingness of individuals to pay for the same service. In the economy in transition, the scope of price discrimination introduces complexities in measurement of value. Individuals pay different prices, depending on who they know, the privileges associated with status, and pure luck in stumbling among supplies being distributed at the official price. Statistical measurement will not encompass these idiosyncrasies associated with price discrimination.

The recording of total output is therefore subject to inaccuracy; and, because of price discrimination in supply for final consumption, valuation of final consumption requires securing data on a host of transaction-specific prices.

Barter

Avoidance of supply to the state at official prices is facilitated by barter of final consumption goods among enterprises. Enterprises producing final consumption goods have an incentive to exchange goods between themselves for direct distribution to workers. It is an advantage to be a worker in an enterprise that produces final consumption goods rather than intermediate goods because of the greater scope for exchange. An automobile can be traded for television sets or fresh meat. Mutual gains from trade are realized by circumventing the monopsony of the state, and by avoiding rubles with their capricious purchasing power. In the words of Abram Bergson (1990), "the ruble is aptly held not to be real money, but a kind of lottery ticket—redeemable for goods only with luck and perseverance". The output used in barter in principle belongs to the state and hence may not be reported in the official measurement of the output of an enterprise.

Forced substitution in consumption

Forced substitution in consumption biases measurement of value in use of output produced. For example, if there is no coffee at "coffee breaks" but beer is available, participants who seek liquid refreshment are obliged to

drink beer. But this is forced substitution. At 10:30 am participants might prefer coffee. The value in use of beer then has to be judged in conjunction with the non-availability of coffee, in circumstances where willingness to pay substantially exceeds the official price of coffee.

Value in use is also influenced by forced substitution in consumption over time. Because of non-availability, there is a need to defer consumption to the future, or to consume in the current period non-durable goods whose future availability is not assured.

Costs of Search and Waiting Time

Valuation at official prices does not reflect the true cost to the consumer, because of costs of searching and waiting time in queues.

Adding these costs to the official price paid can provide an indication of value for final consumption. However, there is no uniform methodology for measuring value of time as a component of the price of purchasing the good. And supply can cease before all the queue have had an opportunity to purchase.

Foreign Transactions

In the measurement of foreign transactions, there is (in general) corroboration from the foreign partner. However, the measurement of the values of exports and imports is subject to difficulties similar to those that arise in the measurement of the value of domestic economic variables. Socialist international trade as conducted within the Council of Mutual Economic Assistance (CMEA) was negotiated bilaterally between the Soviet Union and each CMEA trading partner under conditions that facilitated price discrimination. Because of such price discrimination, the details of CMEA trade were regarded as confidential.

Although the protocols of CMEA trade in principle assured bilateral trade balance, imbalances nevertheless could arise. The magnitudes of the imbalances were measured in terms of transferable rubles. However, transferable rubles were not transferable, neither among countries to facilitate multilateral balance, nor over time to facilitate intertemporal trade. Trade imbalances therefore did not imply the offsetting capital movements of western international trade. In effect, CMEA trade entailed bilateral barter exchange with ex-ante balance requirements at various subaggregate levels, but

not necessarily ex-post realizations of balance (see Schrenk, 1990, Hillman and Schnytzer, 1990 for elaboration).

Since CMEA trade should have been balanced, the only source of trade imbalance should have been convertible-currency trade. Hence, in principle, there was no need to aggregate CMEA and non-CMEA trade imbalances. But this was an aggregation that could in any event not be performed, since it would entail adding convertible and non-convertible balances.

In socialist international trade, price differences between domestic and foreign goods have been arbitraged via a price equalization mechanism that ensured that the foreign-trade monopolies that engaged in international trade neither profited nor lost from foreign transactions (see Schrenk, 1990). The mechanism insulated the domestic "planned" prices from prices of foreign goods. Thus, an import that would sell for less than a similar domestically produced good was subject to a tax that equalized prices, or conversely the imported good was subsidized if its price was above the price of a domestic substitute. CMEA exports could similarly be taxed or subsidized. The price equalization mechanism had links back to the government budget, which ultimately absorbed either the surplus or the deficit of the price equalization account.

As of 1 January 1991, the Soviet Union will conduct international trade with (former) CMEA partners at world prices, and in convertible currency—where possible. Trade at world prices and in convertible currency will enable integration of the foreign-transactions segments of the national accounts, resolving these problems of measurement of foreign transactions. The move to world prices implies the end of the price equalization mechanism. However, as long as this mechanism persists, valuation of foreign sector transactions takes place in a framework where domestic prices bear no relationship to the prices at which goods are internationally traded.

Exchange Rates

On the one hand, the price equalization mechanism eliminates the effects of exchange rates (or anything else) on domestic prices of foreign goods. On the other hand, there are a number of exchange rates that vary from less than a dollar for a ruble (the gold ruble exchange rate) to 25–30 rubles to the dollar in the unofficial (free) market. Certain exchange rates are obligatory for specified transactions. Exchange rate conversions in these circumstances are a dubious basis for international comparisons. Given internal price dis-

crimination, there is also little basis for appeal to the law of one price or to international comparisons of purchasing power.

Measurement of Capital

The System of National Accounts includes measurements of utilization or depreciation of the economy's capital stock, and also the returns to capital. In the planned socialist economy, the state is the owner of all capital and there is no market in trades for claims to capital. Establishing the value of capital of enterprises, however, requires such a market. But such a market cannot exist so long as the state remains the monopoly owner of enterprises. Privatization is therefore a prerequisite for valuation of the economy's stock of productive capital; but, of course, it is difficult to privatize without having a market to value the worth of the state assets that are to be sold. This is a familiar dilemma in the transitionary economy.

Conclusions

Anecdotes are what good economic measurement seeks to supplant; for anecdotes can be idiosyncratic, and unreliable. Much of the evidence on transactions in the Soviet Union in the course of transition has been anecdotal, although with sufficient repetition and confirmation to warrant the conclusion that measurement of costs of production, of incomes, and of the value of final consumption at official prices, and conversion at official exchange rates is misleading.

It is not, however, surprising that the Soviet economy in transition does not lend itself readily to economic measurement within the framework of the orthodox System of National Accounts (SNA). The planned economic system from which the transition is being made did not suppose that market allocation and market transactions would determine the values of economic variables. A market of sorts was always present outside the plan, with illegal and unofficial economic activity not recorded in the official statistics. The expansion of scope of the market in the hybrid transitionary economy has been at the expense of supply via the state distribution system, and the illegal economic activities—which have become unambiguous in their illegality—have expanded. There have been new entrants (the "cooperatives") into non-state distribution of the output produced by state enterprises, and also the incumbents with their established channels of communications and trans-

actions for non-distribution have had the incentive to increase their activity. The non-state distributors of the output produced by the state's enterprises are earning rents that remain not amenable to measurement because of monitoring and reporting impediments.

So long as the official sector persists with its less-than-market-clearing prices, there are rents from securing claim to goods at the official price (and in excess). So incentives are provided for distribution and redistribution. Economic activity revolves around the quest for a share of the scarcity rents. Enterprises that would gain from increasing production are constrained by ambiguities in ownership, by the continuing centralized allocation of raw materials, and by the legal obligations to deliver to the state. Since the incentive is to avoid supply to the state because of low official prices, asking the state to measure what is going on and provide statistics that accurately reflect the economic activity of individual agents and enterprises presents statisticians and compilers of data with a difficult task. As with many aspects of the transition of socialism, the market will ultimately perform the task. When there are factor and product markets with market-clearing prices and economic agents confront no compelling disincentives to report their transactions, then markets will provide the data that will facilitate economic measurement. But then the transition to a market economy will be well under way. How to provide meaningful statistics in a hybrid economy where Gosplan is still alive, but the incentives are to avoid Gosplan's specification of how economic activity should take place, is a problem that raises interesting challenges.

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Introduction of GDP Estimations in Central and Eastern European Countries

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Abstract

The fundamental political, social and institutional transformation which has taken place in the Central and Eastern European Countries in the last 1 to 1 1/2 years, has a great influence also on the entire statistical system. Many external and internal requirements argue for a general renewal and reshaping of the structure, concepts, classifications, and moral status of statistics in order to correspond to international standards. The main direction of transformation is fundamentally similar in all the countries of this region and, today, these changes are already embodied in nationally and internationally agreed upon and supported programs. One of the most important elements of these far reaching programs is the introduction of the United Nations System of National Accounts (SNA) which will replace the Material Product System (MPS) utilized thus far throughout the CMEA. In the SNA, GDP is the most important central indicator and has recently been both acknowledged as such and introduced in all countries of the region. The rapidly compiled, initial results were already published.

At all important, international meetings held this year in the area of statistical problems focusing on the transition of Central and Eastern European Countries (CEECs) from centrally planned to market oriented economies,[1] each country from this region announced an affirmative decision to introduce the United Nation's System of National Accounts (SNA) within the next two to three years. The SNA is to replace the MPS, which was (until very recently) considered to be the only correct system, relying on the material production concept of marxist theory. This simultaneous and uniform declaration can be considered as the greatest break-through in the cooperation and harmonization of statistics between East and West in the last four decades. It is the beginning of a significant process that will facilitate the improvement of international comparability, not only with respect to the most important macro-economic aggregates, but also in terms of the indicators of the different branches of economic statistics and classifications. In addition to these declarations, several practical measures were taken during the last 1 to 1 1/2 years, in most of the countries in order to present the most important indicators of SNA.

In this short note, I summarize the results of my investigation made in August/September 1990 concerning the present stage and availability of GDP estimations in CEECs. Only Albania is missing from this review since no information in this respect was available to me. Before reviewing the practice of each individual country, it may be interesting to raise the question: What are the main reasons and factors which led to this breakthrough? According to my judgment, the following factors were of paramount importance:

(1) The internal, organical development of macro-economic statistics; the growing need for more complete information on the functioning and performance of the economy.
(2) An increasing need for world-wide international comparisons of both the level and growth rate of the economy.
(3) The requirement of SNA-type statistics by the World Bank and IMF in lieu of countries applying for membership in these organizations.
(4) Growing and more intense internal and external criticism of the official macro-statistical data questioning the reliability and validity of the published growth rates and relative levels of development.

[1]Transition Workshop (Geneva, May 1990); Thirty–eighth Plenary Session of the Conference of European Statisticians (Geneva, June 1990); Conference on Statistics of Central and Eastern European Countries (Paris, OECD, September 1990); Economies in Transition: Statistical Measures Now and in the Future (Sochi, IIASA, October 1990.

(5) Last, but not least, the diminishing and subsequent disappearance of the political and ideological rejection of Western concepts, methods and statistical systems, including the recommendations of the United Nation's systems.

It is natural that these factors played a very different role in the individual countries and in the successive periods, however, each of them forced the statisticians in the same direction.

Present State of GDP Estimations in the Individual Countries

USSR

The results of official GDP estimates were first published in the Statistical Yearbook of the USSR for 1987, issued in 1988 (Narodnoe Hoziaistvo 1987.) The current value of Gross National Product (GNP) is given for all years after 1980. In addition to these absolute figures, the volume indices of GNP are published for the period starting with 1966. For the period between 1966–1980, average growth rates of five year subperiods are provided. For the decade of the 1980s, growth rates are given for each year. In the 1989 Statistical Yearbook, issued in 1990, GNP is also disaggregated according to the main categories of end-uses in absolute terms for the period 1985 to 1989 and in terms of percentage share of the main producing sectors for 1980, 1985 and 1988.

It should be noted that it is not clear from the publication whether the published data is corrected for factor incomes received from or paid to abroad; in the absence of such an adjustment this value corresponds to the concept of Gross Domestic Product (GDP). (It is very likely that, in the years under review, the net factor income from abroad was relatively small.)

GDR

For the first time in the history of GDR, a complete set of GDP data was published by the State Statistical Office for all years between 1980–1989, in the weekly magazine "Die Wirtschaft" (Economy) on 5 April 1990. The aggregate value of GDP, both at current and at constant prices, is subdivided according to the main producing branches and the SNA-type categories of end-uses. It is very likely that these data will be published in the next issue

of the Statistical Yearbook of the GDR. (Maybe this volume will be the last Yearbook of the GDR published separately.)

Czech and Slovak Federal Republic (ČSFR)

A first estimation of GDP for the ČSFR in 1987 was presented by the Federal Statistical Office of the country at a CMEA Seminar held in Spring 1989 in Prague. In the paper presented there, detailed elements of GDP are shown both according to the origin by producing sectors and by end-use categories. In addition to GDP at market prices, its value at factor costs is also given. Later in 1989 and in 1990, similar estimations were carried out for each year dating back to 1969. In the 1990 Statistical Yearbook of the FSO a relatively detailed set of data on GDP was published for 1980 and each year between 1985–1989. All official estimations are available in current prices only.

Hungary

Hungary was the only country among the CEECs where the UN System of National Accounts was incorporated in the official national accounts, parallel with MPS, as early as 1970. In this system, the aggregate value of GDP and its components are obtained from the processing of the elementary, primary data as required by the rules of SNA. The system also provides the main indicators as defined by MPS. The GDP, subdivided by sector of origin and end-use categories are officially published in the Statistical Yearbooks of Hungary both at current and constant prices for the period starting with 1960 up to the latest year. Additionally, since joining the World Bank and IMF, Hungary officially reports the data to these organizations. Since 1990, Hungary began to report its data to the United Nations Statistical Office for the Yearbook of National Accounts Statistics according to the "SNA-type" questionnaire.

Bulgaria

In the first half of 1990, Bulgaria carried out official estimations of GDP at current prices for all years between 1979–1988 at the request of the World Bank. A detailed breakdown is available according to end-use categories; however, no data is given on the value added of the producing branches. No official estimates of GDP or its components are available at constant prices.

Poland

As a member of the World Bank and IMF, Poland submits data on GDP and its components both at current and constant prices to these organizations. The period for which these data are available begins in 1980.

For the first time, a set of indicators according to SNA (aggregate GDP and its components) were published parallel with the MPS categories in the 1990 Statistical Yearbook of Poland. These components of GDP, both at current and constant prices, are given for 1985, 1986,and 1987, broken down by producing sectors and by end-use categories. In addition to these absolute figures, volume indices are shown for all components and all years between 1980–1989.

Romania

Romania, since being a member of the World Bank and IMF, regularly reports GDP data and some of its end-use components for "International Financial Statistics." Earliest data are from the year 1977. Aggregate values are given for selected years, both at current and constant prices. A drastic break-through can be seen in the 1990 Statistical Yearbook of the country, where, in addition to a full set of revised data on MPS-type balances, a comprehensive set of data on GDP and its components (both by producing branches and end-use categories) are also published for all years between 1980–1989. Additionally, the volume indices of GDP components for the 1980s are also given.

Yugoslavia

In response to the request of the World Bank and IMF from their member states, Yugoslavia provides statistical information for these organizations for all years between 1970 and the last accounting period. GDP is broken down, both at current and constant prices, according to branches of origin and end-use categories. Until 1990, no SNA-type data were published in the Statistical Yearbook of Yugoslavia.

Extension of Official GDP Estimates

Considering the relatively rich information found in the countries listed above, an attempt was made to extend the GDP estimations for the following benchmark years: 1970, 1980, 1988 and 1989. Basically the following information was used for filling in the missing data:

(1) Data on Net Material Product (NMP) which were available for all countries and all benchmark years at current prices and volume indices for the whole period between 1970–1989.

(2) The ratio of GDP to NMP at current prices, which was available for all countries for 1980 and 1988 and/or 1989 (and for some nations also for 1970).

(3) The relationship between the growth rates of GDP and NMP at constant prices, which was available from official sources for Poland and Romania for the years after 1980 and for Hungary, the USSR and Yugoslavia for the period between 1970 and 1989.

After comparing and analyzing the data the following general conclusions could be drawn:

(i) a steady increase of the ratio of GDP to NMP was characteristic for the whole period at current prices, and

(ii) the volume indices of GDP and NMP were similar to one another.

In addition, it was hypothesized that in countries and in periods when the growth rate of NMP was exceptionally high, the growth rate of GDP was somewhat slower. In the opposite cases, a modest upward adjustment was introduced.

The Table in Annex I shows the value of GDP at current and constant prices for each country and for four benchmark years (1970, 1980, 1988, 1989) compared with the value of NMP. The ratio of GDP to NMP is also given. The Table below compares the volume indices of official NMP statistics with the official or extended official volume indices of GDP. (The indices in italic in this table are estimated by the author of this paper.)

Considering the recently demonstrated fast progress in compilation of GDP, there is hope that these countries will revise and extend their estimations and will publish the new results in more detail and for a longer period in official publications.

Comparison of volume indices for NMP and GDP for 1970–1988 (in percent)

	Official NMP			Official or Extended Official GDP		
	1980/70	1989/80	1989/70	1980/70	1989/80	1989/70
USSR	163	130	212	170	138	235
ČSFR	158	118	187	*158*	*119*	*188*
Hungary	156	110	171	159	115	183
Poland	169	108	183	*167*	112	186
Bulgaria	196	134	262	*193*	*131*	*254*
Romania	245	108	265	*239*	113	270
Yugoslavia	173	104[a]	179[a]	179	105[a]	188[a]

[a]1988 is compared with 1980 and 1970.

Some Conclusions

From the comparison of the first estimates of GDP between countries and periods some preliminary conclusions can be drawn:

a) In all countries, except Hungary, the value of GDP was derived from NMP; namely, by adding or deducting some items to or from NMP. This would indicate that any distortion embedded in NMP is entirely maintained in the newly published GDP. This type of problem relates not only to GDP, but to all indicators of SNA. Therefore a warning with respect to the introduction of SNA is very timely, since there are over-optimistic views that identify the adoption of SNA as the sole and automatic manner to guarantee an improvement in the realibility and credibility of economic statistics in Eastern European. This is not the case, since if the same prices and price indices are applied for measuring the structure and growth of the economy within the SNA as was used for measuring the MPS indicators, the results remain distorted to the same extent as before.

b) The ratios of GDP to NMP show great differences between countries; some of them seem questionable. It is a well known relationship that the share of services increases with the level of economic development. However, in the present comparison some opposite deviations can be seen. For example, in the ČSFR and Hungary GDP only exceeds NMP by 20–25 percent, while in Bulgaria it is by 30, and in the USSR by 35–40 percent, although the per capita GDP is higher (or at least at the same level) in the former than in the latter countries. There are

about 4–6 important items within the sphere of non-material services that are probably treated differently in these countries and cause undue differences in GDP estimates. These are:

- Differences in accounting of interest and insurance payments.
- Deviations in valuation of fixed assets, aggravated by differences in the rates of depreciation. An additional large bias originates from the fact that some countries include capital repairs into the value of fixed capital formation while others consider it as current input.
- Considerable differences may exist in the valuation of housing services provided by the State at extraordinary low rents. In such circumstances the "imputed rent" of owner occupied dwellings has also an uncertain magnitude.
- Deviations also exist in the treatment of food, drinks, etc. consumed by military personnel.
- It is not clear how the non-market services are deflated in the different countries; for example, whether a modest increase of productivity is assumed or not.
- In the ČSFR and the USSR passenger transport and personal communication is excluded from material production (NMP), while it is included in the other countries.

c) The above examples clearly indicate that insufficient knowledge and experience are available in these countries with regard to the detailed recommendations of SNA for certain special circumstances. In particular, great problems may arise in cases where the institutional arrangements in CEECs differ form those of market economies and for which the SNA does not give any guidelines that are applicable to the special situations. Therefore, when preparing detailed work programs for the introduction of SNA in the near future, these countries should explore in detail the above mentioned and possibly other problem areas and search—advisably jointly with each other—for a suitable solution which will be in line with the spirit of the future SNA and in harmony with the given situation in the country. In order to identify the specific areas and problems, a useful step could be the publication of the detailed adjustments made in GDP estimations together with the description of the methodology applied in the compilations.

ANNEX I

Comparison of NMP and GDP for the CEECs
In billions of national currency units

	At current prices				At constant prices			
	1970	1980	1988	1989	1970	1980	1988	1989
USSR:								
NMP	289.9	462.2	630.8	656.8	283.5	462.2	586.0	600.9
GDP	376.0	619.0	875.4	924.1	365.0	619.0	832.6	857.3
Ratio,%	129.7	133.9	138.8	140.7	128.7	133.9	142.1	142.7
ČSFR:								
NMP	312.3	486.3	606.4	617.7	310.0	490.3	572.4	579.7
GDP	372.5	586.8	740.0	759.5	375.0	592.0	698.6	707.0
Ratio,%	119.3	120.7	122.0	123.0	121.0	120.0	122.0	122.0
HUN.:								
NMP	275.5	582.9	1152.7	1414.1	384.4	598.4	666.4	659.3
GDP	332.5	721.0	1409.5	1716.7	472.5	751.0	865.2	863.0
Ratio,%	120.7	123.7	122.3	121.4	122.9	125.5	129.8	130.9
POL.:								
NMP	749.0	1992.0	24995	104952	1179[a]	1992[a]	2151[a]	2151[a]
GDP	964.0	2511.0	29629	118319	5380[b]	8969[b]	9978[b]	9994[b]
Ratio,%	.121.0[c]	126.1	118.5	112.7	...	...	...	...
BUL.:								
NMP	10.5	20.5	29.4	30.2	10.6	20.8	28.2	27.9
GDP	12.9	25.8	38.3	39.3	14.0	27.0	36.7	35.5
Ratio,%	122.9	125.9	130.3	130.0	132.0	129.8	128.0	127.2
ROM.:								
NMP	217.9	513.6	697.4	632.6	209.6	513.6	606.0	554.7
GDP	261.5	619.9	857.0	798.0	358.1	616.9	740.3	697.1
Ratio,%	120.0	120.1	122.9	126.1	123.1	120.1	122.2	125.7
YUG.:								
NMP	143.0	1401.0	132648	...	197.0	340.0	353.0	...
GDP	172.0	1800.7	155808	...	237.7	425.5	445.3	452.0
Ratio,%	120.3	128.5	117.5	...	120.6	125.1	126.1	...

[a] At 1980. prices.
[b] At 1984. prices.
[c] Ratio is calculated from an adjusted NMP (964/771).

Part II

Non-Traditional Measures and International Comparisons

Problems of Measurement of Non-Residential Reproducible Tangible Fixed Capital Stock

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Estimates of capital stock can be made in two ways:
(1) by wealth surveys, insurance valuations, company book-keeping, or stock exchange values;
(2) by cumulating historical series on past investment and deducting assets which are scrapped, written off or destroyed by war.

The second (perpetual inventory) method is preferable because it produces figures whose meaning is clearer, since all the hypotheses and calculations are transparent and consistent. It is now generally used in official estimates, though the Japanese statisticians use a postwar wealth survey benchmark.

Coverage of Non-Residential Capital

The standard definition of non-residential capital includes all non-residential structures, machinery and equipment, and vehicles. It excludes land and natural resources, intangibles like human capital or the stock of knowledge, precious metals, international monetary reserves, foreign assets, inventories, consumer durables, housing, and military items. The official estimates for

Germany, the UK and USA conform to the desired coverage, but those for France and Japan exclude all government assets.

"Gross" and "Net"

Estimates are usually made both on a ***net basis***, with allowance each year for "depreciation" of old assets (i.e. for assets that are retired from use and for declines in the use value of existing ***assets*** that are not retired), and on a ***gross basis***, where allowance is made only for retirement and not for the decline in use value. The gross concept is equivalent to assuming that all existing assets are as good as new; it is appropriate for measuring factor productivity and assessing production potential, because most assets in use are repaired and maintained in such a way that their productive capacity remains near to their original level throughout their life. Net values are useful in measuring profitability or rates of return, because they involve a discount for differences in the expected future life of assets.

The level of the net stock will always be lower than that of the gross, and the relationship between the growth of the two measures will depend on the past history of capital formation. The pace is similar when growth has proceeded steadily for long periods, but when investment accelerates, as in 1950–73, the net stock rises more rapidly than the gross. The converse is true if investment decelerates as it did after 1973.

Asset Lives

The most difficult problem arises from the general ignorance about the actual length of the life of assets. Assumptions about asset lives are always stylized and to a substantial degree hypothetical, and they differ significantly between the countries covered here. Table 5.1 provides a summary measure of the spread in average life expectations assumed in the official figures of four countries.

It is clear that asset lives are assumed to be considerably shorter in France and the USA than in the other countries. Average expectation will, of course, depend on the mix of assets in the stock as well as on the lives assumed for particular items. Thus, the change in average lives that is general between 1950 and 1987 is due in some degree to a change in the asset mix. However, in Germany and the UK, official statisticians assume that lives of individual assets have shortened over time. In these two countries, this shortening

Table 5.1. Average life expectation of non-residential fixed capital assets in official estimates.

	Average Life Expectation	
	1950	1987
France	22.8[a]	16.0[a]
Germany	40.0	31.2
UK	38.6	28.9
USA	27.4	23.6[b]

[a]Private sector only.
[b]1985

Note: Average life expectation is calculated by dividing the end year gross stock of a given year by the depreciation allowance in the same year. If straight-line depreciation is used, this will provide a reasonable estimate of average life expectation. (I am indebted to Tom Griffin of the UK Central Statistical Office for pointing out the possibility of estimating life expectation in this way.) The same technique is used by E.F. Denison and W.K. Chung, *How Japan's Economy Grew So Fast*, Brookings Institution, Washington. 1976, p. 223.

means that the capital stock increases more slowly than if fixed lives were assumed. There is no strong ground for the German and British assumption that asset lives (within a particular category and excluding compositional effects) decline over time. Studies of second hand markets do not suggest this and there is no real evidence of an accelerating pace of technical progress.

Retirement Patterns Used to Calculate Official Gross Stocks

The simplest assumption about asset lives is that all goods of the same kind bought in the same year are scrapped together when their expected life is reached. This (rectangular) assumption makes no allowance for accidents, fires, etc., so a number of alternative dispersion patterns have been developed. The following retirement patterns are those predominantly used in the official statistics of the following five countries:

France : lognormal
Germany : gamma probability density function
Japan : rectangular
UK : even spread 20 per cent on each side of average life
USA : bell-wise spread 55 per cent on each side of average life

Depreciation Formulae (used to calculate net stock)

Most countries making official estimates of the net capital stock appear to use straight line depreciation as the standard technique, but Germany makes no depreciation allowance for government infrastructure. Japan used declining balance depreciation in its official capital stock measure (and survey data on actual depreciation practice for its national accounts!).

Standardized Estimates

As the official estimates involve important differences of assumptions of various kinds and particularly about asset lives, I have constructed standardized estimates for 6 countries using identical assumptions about lives, retirement and depreciation patterns. They are presented in Table 5.2 and Table 5.3 below. As a major purpose of this study is to measure the distance between the follower countries and the lead country, the USA, the figures are converted into dollars at 1985 US relative prices using purchasing power parities supplied by Eurostat rather than exchange rates. I also used asset lives which approximate as closely as possible those for the USA. I distinguish two categories of asset: machinery and equipment with a 15 year life, and non-residential structures with a life of 40 years. I assume a rectangular retirement pattern and straight line depreciation.

Thus, I arrive at the following average asset life expectations in Table 5.2 calculated by the same method as in Table 5.1. In the USA, the results of Table 5.2 and Table 5.1 are very close, but they are very different for the other countries.

In Table 5.2, the intercountry disparity in lives is much smaller than in Table 5.1 and is due entirely to differences in the distribution of assets between our two major categories. In France, Germany, the Netherlands and the USA, average lives fell between 1950 and 1987 because of the increased share of shorter lived assets (see Table 5.3). In Japan and the UK average lives increased for the opposite reason.

Table 5.4 compares our results with the official estimates for Germany, the UK and USA. Such a comparison with the Netherlands is not possible as there are no official estimates, and for France and Japan it would be misleading because the official figures exclude all publicly owned assets.

Table 5.2. Average life expectancy of total non-residential fixed assets in standardized estimates valued at 1985 US $.

	Average Life Expectancy	
	1950	1987
France	29.1	22.2
Germany	28.2	24.9
Japan	22.9	25.9
Netherlands	30.3	24.8
UK	20.1	21.2
USA	26.9	23.9

Table 5.3. Shares of machinery and equipment in standardized estimates of gross fixed capital stock valued in 1985 US $.

	Shares of Machinery and Equipment		
	1950	1973	1987
France	18.9	43.3	43.8
Germany	22.4	34.6	31.5
Japan	41.8	36.9	29.9
Netherlands	15.8	32.0	32.8
UK	52.7	52.8	48.2
USA	26.1	30.5	36.2

It is clear, from Table 5.4, that the international comparability of official stock estimates is badly compromised by differences in the length of life assumptions (and to a lesser extent by the other differences mentioned above). Thus, in 1950, the German and UK official capital stock level was much higher than the stock reestimated with US lives. The differences in level narrowed over time, because both Germany and the UK assume declining lives of assets. A consequence of this is that the official British and German estimates show slower growth rates for 1950–73 than the standardized figures.

The official estimates are more finely disaggregated than mine. Germany has 207 different types of assets (see H. Lützel, "Estimates of Capital Stock by Industries in the Federal Republic of Germany," *Review of Income and Wealth*, March 1977, p.65). Average life for the non-residential assets of enterprises are 14 years for machinery and equipment and 57 for structures (see L. Schmidt, "Reproduzierbares Anlagevermögen", *Wirtschaft und Statistik*, July 1986, p. 503). The UK has four types of non-residential asset whose

Table 5.4. Confrontation of official estimates of total tangible non-residential fixed capital stocks in national prices and standardized estimates (all figures are adjusted to a mid-year basis).

Confrontation of Official Estimates						
Germany (billion 1980 DM)						
	Standardized Estimate		Official Estimates		Ratio Official/ Standardized	
	Gross	Net	Gross	Net	Gross	Net
1950	640.8	326.1	935.2	563.5	146	172
1973	2,834.6	1,823.3	3,263.5	2,333.5	115	128
1987	4,537.8	2,637.9	5,132.7	3,514.1	113	133
	annual average compound growth rates					
1950–73	6.7	7.8	5.6	6.4		
1973–76	3.4	2.7	3.3	3.0		
UK (billion 1985 pounds)						
1950	185.4	99.1	341.6	190.2	184	192
1973	582.7	359.8	745.7	474.6	128	132
1987	877.8	494.4	1,055.2	642.9	120	130
	annual average compound growth rates					
1950–73	5.1	5.8	3.5	4.1		
1973–87	3.0	2.3	2.5	2.2		
USA (billion 1982 dollars)						
1950	2,902.2	1,550.3	2,843.9	1,538.1	98	99
1973	6,053.2	3,684.4	6,180.4	3,774.1	102	102
1987	9,535.5	5,286.1	9,332.9	5,358.0	98	101
	annual average compound growth rates					
1950–73	3.2	3.8	3.4	4.0		
1973–87	3.3	2.6	3.0	2.5		

lives vary across a 36 industry division (see CSO, *UK National Accounts: Sources and Methods*, HMSO, London. 1985. p. 200). The impact of compositional changes will thus be different from mine. However, this is not likely to be a major reason for differences between the standardized and the official estimates because the crude two-way asset breakdown replicates the US level very well, although the official figures are disaggregated into 95 different types of non-residential asset.

Another possible difference is in the investment series used in cumulating the stock of assets. For the USA, I used the same annual asset formation figures as those used to construct the official capital stock series. For the UK, I used the same investment series as those in the official estimates for 1947–87 and the standard source (Feinstein) for prewar years. For other countries, I used national accounts for postwar years and the standard historical sources, so I presume that they closely replicate those officially used. However, there may be differences in the years chosen for weighting and deflation, or in the assumptions made about war damage. Any defects of this kind in the standardized series would be remediable with more detailed public availability of the sources used in constructing the official series.

There are of course differences in the age at which assets are scrapped in different countries, so it could be argued that standardization is not warranted. However, the intercountry variation is quite unlikely to be as large as the different authorities assume and, more fundamentally, as our purpose is to measure assets at prices prevailing in the lead country, I would argue that the US price is zero for the old vintages of capital which the British and German statisticians include in their stocks and which US statisticians assume to have been scrapped. Ultimately, the case for a standardized approach is that it provides a much cleaner reflection of differences in historical patterns of accumulation.

Growth of Capital Stock per Employee

A necessary condition for exploiting the possibilities offered by technical progress is an increase in the stock of machinery and equipment in which this technology is embodied, and the buildings and infrastructure in which they operate. Table 5.5 shows the impressive growth of gross capital stock per person employed. The UK, which was the economic leader until 1890 and has since had the slowest productivity growth of the countries listed, had the slowest growth of capital per person employed (2.1% a year since 1890). Conversely, Japanese capital stock per employee was initially the lowest and has grown the fastest (4.2% a year since 1890), which is equally true of Japanese productivity experience. One can also see that the US capital stock per employee was more than double that of the UK in 1890, when it overtook the UK in terms of productivity. US productivity leadership over the past century was accompanied throughout by a superior level of capital;

Table 5.5. Gross non-residential fixed capital stock per person employed, 1890–1987 (at 1985 US relative prices).

	Capital Stock per Person Employed				
	1890	1913	1950	1973	1987
France	n.a.	(9,600)	14,800	43,309	80,604
Germany	(9,611)	(13,483)	16,291	55,421	89,154
Japan	1,454	2,264	6,609	33,101	78,681
Netherlands	n.a.	n.a.	20,181	59,459	80,897
UK	7,634	9,780	13,923	39,100	58,139
USA	16,402	35,485	48,118	70,677	85,023

Source: A. Maddison, *Dynamic Forces in Capitalist Development,* OUP, London, 1991.

Table 5.6. Ratio of gross non-residential capital stock to GDP, 1890–1987.

	Capital Stock to GDP				
	1890	1913	1950	1973	1987
France	n.a.	(1.64)	1.68	1.75	2.41
Germany	(2.29)	(2.25)	2.07	2.39	2.99
Japan	0.91	1.01	1.80	1.73	2.77
Netherlands	n.a.	n.a.	1.75	2.22	2.74
UK	0.95	1.03	1.10	1.73	2.02
Average excluding USA	1.38	1.48	1.68	1.96	2.59
USA	2.09	2.91	2.26	2.07	2.30

Source: A. Maddison; *Dynamic Forces in Capitalist Development,* OUP, London, 1991.

but by the late 1980s, when its productivity lead had narrowed, it had begun to lose its marked superiority.

There has been a broad similarity in the phasing of growth rates for capital and output with a slackening in the 1913–50 period and an unprecedented acceleration in the post-war golden age. Since 1890, there has been a very substantial long term increase in the non-residential capital output ratio in the follower countries, and particularly the postwar period. This is clear from Table 5.6 and Figure 5.1 which shows the rise in the Japanese capital/output ratio as compared to the relatively stable relationship in the USA.

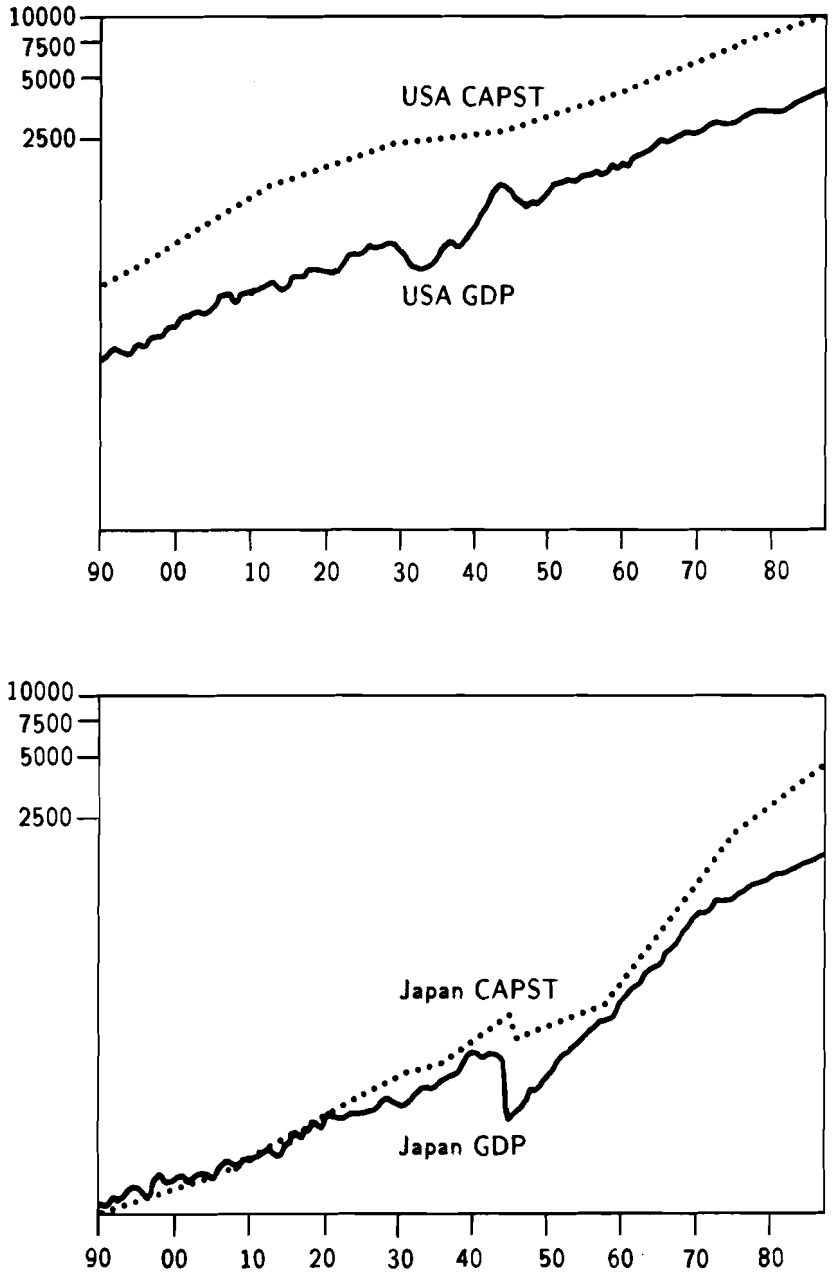

Figure 5.1. Growth of Non-Residential Gross Capital Stock and GDP in the USA and Japan, 1890–1987.

Note: Vertical scale is logarithmic and shows levels of GDP and gross capital stock in billion 1985 US $. Horizontal scale is chronological and indicates decade intervals from 1890 to 1980. The data are annual.

Typological Analysis of Personal Consumption in OECD Countries, Hungary, and Poland[1]

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Abstract

This paper focuses on the level, structure and dynamics of personal consumption in OECD countries, Poland and Hungary. Based on principal component analysis and modifications of cluster analysis (the so called linguistic approach), low dimensional space of integral indicators is designed. The constructed representation facilitates the identification and evaluation of key peculiarities of personal consumption in the early eighties and singles out historical perspectives for the catch-up of less developed countries of Eastern Europe. Our central conclusions are: first, along with sustained growth of the level of consumption, well-synchronized structural shifts took place toward "secondary" human needs and a less technocratic society; second, these structural shifts can be entirely described with two aggregated

[1]We are indebted to Yuri Dikhanov for the preparation of necessary data. Most of his careful work was performed while he was a participant in the Young Scientists Summer Program at the International Institute for Applied Systems Analysis (IIASA) in 1990.

"dimensions" responsible for the "advancement of structure" and "humanization of structure" of personal consumption; third, certain "advancement of structure" of consumption is a necessary (but not sufficient) precondition for the catch-up of less developed countries; fourth, the original sample of countries can be split into a few sub-samples (types) with respect to the attained level of adoption of the recent consumption paradigm. The study does not provide comprehensive theory, but rather provides a better understanding of the consumption paradigm recently adopted by developed countries. It also provides theoretical insights on overcoming routine contradistinctions between rich and poor, North and South, East and West, and practical experience on new ways to use typological analysis for the evaluation of national performances.

Introduction

Personal consumption is among the most popular issues of international comparisons. This is natural, since it may be treated as an output of economic growth and development. It is even more natural when it comes to the comparisons between East and West, because traditional measures of GNP per capita are generally more distorted than consumption data.[2]

The accomplishment of international comparisons calls for the quantification of relevant notions such as "level", "structure" or "quality" of consumption. By quantification we mean the establishment of accordance between each of the notions used and a set of measurable indicators. Such a quantification is always controversial. First, ideas on the substance of, say, the notion labelled as "level of consumption" vary between different scholars since such ideas depend on their personal experience and goals of the research. The notions employed in the analysis may also vary.

Second, the quantification is constrained by the possibilities of data collection. Frequently, data on certain "ideal" indicators are lacking in the statistics; therefore, relevant substitutions are necessary. Besides, methodological differences in the calculation of similar indicators between countries

[2]Detailed explanation of this issue can be found, for instance, in Winiecki, 1988. The author mentions that large discrepancies between levels of per capita GNP and consumption can arise when comparing Western and Eastern national economies. This happens if resource allocation in some country ... *is less efficient and that country must invest more per unit of GNP to keep up with the others or it is investing to meet other needs than consumption, i.e. for the greater glory of the state.*

may also prevent the use of certain characteristics. Third, the substance of each notion is changing over time. Thus, the list of consumer durables to be used for the measurement and comparison of the consumption levels is gradually changing. Certain goods may be left within the list, but their "weights" will be changed. The sample of countries also influence the choice of indicators suitable for international comparisons.

In this paper, notions preliminarily chosen for the comparative analysis of personal consumption were traditional: level and structure. Each was reflected by the number of measurable indicators. These are listed in Tables 6.1 and 6.3. However, our goal was to construct a small number of aggregate characteristics (new quantified notions) which may adequately describe the situation of personal consumption and its dynamics in developed countries. By the use of these characteristics we wanted:

- to ascertain relative positions of individual countries from the consumption viewpoint;
- to find main regularities in the development of personal consumption, including the relation between the level and the structure; to clarify the existence of saturation and to display dynamics of consumption "far from" and "near" it;
- to determine whether a single pattern of consumption development exists or if several clusters of development (typical trajectories) may be singled out.

The authors have made an effort not to repeat quite popular and well-known comparative studies of living standards and personal consumption focused mostly on contradistinctions between low- and high-income countries, North and South, and East and West. The main concern of this study was to not only single out countries with highest and lowest level and/or shares of certain consumer goods groups, but rather to reveal common and specific features of the recent consumption paradigm. In other words, the main focus was not on individual countries but rather on clusters, groups of objects with a high level of similarity; not on individual objects but rather on connections between them.

Our investigation has proceeded within the conceptual framework described in a more general study of "socio-economic self-feeling" of various nations (Aven, 1990). Twenty three countries are included in our sample,[3]

[3]These countries were Austria (AUS), Belgium (BLG), Canada (CAN), Denmark (DEN), Finland (FIN), France (FRA), Federal Republic of Germany (FRG), Great Britain

although in certain computations some of them were presented only for the year 1985 due to the lack of data.

Two points in time—1980 and 1985—were chosen for the analysis. This choice was based on our specific interest in "transitional" economies. The eighties evolved as a period of rapid transition, especially from industrial to post-industrial societies in the West and from centrally planned to market (or quasi-market) economies in Eastern Europe. The analysis of recent developments provides a basis for forecasts about the nearest future. Such prognostication was among our main goals.

As planned for the general study, the methodology of typological analysis was also utilized here. More precisely, we used the so-called "linguistic approach" to process data specifically selected for the regional socio-economic comparisons (Braverman and Muchnik, 1983).

The remainder of the paper is divided into four sections. Section 2 recounts basic principles of the linguistic approach and explains advantages of low-dimensional space of aggregated indicators. In Section 3, aggregated indicators are constructed and dimensions of level and structure of personal consumption are interpreted. Section 4 describes the modern consumption paradigm in light of recent changes in developed and catching-up countries. Countries are divided into a few subsamples with different consumption dynamics and various saturation levels. Followingly, dynamic components of countries' performances are interpreted. Section 5 is the conclusion.

Linguistic Approach: The Conceptual Framework

One of the main "lifestyle" peculiarities in modern societies is an increasing variety of individual consumption. The up-to-date consumer is becoming more and more demanding, selective and capricious. He/she is no longer satisfied with various, though standard, sets of consumer goods and requires personally adjusted and cultivated details. Adequate responses of industries bring about an increasing variety of production and stimulate the growth of a new segments of consumer markets. New dimensions of individual consumption continually appear. The most distinctive feature of the recent consumption paradigm is the "multi-dimensionality" of personal consumption.

(UKI), Greece (GRE), Hungary (HUN), Italy (ITA), Ireland (IRE), Japan (JAP), Luxembourg (LUX), Netherlands (NET), Norway (NOR), Poland (POL), Portugal (POR), Spain (SPA), Sweden (SWE), Turkey (TUR), the United States (USA) and Yugoslavia (YUG).

An implementation of cross-country comparisons of consumption calls for an effective analytical framework to reduce dimensionality and to represent the original problem in the most convenient way.

Methods of multi-dimensional statistics are quite sophisticated. They include factor analysis, principal component analysis, cluster analysis, multi-dimensional scaling, discriminant analysis, functional scaling and principal plane analysis. In one way or another, most of them were applied to the problems of measuring national welfare, living standards, personal consumption, quality of life and so on.[4] Among the methods mentioned above, the linguistic approach is less well known and much less popular; regardlessly, it has some beneficial advantages if applied to a wide class of multi-dimensional problems.

The linguistic approach originates from the methods of the "extreme grouping" of indicators elaborated by E.M. Braverman (Braverman and Muchnik, 1983). The idea of the extreme grouping is to separate indicators which are strongly bonded (correlated). Indicators that belong to one such group strongly correlate with one another and relatively weakly with other indicators. In the case of such strong inter-group correlation, a full-scale representation of all indicators of a group is not obligatory. It is reasonable to identify some new numerical characteristic (or limited set of characteristics) which adequately represents all indicators (i.e. is highly correlated with all of them).[5] Such characteristics (aggregated or integral factors) constitute a new low dimensional space which can accumulate a significant portion of information born by the initial set of indicators.

The higher the absolute value of the correlation coefficient between a certain indicator and its respective factor is, the better the representation of this indicator by that factor. A positive correlation coefficient corresponds to the simultaneous growth of the factor and the indicator, while the negative one reflects the feedback between them.[6]

[4]For example, see Cole, 1981; Kovacs, 1985; Morris and Adelman, 1988; Palomaki, 1980; Ram, 1982.

[5]This idea is general for the whole group of methods of multi-dimensional statistics. It comes from the consideration that: ... *the level of development of a country may be treated as an unobservable or as latent variable, while several other variables, like GNP per capita and other various basic needs indicators, could be regarded as different proxies for that latent variable.* (see Ram, 1982, pp. 230–231).

[6]If the values of the coordinates of objects grow along the axis of the induced factor, this indicates the growth of the values of some indicators on these objects (with positive correlation) and the fall of others.

There are two main maximization functions which are used to construct integral factors in the linguistic approach: these are "square" and "module" functions:

$$S_1 = \sum_{X^j \in A_1} \rho^2(X^j f_1) + \cdots + \sum_{X^j \in A_k} \rho^2(X^j f_k)$$

$$S_1 = \sum_{X^j \in A_1} |\rho(X^j f_1)| + \cdots + \sum_{X^j \in A_k} |\rho(X^j f_k)|$$

where: X^j—original indicators given for the entire sample of objects under consideration;[7] k—conventionally prescribed number of groups of indicators; $A_1, \cdots, A_k$—groups of indicators with at least one indicator in each; $f_1, \cdots, f_k$—unknown factors (linear combinations of indicators of a certain group) constituting new low-dimensional space; $\rho(X^i, f_j)$—correlation coefficient of vector X^j with the factor f_j.

Recall that the number of groups k is exogenously given. Therefore, maximization is implemented with respect to:

(1) to the separation of indicators into groups: $A_1, \cdots, A_k$, and

(2) linear combinations of indicators—integral factors $f_1, \cdots, f_k$.

It can be seen that, when groups $A_1, \cdots, A_k$ are fixed, maximization of S_1 brings about the principal components, i.e. factors obtained are just the first principal components for their respective groups of parameters. Thus, it is important to distinguish between specific features of the linguistic approach and principal component analysis, because, at first sight, these methods look very similar.

The difference between the these two methods is, first, that in principal component analysis the various component series are orthogonal to each other.[8] Under different conditions, this distinctive feature can be treated as an advantage or as a disadvantage. Generally speaking, it gives the researcher more flexibility in designing a new low-dimensional space. Although collinear factors, if received, display a lack of real informational diversity, their orthogonality clearly confirms native "multi-dimensionality" of the data originally selected.

Second, in principal component analysis, components represent percentage share of a variance of the same entire set of indicators (altogether they "explain" 100% of information performed), while in the linguistic approach

[7] Centered and normalized to unity.

[8] The weights of original indicators are just the elements of characteristic vectors of the covariance matrix of indicators. These vectors are orthogonal to each other by definition.

each component is "first" and only represents a variance of a respective subset of indicators. This enables the investigator to clearly attribute each aggregated linguistic factor to certain individual phenomenon, while in principal component analysis components always contain at least a small "portion" of all phenomena under consideration.

Finally, in principal component analysis, although the second component is usually computed, it does not necessarily offer clear interpretation. The linguistic approach clearly attributes each factor to a particular subset of original indicators, but not to an indefinite mix of all of them.

The extreme grouping is just an intermediate mean for forthcoming clustering of objects under consideration (countries, regions, enterprises, households and so on); for example, the identification of classes of recipients of originally chosen indicators. A straightforward clustering of objects given in the space of original indicators, as it takes place in cluster analysis, is often difficult and even impossible due to the presence of a large number of parameters. Besides, with such clustering, equal values are imparted on each parameter and it can become difficult to interpret the classes obtained. Since the use of the linguistic approach implies the weighting of indicators according to their contributions to a relevant factor, "compression" of initial information along an axis of integral factors aligns classes which can be easily interpreted.

The so called re-indexing algorithm, which divides the axis of each factor into the prescribed number of integral classes, is used to split up an initial sample of objects given in an integral factor's space. The intersection of uni-dimensional divisions brings about a multi-dimensional clustering or typology. Thus, the type attributed to each object is given by a digital code whose symbols are the numbers of respective uni-dimensional classes.

The linguistic approach has been chosen for this study of personal consumption because it gives the researcher more flexibility than similar methods of principal component analysis and cluster analysis. Although the linguistic approach is much more time consuming, it facilitates the final procurement of a much clearer interpretation of new "dimensions" than with principal component analysis and, therefore, a much better understanding of clusters (than cluster analysis).[9]

[9]Basically, time of the researcher but not computing time, because the linguistic procedure is much less computer oriented and much more researcher-intensive than other well-known multi-dimensional procedures.

Besides, we proposed to not only make use of a purely static approach, but also to include some dynamic considerations related to the intertemporal shifts of consumption patterns into the study. Dynamic aspects always presume that integral factors provide a "direction" in the multi-dimensional space, along which consumption patterns are adjusted to a new paradigm. As mentioned above, we have chosen the 80s for the study due to the rapid transitions which took place in that time both in Eastern and Western Europe. Therefore, dynamic considerations have to become the main focus of our study, and the "purity" of aggregated factors becomes a priority rather than complete representation of variance. In view of all of this, it is always better to have "directions" initially independent, while principal component analysis always presumes co-ordination of components: the first one is the most important and the rest can be treated only as "second best."

Dimensions of Personal Consumption

Although quite a few indicators of personal consumption can be provided, for this particular study the number of them is sufficiently limited by the general requirement of East–West compatibility. Such indicators as, for instance, food consumption cannot be used at the present stage, not only because of the ideologically based distortions, but rather due to the critical differences between East and West in basic definitions and data collecting principles. First, the design of a statistical system is always relevant to what is important for the functioning of the object it describes and what objectives are to be captured in controlling the object. Second, the design of the system is determined by the choice of means, methods, control instruments, and by the type of control system.[10] For example, cereal consumption in the USSR, as it shown by official statistics, is both *overstated and understated.* Overstated, because the use of subsidized (and, therefore, cheap) baked bread as forage is not monitored. Understated, because of the lack of reliable data about thefts of corn from "collective" (nobody's) granaries. Both distortions can be easily—in technical terms—eliminated, but the general design of the statistical system in the USSR guarantees their retention.

A researcher must also consider evident differences between quality and quantity indicators applied to the less developed countries. This considera-

[10] For more information see (Aven, 1991), where usual shortcomings of statistical systems in centrally planned economies are addressed with the example of Soviet agricultural statistics.

tion, although well known and quite serious, is much less "operational"; in comparative studies, there is often no allowance for such "rhetorical" questions as the following (see Winiecki, 1988):

> How often and how fast does this bus run? Electricity is cheap, but how often are there power cuts? How old are these eggs? Does the rent include lift maintenance, and how often is the lift out of order? How truthful is this newspaper?

These and similar questions arise not only in East–West comparisons. The gap between less developed countries and advanced economies is always *understated* to some extend, and it always significantly limits the set of indicators which are suitable for cross-country comparisons.

Many (if not most) of the indicators of personal consumption and living standards are not directly comparable, even in intra-Western comparisons. Sometimes, "importance" of a certain indicator is not even fixed within a single country taken individually. For instance, the importance of a private car is quite different for the people from the east or west coast of the USA. Additionally, if we take all transport-related taxes, development of services and road network, maintenance record, average distance covered per day, price of gasoline and many other important considerations, the problem hardly becomes observable. Then, if we consider two countries which are situated on different segments of the diffusion curve, we face a dynamic consideration: the importance of 1% growth is significantly different for these countries.[11]

However, our "doctrine" is, if we fully realize the scale of possible distortions, to even make use of imperfect statistics rather than try to eliminate distortions for every indicator under consideration. This last approach is, of course, reasonable, although incomparably time consuming.[12] It makes sense only if exaction of some specific indicator helps to address very concrete questions. Otherwise, especially in multi-dimensional studies, the efforts required are hardly in line with the anticipated results.

From the very outset of this study, we distinguished two principle groups of indicators: one for the "level" and another for the "structure" of personal consumption. This distinction is critical because there are some "physical" consumption indicators which cannot be structurally quantified. At the same time, incorporation of "physical" indicators into this study is very

[11] One country is only at the beginning of the diffusion of private cars (like the USSR), while another is close to the saturation peak.

[12] If we take the entire commodity basket, this approach definitely becomes impractical.

important due to obvious distortions of value measured indicators applied to comparisons between advanced and less-developed societies.

The choice of concrete indicators for comparisons is always limited by the substance of the consumption paradigm under consideration. The late 70s and early 80s were the years of the microelectronics and information take-off all over the world. It is natural to consider the impact of microelectronics and new information technologies as critically important components of the recent technological mode on private consumption. This impact is clearly visible even without scientific tools: changes in household equipment, communications, and information technologies are truly critical. The dynamics of value structure of these components is, however, controversial, but quantitative growth is evident. In order to represent these changes, the number of public and private telephones and residential electricity consumption were selected for this study. Both indicators are usually monitored and carefully calculated in all countries, and are broadly used in cross-country comparisons.

The disadvantages associated with the indicator for the number of private cars were mentioned above. However, this indicator is broadly used in cross-country comparisons including those between East and West. Moreover, from the very beginning of the automobile era, the growth of welfare is always associated with the increase of the motorvehicle population. This is why this "physical" (non-value) indicator was also included in the original list.

The three "physical" indicators explained above were used in addition to the popular and broadly used ones in the international comparisons' set of value-measured indicators of personal consumption. Value-measured indicators for the level of personal consumption were prepared in comparable format by Yuri Dikhanov (for the methodology see Dikhanov, 1991); structural indicators of personal consumption were taken from ICP data (see World Comparisons ..., 1987 and International Comparisons ..., 1988).[13] In this list, we also included the indicator for "Gross fixed capital formation in residential construction" which, although it provides "stock" rather than "flow" observations, is closely connected with personal consumption.

[13]The relation between indicators for level and structure are as following: indicator for *Clothing and footwear, int. $*, for instance, is a multiplication of *Personal consumption in GDP per capita, int. $* by the indicator for *Share of clothing and footwear in personal consumption* (for further explanation see mentioned sources). All indicators are given for all objects in both 1980 and 1985, except in the cases of Sweden and Turkey where they are given only for the year 1985.

Table 6.1. Principal component: Level of personal consumption

Indicators	Correlation with the principal component
Personal consumption in GDP per capita international $	0.9906
Public and private telephones per 1000 inhabitants	0.9371
Passenger cars per 1000 inhabitants	0.9457
Residential electricity consumption per capita	0.6061
Gross fixed capital formation in residential construction, int. $	0.7340
Food, beverages and tobacco international $	0.6402
Clothing and footwear international $	0.8353
Gross rent, fuel and power international $	0.8955
Furniture, household equipment and operation international $	0.8794
Education, recreation, entertainment and culture international $	0.8761
Medical care international $	0.7315
Transport and communication international $	0.9165
Other international $	0.8996
Percentage of variance represented	71.5%

The list of level indicators is given in Table 6.1. The results indicate that all indicators are closely correlated with the integral factor (first principal component) and, therefore, the latter represents a high percentage of variance born by original objects along the scales of these indicators.[14] Recall that the principal component is constructed for the original sample of objects given by "country-years"—for instance, Canada–1980, USA–1985 and so on (see Captions at the end of this paper). This component does not need any specific interpretation because it just gives an integral index of the level of personal consumption.

In Table 6.2, clusterization along the scale of this principal component associated with the level of consumption is presented. As this Table shows, the movement which we usually imply by the term "development" is associated here with transition along the scale of the principal component *from the "left" to the "right"*. It is true both in terms of national income disparities (rich countries are at the right hand and poor are at the left) and in terms of real time: 80COUNTRY is always to the left from or in the same cell with 85COUNTRY. Moreover, the cluster of less developed countries (first column) is undoubtedly separated from highly developed countries which constitute standard homogeneous unimodal distribution (2nd—5th clusters).

This separation of two consumption "bandwagons" conforms to conventional wisdom of what is the distribution of welfare across the nations. Two similar groups of high-income and low-income countries have been singled out in a recent European ICP report according to per capita GDP level (see Results of the European ..., 1989).).[15] Table 6.2 also allows us to formulate some general conclusions about the dynamic components of countries' performances. Obviously, the gap between the two "bandwagons" has not decreased during the early 80s: all less developed countries are in the first cluster for both 1980 and 1985, while all advanced economies left even the second cluster in 1985 (with the exception of "intermediate" Spain, which cannot be properly attributed with data only on the level of consumption. Among these developed countries only Italy "jumped over" one cluster; the rest either remained in the same column (like Austria, Belgium, Netherlands) or moved to the next level of consumption). The disparities within the "consumption bandwagon" of developed countries have neither increased nor decreased: with very few exceptions, they just move in an "indian file"

[14] Factor correlations with indicators are presented. Normalized to unity, they are equal to so called factor loadings.

[15] With the exception of Spain, which was attributed as low-income country, although as the *best among equal.*

Table 6.2. Clusterization along the principal component constructed on the basis of 13 level indicators.

1st cluster	2nd cluster	3rd cluster	4th cluster	5th cluster
80GRE	80JAP	80AUS	80CAN	85CAN
80HUN	80FIN	80BLG	80USA	85USA
80IRE	80ITA	80DEN	85DEN	
80POL	80SPA	80FRA	85FRA	
80POR	80UKI	80FRG	85FRG	
80YUG	85SPA	80LUX	85ITA	
85TUR		80NET	85LUX	
85GRE		80NOR	85NOR	
85HUN		85JAP	85SWE	
85IRE		85AUS		
85POL		85BLG		
85POR		85FIN		
85YUG		85NET		
		85UKI		

order, which exists when followers occupy the place which has just been vacated by leaders.

In contrast with groups of level indicators, structural indicators are not as homogeneous and a general integral index cannot be constructed here (see Table 6.3). This is natural since, in the first case, growth of all selected indicators during the early 80s was stable and significant for most of the countries under consideration, while, in terms of structure, fluctuations of various indicators can only be contrarily directed. Generally speaking, while some of them increase, others decrease for most of the countries, but this base is not necessarily enough for a complete representation of structural change. Spatial geometry of an 8-dimensional sample may be quite complicated: for instance, a decrease of the share of "Food, beverages and tobacco" is not necessarily accompanied by an adequate increase in "Medical care"—at least direct substitution is not evident even if both processes take place both in terms of real time and in terms of growth of welfare of the nations. In order to make sure that there is direct substitution between these two items, it is necessary to confirm or disprove the following statement: the higher the share of "Food, beverages and tobacco", the lower the share of "Medical care". This can be confirmed/disproved only with the use of bilateral correlation analysis. Then, if we have several such items, the problem

Table 6.3. Grouping indicators in two groups based on optimization (extreme grouping): structure of consumption

	Correlation	
	1st group	2nd group
Group 1: Advancement of consumption	1.00	0.27
Percentage of variance represented by principal component	64.9%	
Food, beverages and tobacco	*−0.82*	**−0.02**
Clothing and footwear	*−0.86*	**−0.23**
Gross rent, fuel and power	*0.76*	**0.28**
Education, recreation, entertainment and culture	*0.78*	**0.35**
Group 2: Humanization of consumption	0.27	1.00
Percentage of variance represented by principal component		51.9%
Furniture, household equipment and operation	**−0.37**	*−0.66*
Medical care	**0.37**	*0.81*
Transport and communication	**0.18**	*−0.68*

becomes hardly observable and a specific hierarchical procedure is required for co-ordering alternatives. The extreme grouping mentioned above is the very method used to identify and evaluate complicated structural change in multi-dimensional space.

In Table 6.3, the results of extreme grouping of structural indicators are presented.[16] The original set of indicators (without "Other" which has no clear interpretation) is divided amongst the prescribed number of groups—in our case two.[17] These groups are quite stable across the objects: while eliminating some of them does not change the original picture, some correla-

[16]Structural indicators are equal to the shares of certain consumption groups in total personal consumption. As mentioned, these data are taken from ICP tables. In some cases, the percentage shares presented in these tables do not add up to 100, due to the lack of additivity. For the year 1985, for instance, the sum of the shares of the 8 groups exceeds the total domestic consumption by 1.6 percent for Norway, 2.2 percent for Sweden, 9.4 percent for Hungary and 5.7 percent for Yugoslavia. It makes Hungarian performance significantly overstated. For more explanations see International Comparisons ..., 1988.

[17]Numbers in italic in Table 6.3 represent the correlation of indicators of a certain group with the principal component originating from them (linear combination of those indicators), while the bold numbers show the correlation with another principal component

tion coefficients float slightly, but the division remains the same. This point is crucial for multi-dimensional comparisons because a principal component is very "sensitive" to the "outlying" objects. Without technical details, adding some "outlying"[18] object to the original sample of objects can significantly increase correlation between these indicators. Elimination of outliers can, therefore, critically change the entire picture. In our case, eliminating Turkey and Yugoslavia—major outliers—gives the same division. It confirms the high degree of statistical connections within each of the two groups of indicators.

As it can be seen from Table 6.3, the integral factors obtained are almost orthogonal to each other (the correlation coefficient is 0.27). It confirms natural two-dimemsiality of the evolution of consumption patterns during the early 80s: there were two clearly visible and mutually independent substitution processes between different components of personal consumption: 1) between decreasing "Food, beverages and tobacco" and "Clothing and footwear", on the one hand, and increasing "Gross rent, fuel and power" and "Education, recreation, entertainment and culture", on the other hand, and 2) between decreasing "Furniture, household equipment and operation" and "Transport and communication", on the one hand, and increasing "Medical care", on the other hand. Hereinafter, we call these two dimensions of the consumption pattern's evolution factors of **"Advancement of consumption"** and of **"Humanization of consumption"** respectively.

The statistical linkages within the groups are also quite high: the minimal absolute correlation coefficient with respective factors is 0.76 for the "Advancement" group and 0.66 for "Humanization" group. Thus, we ask ourselves whether this is somehow related to real development in terms of wealth or in terms of real time?

To address this question, let us have a look at Tables 6.4 and 6.5. Table 6.4 presents the clusterization along the principal component built up on four structural indicators. The initial sample of objects can be considered here as a highly homogeneous group of countries with definite unimodal distribution. Slight inversions in the countries' order can be attributed to the disparities in national tax and insurance systems and, probably, to already mentioned distortions related to the lack of additivity of percentage shares (see Footnote 16). In terms of real time, development is associated

(linear combination of indicators from another group). For example, 0.27 is the correlation between principal components.

[18] In terms of indicators under consideration.

Table 6.4. Clusterization along the principal component constructed on the basis of structural indicators: Advancement of consumption

1st cluster	2nd cluster	3rd cluster	4th cluster	5th cluster
80GRE	80AUS	80CAN	80DEN	85DEN
80SPA	80FRG	80USA	85CAN	85FIN
85TUR	80HUN	80JAP	85USA	85SWE
	80ITA	80BLG	85JAP	
	80NET	80FIN	85BLG	
	80POL	80FRA	85HUN	
	80POR	80IRE	85LUX	
	80YUG	80LUX	85NET	
	85GRE	80NOR	85NOR	
	85YUG	80UKI	85POR	
		85AUS	85SPA	
		85FRA	85UKI	
		85FRG		
		85IRE		
		85ITA		
		85POL		

here with movements *from left to right* along the scale of the factor for "Advancement of consumption": as countries remain in the same column (for instance, Yugoslavia, Ireland and France) or "jump" to the right one, two (like Portugal, Netherlands, Hungary and Finland) or even three cells (like Spain). In terms of the real level of welfare of a nation, development is not so clearly related to the respective place of certain nations in the Table: even in this unimodal distribution there are no critical disparities between the "bandwagons" of rich and poor countries. This indicates that rich nations do not necessarily have a lesser share of "Food ..." and "Clothing ..." and greater share "Gross rent ..." and "Education ...", than poor countries. However, a general tendency is clearly visible (see Figure 6.1).

Similar results were obtained in Kovacs (1985), where structures of personal consumption of 17 OECD countries and Hungary were compared by cluster analysis. Concretely, Kovacs also identified that the correlation between the consumption pattern and the level of economic development, which appeared to be rather strong in the 60s, proved, in the early 80s, to be ...

> ...subsequently weakening, although it cannot be characterized as weak.
> ...In the long run different growth rates were not always accompanied by

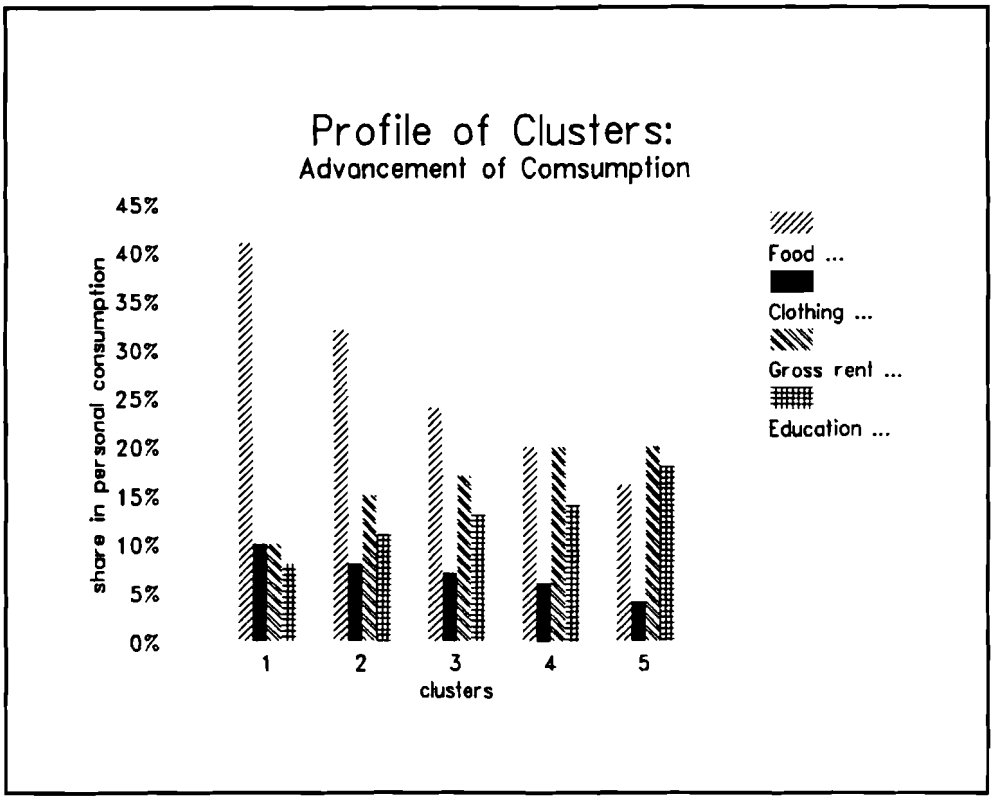

Figure 6.1.

corresponding changes in consumption patterns. This is not astonishing, since changes in consumption patterns are not directly related to the rates of increase in GDP but to those of personal income or personal consumption expenditure, although the correlation between GDP and the other indicators seems to be rather strong, in the long run. There are, however, certain periods and certain countries showing a weaker correlation in this respect.

When it comes to the dynamic changes of consumption patterns, Kovacs also recognizes the same tendencies, although for triple the time interval. For instance, decreasing tendencies for the share of "Food ..." and "Clothing ..." were also identified, although for the latter case this tendency was found true only for the end of the time interval (actually, for the same time interval that our paper considers). Thus, we can confirm the Kovacs's result as it

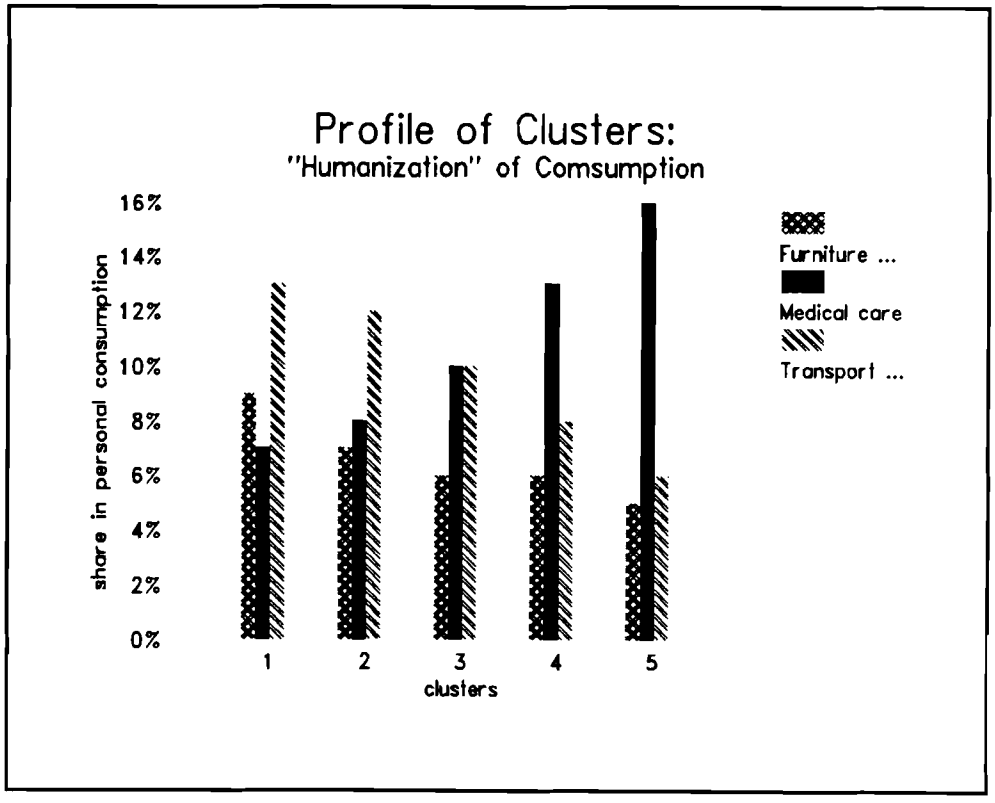

Figure 6.2.

relates to the growth of the share of "Gross rent ..." with the growth of consumption.

However, similarities in the results are quite limited, as it becomes clear from the analysis of the "Advancement" factor. For instance, Kovacs identified the growth of the "Transport ..." share, while we found it undoubtedly decreasing with the growth of consumption, as well as for "Furniture ...". This may be perceived as an interesting contradiction in view of recent changes of consumption patterns. As it follows from Figure 6.2, there is evident substitution of the just mentioned indicators by "Medical care". This "novelty" of the 80s can be interpreted as "humanization" of consumption, as it was earlier attributed to the integral factor of the second group of struc-

tural indicators. Many nations reached their saturation level in consumption of technological "totems" of the 70s—electronic household equipment, and sophisticated transportation and communication facilities. Of course, in terms of absolute level, these two groups continue to rise, but growth rates now are less than for "Medical care". These two groups are not longer "leading"; they are no longer main consumption attractors.[19]

In terms of real time, all countries, with the exception of Canada, are moving toward the right along the scale of the factor for "Humanization of consumption" or staying in the same column (see Table 6.5). In terms of correlation between level and "humanization" of the consumption picture, it is not as clear primarily due to different countries being at the different stages of saturation of new electronic facilities: the entire picture is reminiscent of "sea tides". Advanced countries, like USA, Canada and Luxembourg, were "at the crest" of the electronics "wave" when it suddenly started to roll back. At the same time, outsiders from Eastern Europe were transformed into the leaders overnight. This is probably a good issue for political speculations about "socialism as the most humanized society".

Typologies of Personal Consumption

The classification (clusterization) of an initial sample of objects is always based on some kind of similarity or likeness of those objects. With very few exceptions, all clusterization procedures, the same as classification algorithms, are built up on binary similarities. The procedure always begins with comparisons of initial objects and checks to find the two most "congruent" among them. Then these two are joined into a group and considered as the new "object". The procedure continues until the next closest are joined,

[19]An adequate, but rather anecdotal description of these processes can be found in Simple Life ... (1991), where the *new American consumption pattern* is identified:

> NOW: Recyclable, cheap, plain and nostalgic are the qualities people want ...
>
> THEN: ...instead of disposable, expensive, high-tech and sophisticated.

The author of this article does not mention that, probably, the USA is the worst example of a *Simple Life* in the World. However, this anecdotal evidence does not shake the general tendency toward an increase in the variety of individual consumption.

Table 6.5. Clusterization along the principal component built up on structural indicators: "humanization" of consumption

1st cluster	2nd cluster	3rd cluster	4th cluster	5th cluster
80USA	80CAN	80AUS	80JAP	80HUN
80BLG	80DEN	80FIN	80NOR	85JAP
80FRG	80FRA	80IRE	80POL	85HUN
80LUX	80GRE	80POR	80YUG	
85CAN	80ITA	80UKI	85FIN	
85TUR	80NET	85AUS	85FRA	
	80SPA	85BLG	85IRE	
	85USA	85DEN	85NET	
	85GRE	85FRG	85NOR	
	85LUX	85ITA	85POL	
	85SPA	85POR	85SWE	
			85UKI	
			85YUG	

and so on. Given the criteria of similarity and prescribed number of groups, we can always determine the "optimal" split.[20]

Such a popular classification procedure as cluster analysis joins objects given in multi-dimensional space. With all its advantages, cluster analysis does not fit our specific purposes. First, cluster analysis mixes all indicators in one aggregated criterion and, therefore, does not allow singling out dimensions of similarity. Second, cluster analysis belongs to so called algorithms of discrete optimization, which presume exponential growth of computing complexity along the number of objects under consideration. Together with an interactive character of calculations, the problem can become very time consuming.

To simplify the problem, we utilize linguistic algorithms assuming the intersection of initial uni-dimensional clusterizations. Given the results in Tables 6.2, 6.4, and 6.5, we can construct binary clusterizations presented in Tables 6.6, 6.7, and 6.8. In Table 6.6 "advancement of consumption" is plotted with respect to the "level of consumption". It is clearly visible that countries which were in the first two groups of advancement and si-

[20] Clear representation of such procedures can be found in Cole (1981), where the process is shown in a linkage tree or dendogram (p. 127). Every *level* of such a tree is constituted by a subsequent acquisition of certain single or aggregated object by a larger group, which permits the reduction of the number of *objects* at one point.

Table 6.6. Binary clusterization: level vs. "advancement"

Advancement of consumption						
	5			85FIN	85DEN 85SWE	
	4	85HUN 85POR	85SPA	85DEN 85JAP 85BLG 85NET 85UKI	85LUX 85NOR	85CAN 85USA
	3	80IRE 85IRE 85POL	80JAP 80FIN 80UKI	80BLG 80FRA 80LUX 80NOR 85AUS	80CAN 80USA 85FRA 85FRG 85ITA	
	2	80HUN 80POL 80POR 80YUG 85GRE 85YUG	80ITA	80AUS 80FRG 80NET		
	1	80GRE 85TUR	80SPA			
N/N clusters		1	2	3	4	5
		Level of Consumption				

multaneously in the first two groups of consumption levels in 1980, have not improved their position with respect to the horizontal scale (with the exception of Italy). Even Spain with its impressive jump of 3 clusters along the advancement scale did not move from the second level of consumption. On the other hand, countries from 4th and 5th levels of consumption are located in 3rd, 4th and 5th clusters with respect to the advancement scale for both years. This allows us to conclude that the recent consumption paradigm is characterized with a high level of consumption and, respectively, rapid growth of this level only if a certain minimum "advancement of consumption" is guaranteed. The highest advance, as in northern European countries, is not necessary on the whole, but certain advancement is definitely necessary for catching-up.

Table 6.7. Binary clusterization: level vs. "humanization"

Humanization of consumption						
	5	80HUN 85HUN		85JAP		
	4	80POL 80YUG 85IRE 85POL 85YUG	80JAP	80NOR 85FIN 85NET 85UKI	85FRA 85NOR 85SWE	
	3	80IRE 80POR 85POR	80FIN 80UKI	80AUS 85AUS 85BLG	80DEN 80FRG 85ITA	
	2	80GRE 85GRE	80ITA 80SPA 85SPA	80DEN 80FRA 80NET	80CAN 85LUX	85USA
	1	85TUR		80BLG 80FRG 80LUX	80USA	85CAN
N/N clusters		1	2	3	4	5
		Level of Consumption				

Various speculations or even explanations can be suggested to identify obtained phenomenon. It is not clear, if this phenomenon is a sufficient or only necessary condition (in terms of structure of consumption) for less developed countries; if advancing consumption is an independent movement or less developed countries just follow the way directed by those more developed. This question cannot be addressed within the framework of our paper, which is clearly limited to consumption studies and does not touch any institutional considerations.

Table 6.7 presents binary clusterization, based on the "humanization" scale with respect to the level of consumption. The most surprising thing is that the "most consuming" countries, Canada and USA are in the lowest group of "humanization". This, however, has its own explanation. The seventies were characterized with the processes which were, in a certain sense, opposite to "humanization". The most developed countries actively consumed the most advanced and sophisticated "totems" of the electronic era during the 70s: household equipment, communication means, etc. In the 80s, this process reversed: consumption of new technologies became satu-

rated and additional attention has been paid to less technocratical, namely social matters, such as Medical care.[21] However, various countries achieved different stages of maturity in technological competition.

This consideration is broadly discussed in various respects, for instance, in diffusion studies. Interesting comments can be found in Gruebler and Novotny (1990), where the authors ...

> ...observe heterogeneity (i.e. explicit differences) in the ultimate diffusion (i.e. density of consumption) levels achieved in different countries taking part in the realization of a particular development phase.

If we again look at Table 6.7, we can see that various countries reached different stages of "technocratization", and the latter is not essentially related to the level of consumption. For instance, Turkey and Canada are at the same stage for 1985, but on opposite boundaries of the consumption scale. At the same time, Turkey has the same level of consumption as Hungary in 1985, while they are located at different boundaries of the "humanization" scale. Among developed countries, however, only Norway and Japan were above the 3rd stage of "humanization" before the reverse of development goals transpired. At the same time, some less developed countries such as Greece, Portugal, and Spain are located at a very low level of "humanization" together with rich countries.

In Table 6.8, "advancement" of structure vs. "humanization" of structure is presented. The so called "structural leaders", with the sum of two factors equal to 9, can be easily recognized here: these are Finland, Sweden, Japan and Hungary, although the case of Hungary is specific due to obvious underdevelopment of the "technological" components of personal consumption.

The lacunas in the upper-left and bottom-right corners seem to demonstrate the infeasibility of certain combinations of structural factors highest/lowest levels of "advancement of structure" to coincide with lowest/highest levels of "humanization".

Final three-dimensional typology can be identified with Tables 6.6, 6.7 and 6.8. In terms of structure, Scandinavian countries must be separated as the most "promotive" in all dimensions: Sweden and Norway. For the year 1985 they are located *not lower than the 4th level on each scale.* If we extend our range to include the with 3rd class for the year 1985, this sub-

[21] Not only Medical care, of course, but correlation shows the fastest growth of medical care along with a decline of *technical* components, both in terms of real time and in terms of the level of development.

Table 6.8. Binary clusterization: "advancement" vs. "humanization"

	5		80HUN		85JAP 85HUN	
	4		80POL 80YUG 85YUG	80JAP 80NOR 85FRA 85IRE 85POL	85NET 85NOR 85UKI	85FIN 85SWE
Humanization of consumption	3		80AUS 80POR	80FIN 80IRE 80UKI 85AUS 85FRG 85ITA	85BLG 85POR	85DEN
	2	80GRE 80SPA	80ITA 80NET 85GRE	80CAN 80FRA	80DEN 85USA 85LUX 85SPA	
	1	85TUR	80FRG	80USA 80BLG 80LUX	85CAN	
N/N clusters		1	2	3	4	5
		Level of Consumption				

sample is accompanied by Denmark, Finland, France, FRG, United Kingdom, Netherlands, Belgium, Austria, Italy and Japan. Together with the Scandinavians, these countries can be considered as the *core* of the recent consumption paradigm. Outside the core, countries must be split up into a few subsamples. The first consists of the USA, Canada and Luxembourg—countries with highest levels of consumption, but relatively *"de-humanized"* in terms of modern changes in the structure of personal consumption. Then, Spain and Portugal must be characterized as countries with very dynamic structures and with low levels of personal consumption. Yugoslavia, Greece and Ireland are the countries where nothing actually happens in terms of structure, or in terms of level. Finally, Hungary and Poland constitute a separate group of less developed countries, "advancing" their consumption

on the base of a low technocratical development component. The lack of information does not allow us to properly assign Turkey.

Conclusions

The original sample of 21 indicators of level and structure of personal consumption is reduced to a 3-dimensional space of integral factors which facilitates quite clear interpretation. Such representation allows us to identify and evaluate key peculiarities of the recent consumption paradigm. Along with continuous quantitative growth of personal consumption in total and within every commodity group, remarkable structural changes took place in the early 80s. These changes are associated, first, with further relative weakening of "primary" components of human consumption, and, second, with saturation and even decrease of the share of electronics and communications (value-measured). Moreover, the applied technique facilitates the identification of not only growth or decrease of certain commodity groups, but also singles out *dimensions* of structural changes. These dimensions can be interpreted as aggregated directions along which various commodity groups substitute each other. For instance, the "Medical care" group not only increases, but does this according to and owing to the decrease of both "Furniture, household equipment and operation" and "Transport and communication" groups. At the same time, obvious and well known decline of "primary" groups as "Food, beverages and tobacco" and "Clothing and footwear" is highly correlated with growth in "Gross rent, fuel and power" and "Education, recreation, entertainment and culture".

These trends are monitored, although to a variable extent, both in terms of real time and in terms of wealth of certain nations. However, the movements along respective scales are not independent and correspond with the full set of coordinates of certain nations in the 3-dimensional space. Moreover, the trends obtained cannot be clearly attributed to the routine contradistinctions between rich and poor, North and South, and East and West.

Finally, identified typologies give a better understanding of the consumption paradigm recently adopted by developed countries. This paradigm is represented in a core consisting of the 12 countries of Western Europe. Outside the core, few subsamples with various static and dynamic characteristics can be identified.

Captions

Table 6.1 The principal component is constructed for the original sample of objects given as "country-years": Canada-1980, USA-1985 and so on. This point requires additional explanation. The ordinal technique of the linguistic approach is basically very simple but requires much patience and intuition. It varies generally with respect to data set features. The critical point is whether "synchronic cross-national" or "diachronic within-national" comparisons must be done (see Russet, 1979). Synchronic cross-national comparisons can be done when all countries given in a certain year, are presented with a number of indicators. In that case, every country is a point in multi-dimensional space. If one of those indicators is definitely development-related, it can be used as an "ersatz" time in comparative static analysis. Otherwise, results can be represented for a number of time points (given separately), and intertemporal comparisons can be implemented for within-year distributions of the same countries along the same factor (or along the clusters, if cluster analysis is implemented). A good example of such implementation can be found in Kovacs (1985), where cluster analysis has been implemented to compare structures of personal consumption of OECD countries and Hungary. This study provides useful insights into the dynamics of consumption structures, but most of them were received with respect to "ersatz" time, i.e. changes were monitored *along the clusters within each particular year.*

The same indicators can be used for the diachronic within-national comparisons where various countries given in different years are presented as curves in the same multi-dimensional space. This approach has been chosen for our study due to obvious reasons: we do not need time hazy in natural dynamic representation. Hereafter, unless otherwise indicated, we implement the very technique for diachronic comparisons, which assumes simultaneous representation of "country-year" objects given for all countries for both 1980 and 1985 years.

Tables 6.2, 6.4, 6.5 Clusterization along the principal component is implemented according to the criterion of minimal average "weighted" variance of clusters, given a prescribed number of them.

Table 6.3 Extreme grouping maximizes the sum of "eigen-values" of correlation matrices calculated within the groups of indicators. The grouping is "extreme" if it brings about the maximum of this sum given the fixed number of groups.

Figures 6.1, 6.2 The change of the shares of certain commodity groups along the clusters is presented. Figure 6.1 is related to the first group of indicators, Figure 6.2 to the second one.

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Notes on Comparative Analysis of Structural Change for Economies in Transition

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Introduction

Among the most important statistical measures for economies in transition are those related to processes of structural transformation.

In Western literature, the main approach to economic modernization incorporates economic development as an interrelated set of long-run processes of structural transformation that accompany growth. The central features of this approach are economy-wide phenomena such as industrialization, urbanization, and agricultural transformation, as they relate to modern economic growth (MEG). MEG is the label used by Simon Kuznets to define "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 multidimensional nature" (Kuznets (1966), p. 1). This process is driven by scientific advance and its application to production and the material satisfaction of wants and needs. The study of MEG is conducted primarily in a comparative framework with information derived from the historical

evolution of the advanced economies and from intercountry associations of structural changes and growth.

Comparative studies of structural transformation have established various uniform features of the development process, commonly known as "stylized facts." These studies have also been useful in identifying the main reasons for departures from the uniform trends.

The Soviet Union and other socialist economies in transition experienced very significant structural transformations fueled by determined efforts to accelerate economic modernization. In the seven decades following the Bolshevik Revolution of 1917, "the Soviet economy grew by a factor of ten and ...changed ...from an economy with 82 percent rural population and most of the GNP originating in agriculture to one that is 78 percent urban with 40–45 percent of GNP originating in manufacturing and related industries" (Ofer (1987), p. 1767). Yet, despite evidence of economic modernization, the Soviet Union and most other communist countries have not been included in the comparative studies of transformation mentioned above. The main reason is that "social structure and the institutional means by which economic growth is secured in communist countries are so different" (Kuznets (1971), p. 10). This argument seemed more compelling when the comparative studies were confined to the relatively homogeneous group of advanced market economies, but less so when the sample of countries broadened considerable to include a large number of developing countries with economic systems that spanned most of the spectrum between that of the Soviet Union and those of Western Europe. It could be argued that the extent to which the social and institutional environment affected the rate and pattern of growth is itself an important issue to be determined empirically. But there was another more practical reason for excluding communist countries from the studies, namely, problems related to the statistical information.

These problems, which have been extensively discussed in the literature, can be summarized as problems related to the availability of information, its reliability, comparability and interpretation. The data necessary for a comparative analysis of structural transformation of the Soviet economy have often been unavailable or when published they have commonly been "partial and presented in obscure, cryptic, or incomplete fashion" (Ofer (1987), p. 1772). Ofer (1987) offers a concise discussion of the uncertainty regarding the reliability of the official information, which makes it clear that one can expect systematic biases in data reported to or collected by the central Soviet statistical agencies. The differences in definitions and applications of common concepts originating due to ideological or practical reasons are of

more significance to the present discussion. The most notable case is the exclusion of most services from the national product calculations on Marxist grounds. Finally, interpretation of available data is made difficult because of the meaning of prices in the Soviet system. These are determined by central authorities and have little or no relation to scarcity prices. Taken together, these data problems create serious "problems of comparability" (Chenery and Syrquin (1975), pp. 11-16), which led to the exclusion of the communist economies from our earlier study.

A comparative analysis of the process of structural transformation in the Soviet Union would appear to be an important item in the research agenda, specially as this nation enters a transition toward a more market oriented economy. How much was the productive structure affected by the economic system? What was the effect of the system on the pace and nature of structural change? The transition stage may be one where the productive structure comes to more closely resemble the one expected for an economy with the characteristics of those of the Soviet Union. How rapid can this convergence of structures be? How much should this convergence be enhanced?

In spite of the problems associated with the supply of information, some analysts, both in and outside the Soviet Union, have ventured into comparative studies of economic structure and performance by imaginatively adjusting, recreating or even creating and interpreting the required information. Some of the results obtained (surveyed below) have proven to be quite robust and, at least for rough orders of magnitude, not sensitive to large variations in definitions, applications, etc.

The following section presents some brief comments on the methodology of comparative analysis, followed in section 3 by a more brief reference to the type of results obtained in that analysis. A sample of studies that compare the patterns of growth and change of the Soviet Union and other communist countries to those in market economies is reviewed in section 4. The last section has some concluding comments. In the following, I draw liberally from Syrquin (1988) and Syrquin and Chenery (1989).

On the Methodology of Comparative Analysis

The empirical research program on growth and transformation originating with Kuznets deals with long-run processes in a comparative framework. Analysis of the comparative experience of nations varying in "size, location

and historical heritage" is essential for establishing "common features and patterns" and for identifying "divergences from such patterns" (Kuznets, 1959). But why do we expect to find any uniform patterns? For Kuznets, the rationale for the comparative study of structure and growth "is conditioned on the existence of common, transnational factors, and a mechanism of interaction among nations that will produce some systematic order in the way modern economic growth can be expected to spread around the world" (p. 170).

The principal *transnational* factors, "those potentially common to the world", are three:

(1) The industrial system, that is, the system of production based on the technological potential afforded by modern science. Some of the requirements of the system are some minimum level of literacy, a non-familiar, impersonal type of organization, and a high degree of urbanization.
(2) A community of human wants and aspirations. This is illustrated by the relatively weak resistance to the spread of modern technology in reduction in death rates, by the generality of Engel's law, and by the widespread desire for higher standards of economic performance and levels of living.
(3) Organization of the world into nation-states.

The way the transnational factors affect the pattern of growth is conditioned by *national* factors such as size, location, natural resources, and historical heritage. "The consideration of the national elements, thus, leading directly to an emphasis on the distinctive structure and on the differences in growth patterns" (Kuznets (1950), p. 166). Finally, there are *international* factors relating to the various channels of interdependence among the different nations. The "complex of international relations can best be viewed, as a mechanism of transmission of the unequal impact of economic growth" (p. 167).

The "crucial point" stressed by Kuznets is that "if there were no substantial transnational factors, there would be no common features of significance in the economic growth of nations and comparative study would be hardly warranted" (p. 170).

In series of empirical studies focused on advanced countries, Kuznets established a number of generalizations about long-term changes in economic structure that are a concomitant and actually define MEG. He then showed that the association between the interrelated processes of change and the level of income found in the long-term experience of the industrialized coun-

tries could also be observed in cross-country comparisons for a given period for a much broader sample that included a large number of LDCs.

In **Patterns of Development** (Chenery and Syrquin, 1975), we chose a large set of the processes that characterize modern economic growth and extended the approach in an econometric study for over 100 countries for the period 1950–1970. The processes chosen for study were centered around those most likely included in a minimal definition of the structural transformation: accumulation of physical and human capital and shifts in the composition of demand, trade, output and factor use. Some socio-economic processes, such as urbanization, demographic transition and changes in income distribution, which appeared to be correlated with the level of development, were also included.

The results of that study presented a view of the transformation as a transition from an economic structure representative at low income levels to one typical for high income countries. The transformation of the economic structure was further elaborated in a recent comparative study of **Industrialization and Growth** (Chenery, Robinson and Syrquin, 1986). The patterns of industrial change summarize the relationships that exist along growth paths where income is the measure of development. The patterns can be interpreted as reduced forms from a more general model. In Chenery and Syrquin (1986), we presented a disaggregated simulation model of industrialization that goes back to some of the underlying relations determining industrial change.

Changes in the sectoral composition of economic activity are the most prominent features of structural transformation. Shifts in the internal allocation of resources among sectors are the result of the interaction of changes in the composition of demand and variations on the supply side. On the demand side, the changes are derived from the pattern of income elasticities of demand, and on the supply side they are the effect of factor accumulation and productivity growth. The demand and supply effects are not totally independent from one another. Thus, changes in demand between internal and external sources reflect changing comparative advantage; while aggregate productivity growth incorporates resource shifts from low productivity to higher productivity sectors.

Sources of uniformity: The main sources of uniformity are the patterns of final and intermediate demand and the evolution of comparative advantage. In final demand, the best established trends are the decline in the share of food in consumption and the rise in the share of resources allocated to investment. Industrialization usually increases the share of intermediates

in total gross output while varying its composition form primary to manufacturing output. The rise in the ratio of capital (human and physical) to labor and the observed higher rate of productivity growth in the more modern sectors of the economy, tend to shift the comparative advantage from primary activities to industrial ones.

An additional source of uniformity is the international environment during the period under observation, which includes imitative (demonstration) effects on consumption and on development strategies.

Sources of diversity: Of the factors that affect the transformation, the most variable is the extent of participation in the international economy. The level and composition of trade and hence the type of specialization are largely determined by the interplay of structure (size and resource availability) and policy. Differences in the type of specialization affect the timing of the transformation more than its overall nature.

The accounting framework: The stylized facts on sector proportions presented below are based on econometric estimates for a large number of countries and on simulation results from a cross-country open Leontief model, all within a common accounting framework.

The accounting framework specifies a sectoral breakdown of the national income and product accounts in a simple interindustry system. The accounting unit is the productive sector defined in aggregate terms (primary, industry, services) or in the finer distinctions of standard international classifications of production and trade. The elements of sectoral transformation are linked by the following accounting identities. First, total gross domestic product by use:

$$Y + (C + I + G) + (E - M) = D + T, \tag{7.1}$$

where Y is gross domestic product, C is private consumption, G is governmental consumption, I is gross investment, E is exports, M is imports, D is domestic final demand, and T is net trade.

At the sectoral level we start with the material balance equation of the input-output accounts:

$$X_i = W_i + D_i + T_i; \tag{7.2}$$

where X_i is gross output of sector i, and W_i is intermediate demand for the output of sector i (D and T are defined above).

Looking at a sector as a producing unit,

$$X_j = U_j + V_j, \tag{7.3}$$

$$V_j = v_j X_j; \tag{7.4}$$

where U_j is intermediate purchases by sector j, V_j is value added in sector j, and v_j is the value-added ratio in sector j.

Adding up GDP by source,

$$V = \sum V_j = Y. \tag{7.5}$$

Patterns of industrialization are chiefly concerned with changes in the distribution of the sectoral V_j's. It is clear from equations (2) and (3) that industrialization has to be analyzed in conjunction with changes in the structures of demand (final and intermediate) and trade.

Patterns of Industrialization

To illustrate the nature of the results obtained in comparative studies of transformation I make use of a summary table of a recent econometric analysis that included over 100 countries for the period 1950–83 (Syrquin and Chenery, 1989). Some socialist countries were in the sample (China, Hungary, Yugoslavia), but not the Soviet Union.

Table 7.1 shows the predicted values from estimated regressions for the shares of the various components of economic structure at different levels of per capita income, taken to represent an index of the level of development. The income interval shown (in 1980 US $) is taken to represent the "transition." In Chenery and Syrquin (1975), this was represented by the income interval $ 100 to $ 1000 in 1964 US dollars, based on the observation that about 75–80 percent of the transformation takes place within this range. The range in Table 7.1 ($ 300 to $ 4000 in 1980 US dollars) accounts for inflation since 1964, and reflects the observation that exchange rates in developing countries have tended to depreciated relative to the average for industrial economies (Wood, 1988). The figures in the Table suggest the following observations.

The transformation in final demand is one of the most uniform features of the process of development. On average, the share of private consumption in GDP declines with the level of income, as the share of investment rises and the trade deficit declines. Food consumption drops by about 20 percentage

points, while non-food consumption (not shown separately) goes up. The shift from consumption to investment takes place at a lower income level; the decline in food consumption is spread over a wider income range.

Only a small part of the variation in aggregate trade can be related to income. In the composition of exports we do find a fairly steady increase in manufacturing throughout and a decline in the share of primary products in the later periods.

Changes in final demand and trade reinforce each other. They combine with complementary changes in intermediate uses and productivity growth to produce a more pronounced shift in the structures of production and labor use.

The share of value added in agriculture declines sharply over the transition, whereas manufacturing, construction, and utilities double their share and the services sector share rises by about 50 percent. The decline in the share of agriculture in employment is more pronounced than in production, but since it starts from a much higher level its percentage decline is smaller than for agricultural production. Thus the relative productivity of labor in agriculture (share in value added divided by share in employment) drops through income levels of around $ 3,000 before the gap in average productivity begins to narrow.

The sectoral correspondence of the structures of demand, trade, and production in Table 7.1 is only approximate. Strict comparability would require matching the classification schemes (International Standard Industrial Classification, and Standard International Trade Classification), and an interindustry framework to allocate expenditure categories to industries and to account for intermediate goods.

Over the course of the transition there is a significant shift in value added from primary production to manufacturing and nontradeables. In Syrquin and Chenery (1989), we analyzed the sources of this shift in terms of changes in the composition of demand for intermediate and final goods and of variations in net trade. Changes in domestic demand (Engel effects) seem to account directly for less than half of the change in structure, and changes in net trade for about 10 percent on the average.

Changes in the use of intermediate inputs as income rises, push down the share of primary sector value added in two ways (this information on intermediate production comes from a comparative study of interindustry relations by Deutsch and Syrquin, 1989). First, as income rises, producers in all sectors substitute manufactured inputs for natural intermediates because of changes in prices and production technology, accounting for around 15

percent of the decline in the primary sector share. Second, producers in the primary sector increase their use of inputs relative to output, reducing the ratio of value added to gross output. About one–fourth of the decline in the share of primary sector output results from this increase in the use of inputs in the primary sector. In the input-output model, the variation in intermediate use can be further attributed to changes in final demand, trade, and input-output coefficients (see, for example, Chenery and Syrquin, 1986, for a cross-country analysis).

Manufacturing-disaggregated results: During the process of industrialization, the composition of the manufacturing sector changes considerably. At a less aggregated level, country-specific features and policy become more prominent in determining the pattern of specialization. Large countries can better afford a strategy of import substitution. Variation in resource endowments is expected to generate differences in production patterns within manufacturing, particularly in small economies. Nevertheless, various studies have shown that a high degree of uniformity still remains in the pattern of change within the industrial sector.

There have been various attempts in the literature to group industrial sectors into homogeneous categories differing in their technology, their dynamism, or the demand for their products. In this study, nine industrial branches were distinguished. The results in Table 7.1 are aggregated into three industry groups "according to the stage at which they make their main contribution to the rise of industry" (Chenery and Taylor 1968, p. 409). *Early* industries are established at low income levels to satisfy the essential demands of the population (food, textiles, clothing). They are characterized by simple technologies and low income elasticities of demand. Their share in GDP remains static during the transition at an average about 7-8 percent. Within manufacturing their share goes down significantly, although there are some recent exceptions where the output of some branches in this group expanded rapidly for exports.

Middle industries typically double their share in GDP early in the transition, from about 3 percent of 6 percent, but show little further increase. A large proportion of their output is used as intermediate inputs by other sectors (chemicals, nonmetallic minerals). This source of demand expands at lower income levels when the matrix of interindustry relations becomes more dense. Income elasticities for the finished products from the group of middle industries are generally above unity.

The group of *late* industries accounts for virtually all of the increase in the manufacturing share in the later stages of the transformation. This

group includes investment goods (machinery), some intermediates (paper), and durable consumer goods with high income elasticities of demand (metal products). At low income levels this group typically accounts for less than 3 percent of GDP, whereas by the end of the transition it commonly reaches or exceeds 10 percent of GDP.

Patterns of Structural Change in Formerly Communist Countries

Various authors have tried to determine the effect of the economic system on the sectoral composition of economic activity. In this section, I review some results of studies by Ofer (1980, 1987), Gregory (1970) and Stollar and Thompson (1987), which followed a methodology similar to that utilized in the previous sections. In the Soviet Union, Netschayev has contributed to this literature but, unfortunately, his work is not readily available in English (except, of course, his contribution in this publication).

These studies find that one can indeed identify a characteristic socialist pattern of industrial change based on the analysis of output shares and employment shares. The latter are usually seen as more reliable as they do not depend on irrational socialist prices.

According to Gregory (1970, p. xxiii) the reasons for expecting a different pattern of industrial development are: first, the thwarting of market allocation by socialist institutional arrangements; and second, the bias toward heavy industry implied by ideological, growth, and defense considerations.

The main distinctive features of the socialist pattern are deficits in services made up by relatively large shares in agriculture. Somewhat surprisingly, the manufacturing sector does not deviate much from the expected level according to the industrial patterns of market economies. Its composition, however, does differ: in socialist countries we observe a much higher share in heavy manufactures than in light industries.

Over long periods of time, the changes in industrial structure have been similar to the ones in market economies of comparable income and size. Stollar and Thompson (1987) report that from 1960 to 1980 there was a reduction in the deficit (relative to the expected level) in the services sector; the positive gap in agriculture turned into a deficit in most cases; and the low deficit in industry switched to a significant positive gap.

The counterpart of low employment share in services and high employment share in agriculture is a low level of urbanization. Ofer, in various stud-

ies, has offered an explanation that links urbanization, industrial structure and socialist growth strategy. "The urban deficiency in [socialist countries] is due in part to an abnormally low level of economic activity in the service industries, which are located mostly in cities, and in part to economizing on the size of rural to urban migration by using a highly capital-intensive production technique in manufacturing and highly labor-intensive modes of production in agriculture" (Ofer, 1980, p. 132).

Another distinctive characteristic of the socialist pattern has been the abnormally low participation in world trade. While no country can afford to do without trade altogether, the Soviet Union came close in the late 1930s when her combined export and import share in GNP fell to less than 1 percent (see Perkins and Syrquin, 1989). After 1946, the volume of trade increased rapidly in the Soviet Union and by 1980 had reached comparable levels to Western economies of her income and size (Ofer, 1987).

Concluding Comments

One reason for our interest in structural change is that it is at the center of modern economic growth. More important is the hypothesis that growth and structural change are strongly interrelated. Most students of growth recognize the interdependence and some emphasize the necessity of structural change for growth. In disequilibrium situations, as when factor returns are not equalized across sectors, structural change becomes a potential source of growth if it leads to a fuller or better utilization of resources. The more pronounced the symptoms of disequilibrium, the more important those potential gains.

Economies in transition, almost by definition, must undergo significant structural transformations. The removal of artificial constraints and a lower degree of directed or induced industrial change will give market forces more influence in the determination of the pace and type of structural change.

The statistical approach—in section 2 and 3—searches for uniform patterns relating changes in structure to the level of development. These patterns provide a concise picture of average long run transformation but are not well suited to incorporate market behavior. A complementary approach that addresses some of the deficiencies of statistical analysis is based on price endogenous models, usually focusing on a specific issue within a country. These computable general equilibrium (CGE) models are better suited to confront issues of causality and to probe beyond "proximate" sources of

growth by endogenizing effects regarded as exogenous in the statistical approach. CGE models are most useful for short or medium-run studies; for long-run analyses of structural change and growth, however, they have to date contributed little (see Chenery, Robinson, and Syrquin 1986, chapters 5 and 11). One by-product of the shift to a more market-oriented system will probably be an increase in the flow and quality of statistical information. Major measured shifts may then incorporate spurious effects reflecting, for example, change in coverage of economic activity captured in official statistics. This can be particularly important for the measurement of the growth of total factor productivity (TFP).

Since 1970, measured TFP growth in the Soviet Union has been nil or even negative (Ofer, 1987, p. 1778). The decline in productivity undoubtedly reflects the distinctive features of the socialist pattern of industrialization: the bypassing agriculture, the autarkic elements with their implied misallocations and their isolation of the economy from the competitive pressures of world markets, and other features of the growth strategy which have been labelled "haste" and "extensive growth" (Ofer, 1987). Therefore, there appears to be a significant amount of slack in the economy which—to end on a more positive note—could become an easily available source of growth. The pay-off to rationalizing the economic system could be high, both in static terms (reducing the amount of slack) and in dynamic ones, once a more efficient and rational economy emerges from the transition.

Table 7.1. Shares of Economic Structure Associated with Levels of Income.

Component of economic structure	Income per capita (1980 U.S. dollars)								Mid-point of change
	Actual average < 300[a]	Predicted[b] 300	500	1,000	2,000	4,000	Actual average > 4,000[c]	Total change	
Final demand									
Private consumption	79	73.3	70.2	66.4	63.1	60.3	60	−19	600
Government consumption	12	13.6	13.5	13.7	14.4	15.4	14	02	—
Investment	14	18.4	20.8	23.3	25.0	25.9	26	12	400
Exports	16	19.3	20.7	22.6	24.5	26.4	23	07	400
Imports	21	24.6	25.2	26.0	27.0	28.0	23	02	—
Food consumption	39	38.7	34.5	29.1	23.9	18.9	15	−24	1,200
Trade									
Merchandise exports	14	15.2	16.9	18.8	20.3	21.2	18	04	400
Primary	13	13.9	14.9	15.2	14.1	11.8	07	−06	—
Fuels	03	04.8	06.3	07.3	07.2	06.1	02	−01	—
Other	10	09.1	08.6	07.9	06.9	05.7	05	−05	1,250
Manufacturing	01	01.3	02.0	03.7	06.1	09.4	11	10	2,000
Merchandise imports	16	18.2	19.3	20.6	21.7	22.7	19	03	—
Primary	05	06.4	06.7	07.1	07.5	08.0	07	02	—
Manufacturing	11	11.8	12.6	13.5	14.2	14.7	12	01	—
Production (value added)									
Agriculture	48	39.4	31.7	22.8	15.4	09.7	07	−41	700
Mining	01	05.0	06.6	07.7	07.5	06.1	01	0	—
Manufacturing	10	12.1	14.8	18.1	21.0	23.6	28	18	1,200
Construction	04	04.4	04.9	05.5	06.1	06.7	07	03	1,000
Utilities	06	06.7	07.4	08.1	08.8	09.3	10	04	900
Services	31	32.4	34.6	37.8	41.2	44.7	47	16	1,300
Manufacturing									
Early	07	06.8	07.6	08.3	08.3	07.8	07	0	—
Middle	02	03.3	04.3	05.3	06.0	06.5	06	04	500
Late	03	01.8	03.2	05.3	07.6	10.2	13	10	2,500
Labor force									
Agriculture	81	74.9	65.1	51.7	38.1	24.2	13	−68	1,300
Industry	07	09.2	13.2	19.2	25.6	32.6	40	33	1,600
Services	12	15.9	21.7	29.1	36.3	43.2	47	35	1,000

[a] Based on 1960–72 period for countries with per capita income less than $ 300 in 1970; mean approximately $ 180,

[b] Assumes average population (20 million),

[c] Based on 1960–72 period for countries with per capita income greater than $ 4,000 in 1970; mean $ 7,300. Countries with income only slightly $ 4,000 in 1970 are excluded: these are Israel ($ 4,035), Ireland ($ 4,135) and Spain ($ 4,310).

Note: Expressed as shares of GDP, except for labor force variables, which are expressed as shares of total labor force.

Source: Syrquin and Chenery (1989).

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Intercountry Comparisons as a Measurement, Analysis and Forecasting Tool for the USSR

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Introduction

The transition from a centrally planned to a free market economy raises the problem of current and future development for the countries involved. This is particularly true with respect to economic growth rates, economic structural changes, future demand for resources, and so on. International comparisons, of various measures can help assess the situation in one nation with respect to that in another. For example, the patterns of economic growth in developed countries appear to be very useful for the long-term evaluation and prediction of the economic development of less developed countries like the Soviet Union.

What special relevance do intercountry comparisons have for such assessments? In this paper, some general approaches will be mentioned and subsequently illustrated with a number of concrete examples.

General Approaches

First, the comparison with other countries improves the understanding of the development specific to the investigated country. In the case of the Soviet Union, it is now of particular importance for the economy that there be estimates of the real proportions and rates of economic growth. International experience can be used here in different ways.

The direct, relatively "simple" way is to apply the main conventional approaches of western statisticians. The use of the purchasing power parities of rubles also seem to be a very effective tool in measuring the real economic proportions in the Soviet economy. At least, the resulting useful information can facilitate the comparison of the Soviet data with general, average tendencies of indicators traditionally studied in the developed countries (i.e., so-called intercountry patterns). This is then the indirect method of analysis of each country's peculiarities.

Another area of investigation focuses on the evaluation of the potential resource conservation in the economy of the USSR. This can be based on a comparison with countries using energy, metals, labor, and other inputs very effectively. The identification of the main factors that dominate the country differences in resource use and intensity and the measurement of their share of influence can help select preferred methods of resource conservation. The structural changes corresponding to a transition to an intensive, socially oriented economy are especially significant.

Second, the intercountry patterns are also useful as a forecasting tool for the less developed countries like the USSR. The effective use of international comparisons in forecasting requires systemizing the countries' data and revealing indicators studied. In order to estimate these average intercountry tendencies the cross-countries or combined cross-countries and time-series regressions can be used. Hence, the key is to mix the international comparison with econometric methods. The first well known attempts in this field were made by Hollis Chenery (H. Chenery, 1960, Chenery H. and M. Syrquin, 1980). Our models are more flexible. They include a broader set of factors that reflect the peculiarities of main resource consumption and of different industries' development. The detailed description of these models is given in Netschayev (1988).

Econometrically estimated average intercountry curves (usually called intercountry patterns) can be used in two ways. On the one hand, they give the measure for the analysis of an individual country by revealing its peculiarities as characterized by the changes in the indicators under investigation.

The intercountry pattern is a sort of mirror, which reflects the peculiarities of any chosen country.

On the other hand, the intercountry patterns can be used in forecasts for an individual country. The comparison of a country's data with the intercountry pattern and the analysis of the resultant similarities and differences may indicate to what degree the indicators of the analyzed country will eventually follow the intercountry pattern. Here, precise quantitative estimates for the future are not as important as the possibility to predict the potential sharp changes in the dynamics of analyzed indicators that are difficult to foretell using only individual country data in isolation.

Practical Examples

Let us now turn to the description of a number of concrete examples. Their purpose is to illustrate the approaches to the application of intercountry comparisons mentioned above.

Among the numerous reasons for countries' dissimilarities are those associated with statistical measurements. The peculiarities of prices and statistical accounts can destroy real economic proportions, rates of economic growth, the degree of inflation, and others. These differences are especially substantial between the free market and centrally planned economies, including the USSR.

For example, according to official estimates published by the USSR State Statistical Committee, annual GNP growth rates were about 4% in the Soviet Union during the 80s. The estimates based on the western statistical methods and indirect indicators show that the real growth rates were 1–2 percentage points lower. The yearly growth rate of industrial production calculated on the basis of traditional techniques was 1.7% in 1989. However, it was only 1,0% by estimation using the western statistical methods (especially with the introduction of price deflators). This difference is explained by "latent" inflation that is not taken into account in the methods applied by the former official statistics in the Soviet Union. In particular, the methods used in the evaluation of production and consumption growth based on constant prices did not reflect the great many shifts in structure of output, changes for the worse in the quality of goods, changes of the selling channels for goods and services, etc.

One of the indirect methods of measuring real growth rates and the degree of latent inflation can be based on the intercountry patterns of different

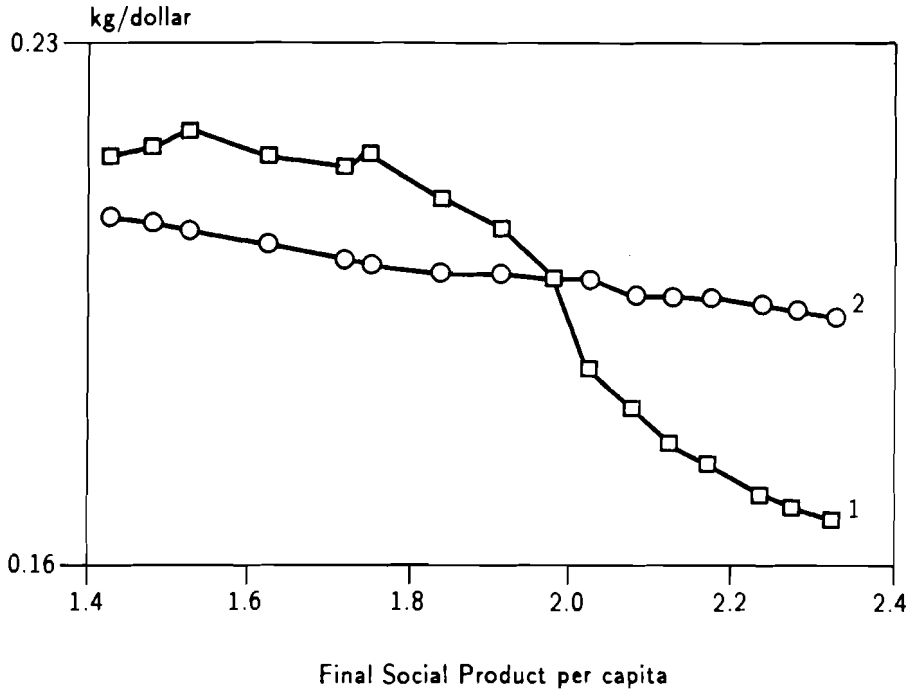
indicators in physical and value terms such as energy or metal consumption per GDP or gross output unit. The assumption is that the theoretical curve estimated by intercountry econometric factor models shows the normal, "natural" dynamics of the indicator used in the analysis. Therefore, if the influence of the determinants (included in the model) is eliminated for the investigating country, then the deviation of the national data from the intercountry pattern can be interpreted as the result of the statistical measurements, especially of the error in growth rates of the indicators in value terms.

Our calculations, based on the international comparisons of ferrous metals and energy use per gross output unit of machinery, show that real production growth rates were twice as low as the official estimates at the end of the 70s and the beginning of the 80s. This gap is lower for national income, but also very remarkable. The illustration of this method is given in Figure 8.1. The detailed description of our approach and of its results is given in Netschayev (1988).

The same general idea may be used to estimate the peculiarities in the deformation of the structure of Soviet retail prices. The structure of consumption expenditures in different countries are compared for selected periods, when their levels of total consumption were equal or very similar. One may assume that after the elimination of the influence of specific national determinants and peculiarities, all countries, generally comparable, should have similar levels of main goods and services consumption per capita or a similar structure of total consumption. This is generally true for developed market economies, but one can see the gap between the USSR and other countries, especially for those groups of consumer goods where per capita consumption rates in physical terms are similar.

We hypothesize that this difference is correlated with the peculiarities of the Soviet price system. Thus, these can be evaluated through this gap. This is a very strong assumption. It is necessary to underline, that the results of such calculations need not be considered as precise estimates, but only as a useful orientation, a reference-point.

The use of purchasing power parities (PPPs) can give valuable information about the real economic proportions. For example, the share of gross fixed capital formation in GNP measured in actual national prices is approximately 20% in the USSR, while it is about 30% when estimated in US dollars using the PPP. This is the result of the peculiarities of the price structure in the Soviet Union. The high share of investment causes the relatively high output of material and energy intensive capital goods.



Legend: 1 the actual USSR data,
2 intercountry pattern adjusted to the values of variables for the USSR

Figure 8.1. Ferrous metals/Final Social Product ratio

One has to underline that the activities focusing on the estimation of PPPs are really just beginning in the USSR. There were a number of unrelated attempts of different expert groups in the Academy of Sciences, but they have not had the possibility to complete this work. The Goscomstat and other governmental organizations were compelled to consider the results of this study—the correlation between the main indicators in the USSR and developed western countries—form the ideological point of view, from the position of socialist versus capitalist competition. Such a position has clear consequences.

The profound studies in this field began only this year. The USSR joined the UN International Comparison Project (ICP). The Goscomstat and the German Statistical Office have also developed separate comparisons between

the USSR and West Germany based on western statistical indicators and techniques.

We now briefly describe the previously mentioned example of the application of intercountry comparisons for the analysis of resource use efficiency and for the estimation of the potential resource conservation. The comparisons of energy, steel, plastics and other resources' consumption per capita or per GNP unit between the USSR and Western countries are very popular now. The results of these comparisons are often used to support one or another thesis or conclusion. However, many experts make an essential mistake. They do not take the wide range of reasons that cause the differences in the resource use efficiency between countries into account. Among these are the macroeconomic factors, the gap in the economic and technological development level, the structure of industrial production, and many more. It is incorrect to conclude that one country uses resources more effectively than another one by only comparing the resource use per GDP or gross output without accounting for all these different factors.

In 1988, ferrous metals use per unit of GNP in the USSR was nearly two to two and a half times as high as in the USA, Italy, France or the United Kingdom, 30% higher than in West Germany and close to, yet still higher than, the Japanese level (see Table 8.1). One can conclude, that it is possible to rapidly reduce the steel consumption in the Soviet Union. Moreover, the State Planning Committee attempted to stabilize and even to reduce the steel production in the USSR at the end of the 70s and at the beginning of the 80s. The result was a drop in the real output volumes in capital goods producing sectors, the fall of economic activity and the development of latent inflation because the cutting of rolled steel production was not supported by a real decrease in the demand for ferrous metals.

There are different factors causing the gap in the ferrous metals consumption between the USSR and developed countries. According to our estimates, 35% of this gap is explained by "technological" factors (use of plastics, quality of ferrous metals, technological level of consuming sectors, etc.), while 65% are the result of "structural" factors (Table 8.2). It is important to emphasize that the "overconsumption" of ferrous metals in capital goods producing sectors is correlated with a relative low steel use in consumer goods production in the Soviet Union.

The main factors and their effects cannot be considerably altered within a short period. One can affirm, that considering the structure of the economy, the use of plastics, the technological level of steel consuming sectors, and so on, the USSR now uses even less ferrous metals than necessary. The

Table 8.1. Ferrous metals use per GNP in developed countries, (t/mln. $).

Country	1965	1970	1975	1980	1985	1988
USSR	103.1	90.4	84.6	69.5	61.6	57.0
USA	53.3	42.0	34.2	30.2	24.3	23.5
Japan	61.8	90.7	69.1	68.8	55.7	53.6[a]
FG	71.6	75.0	54.4	51.0	45.2	43.2
UK	53.4	52.5	37.0	24.3	21.1	23.9
France	51.6	55.3	36.8	36.0	26.8	27.2
Italy	35.4	45.5	34.3	39.3	28.5	29.9[a]

[a]1987.

Note: GNP estimated in 1985 US dollars using the PPPs.

Table 8.2. Additional demand for ferrous metals in the USSR as compared to the USA, (mln.t).

Factors	
1. Use of the ferrous metals substitutors	+ 8.6
2. Quality and assortment of ferrous metals	+14.6
3. Metals utility coefficient in machinery	+10.0
4. Steel use of repairs and spare parts[a]	+15.0
5. Productive investments level	+48.3
6. Investment level in non-productive sphere	− 3.3
7. Equipment/construction ratio in capital expenditures	− 2.6
8. Production of consumer goods[b]	−10.7
Total	+79.9

[a]Adjusted to capital funds difference.

[b]Adjusted to the population size difference.

Note: Adjusted to the GNP difference between the USSR and the USA

intercountry comparisons corroborate this conclusion. In particular, one can see that the ferrous metals consumption per GNP is considerably less in the USSR as compared to the other countries with metal industry intensive economic structures (i.e., Japan, Germany) in the period when the levels of the traditional indicators of economic development in these countries were close to those of the modern Soviet level (see Table 8.1).

Conclusion

As was mentioned above, the most important results of the application of intercountry comparative analysis (especially with respect to forecasting), are not precise quantitative estimates, but the possibilities to gain new information and insights that can be utilized to predict the probable shifts in the development of economic processes under investigation.

For example, the share of employed in mining, manufacturing and construction was rising in the USSR until recently. The main conventional quantitative methods did not allow a prediction of the decrease in the level of this indicator. Moreover, some theorists concluded, that this process is one of the regularities of the socialist economy. However, if one uses the intercountry analysis, it is clear that such dynamics were typical for all countries up to a certain stage of industrialization. This share becomes stable and declines beginning from a certain level of economic development (see Figure 8.2). The Soviet data of the last years corroborates that the general tendency is also comparable to the situation in the Soviet Union. It is also interesting, that the significant differences between countries in the early stages of economic development are gradually smoothed out.

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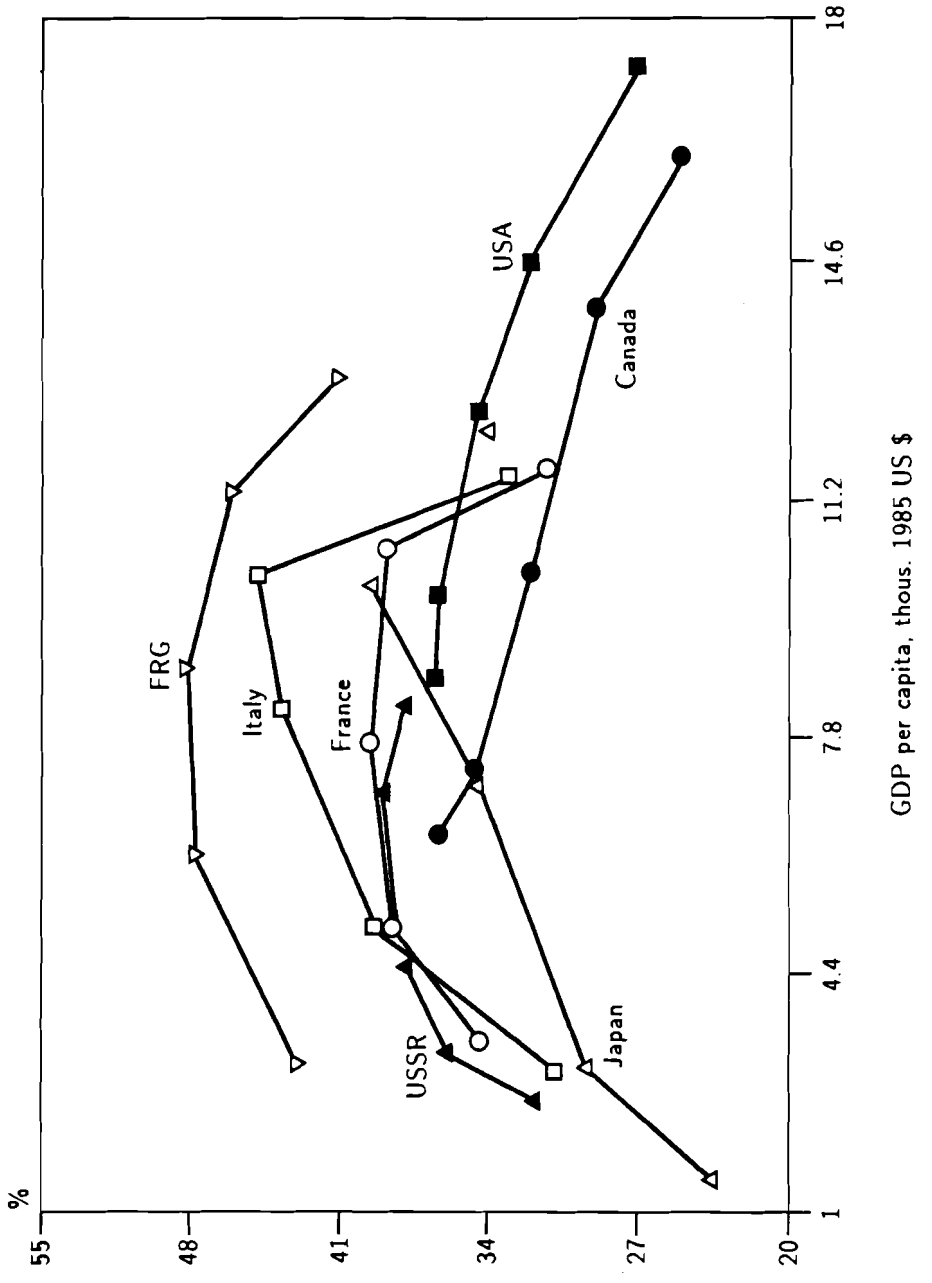

Figure 8.2. Share of employed in industry and construction in total employment.

Correspondence between the Productive Forces' Industrial (material) and Human Components in Eastern European Countries and in the USSR

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Introduction

Recently, Soviet politicians and others from Eastern Europe have frequently used the term "human factor," which has come to denote an uncertain and vague concept of the role of manpower resources in the economy. It seems that this term has much to do with the necessity for qualitative development of these resources. In other words "human factor" denotes the influence on the potential and output of manpower resources as determined by different living conditions amongst the inhabitants, the population's satisfaction with the compensation for work, the social security system, and other factors.

This great interest in the human components of productive forces is quite understandable because changes in the qualitative standards of manpower resources are paramount for economic transformations in East European

countries. Moreover, as we attempt to demonstrate in this paper, the decreasing rate of growth and the stagnation of industrial development in Eastern Europe and the USSR can be mainly accounted for by inadequate development and even exhaustion of these manpower resources. In our context, the term "human resources" include not only gainfully employed population (the quantity and quality of which are crucial characteristics) and not only manual labor in material production, but also intellectual workers, those who are employed in the "tertiary" sector, and the population as a whole. For example, such processes as the training of young people, which enables them to become part of the gainfully employed population and maintain the living standards of the retired, play an equally important role in the development of labor resources.

The labor resources of a country, if taken as one particular and active kind of resource, constitute the main factor ensuring dynamic development of the country's economy, and thus the prosperity of society as a whole. Like other resources, labor potential can also be accelerated, exhausted, or remain at a stagnant level a certain period of time. Naturally, these three tendencies depend on the compensation for work. These expenditures have a dual character—first, the wage and salary system and other pecuniary payments; secondly, provision of this active money with consumer goods and public services including culture, education, etc. This article only indicates the degree of possible material, but not the pecuniary compensation adequate for labor expenditures of the human factor.

Unfortunately, we were only able to estimate this compensation by production capacity of some commodities and services, but not by their consumption as there is no complete data on consumption in the selected countries.

The author is deeply grateful to Professor Robert Eisner for introducing clarity into the estimation method of divergence degree between material and human factors, and also to Professor D. Lvov for his arrangements that have made this research possible.

Problems of Measurement

This work is an attempt at measuring the levels of labor expenditures and compensation for these expenditures, as well as an attempt to compare the results with one another.

The general volume of different commodities' production (per capita) was taken as the initial base for estimation of labor expenditures. Some characteristic domestic living standards per capita were also used. It was necessary to evaluate the compensation level for these expenditures.

As previously stated, the first constituent, namely labor expenditure, will be called industrial (or material) factor and the second constituent, compensation for labor, will be referred to as human factor. In some cases, we make assumptions about the level of development in a country with respect to the selected factor, but using this term in the restricted sense of the work—only from the point of view of produced commodities and not taking into account the level of corresponding technologies, product quality, degree of automation in production, etc.

We have to make a reservation before hand: it is impossible to obtain an absolute scale for these expenditures and compensation degrees; therefore, we will operate only with relative scales.

The comparison of the degree of development of material and human constituents as productive forces has been carried out in research by Freedman, et al (p. 131–151). In their analysis of 85 socialist countries, a connection is shown to exist between the development of material and human factors (data since the end of 1960) [See Fig. 9.1].

For instance, the graph shows that rather quick growth of material factor (M, vertical axis) can be achieved only through the accumulation of some level of human factor development (H, horizontal axis).[1]

The connection, illustrated in Figure 9.1, is based on static data and shows the change of M and H factors' values in countries with different levels of development, but not a trend in the change of these factors within one country. In our present research, this connection can be traced temporally within each country included in the group listed below. Substantial interpretation of M and H factors also changes, (though simplified in some way) due to which material and human components have been estimated [1].

Here, these factors are taken as labor expenditure and labor compensation measurements, but not as a measure for the development level of one or another country determined by these components.

All calculations were made for the six East European countries that had been maintaining socialist orientation (Bulgaria, the ČSFR, the former GDR, Hungary, Poland, Romania, and for the USSR in the period 1951–1985). Four highly developed countries with market economies—the former

[1] **Methodology and measurement method of M and H factors will be given below.**

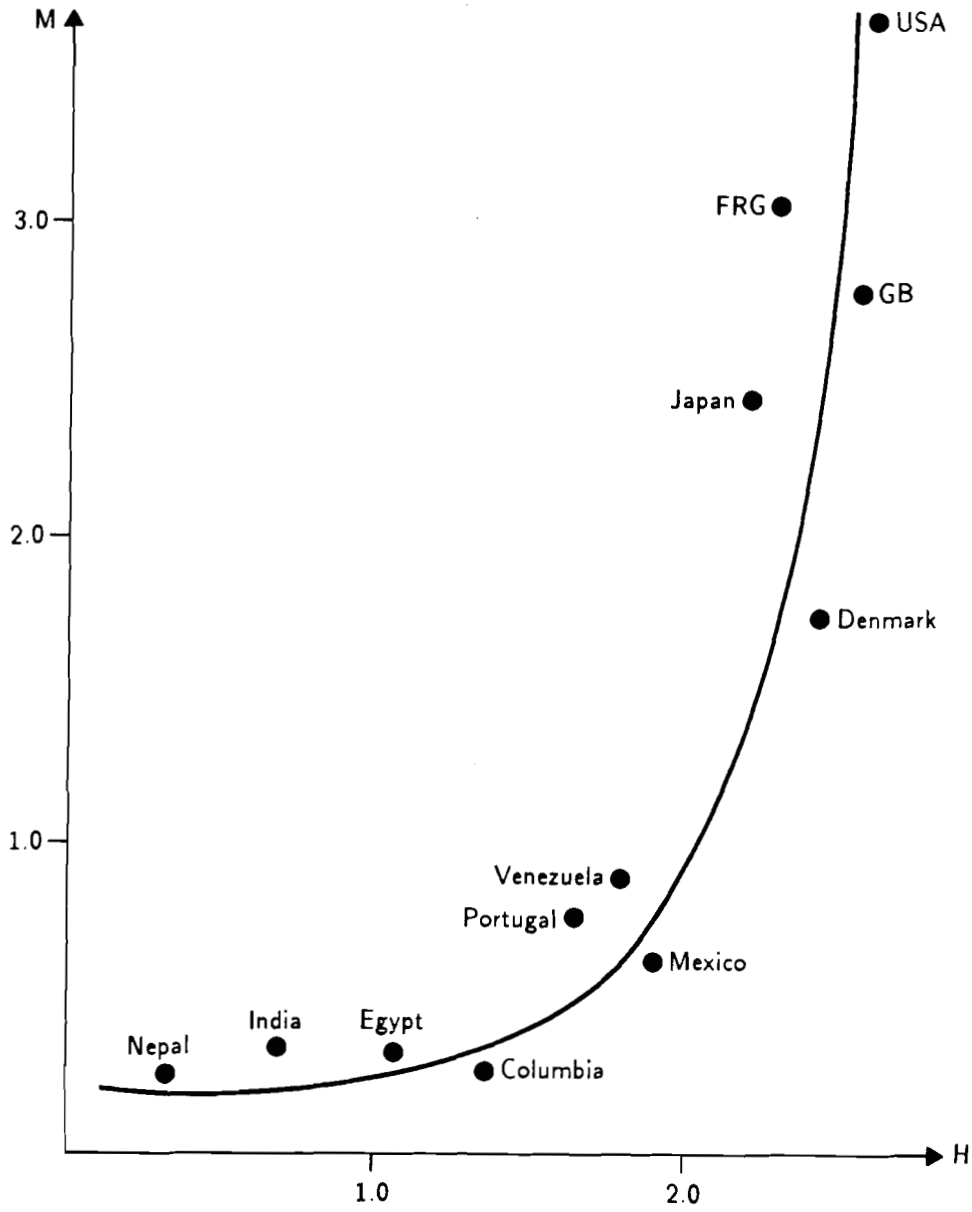

Figure 9.1. Correspondence between values of human factor (H) and industrial (material) factor (M) to distinguish the level of development in various countries.

As is shown, Denmark was on the lower boundary of the group of developed countries, while Nepal had the lowest score.

FRG, Great Britain, Japan, and the USA were utilized to set standards. Estimation of human factor's expenditure and compensation were carried out relative to these standards.

The following are the main principles, upon which our estimations are based:

(1) Replacing cost estimation with natural indicators per capita.
(2) Only those indicators associated with a commodity's production, but not its consumption in the process of production.
(3) Included in the research are only indicators of traditional products, with no regard given to any contemporary high–level product.

The main principle at the basis of this investigation is the first of those mentioned above. It would seem very likely that the estimation of material and human factors using cost figures would include some excessive influences such as the effects on market prices or different governments' pricing policies, and others. Additionally, a comparison of material and human factors' values in the USSR and other East European countries with one of these factors in developed countries would present the nearly unsolvable task of adequately valuing parities of hard currencies with those that are, as yet, unconvertible. This becomes even more difficult with respect to the long period to be investigated. It is practically impossible to correctly determine the necessary values in constant costs during the whole period to be researched, even within only a single country.

Shortcomings of natural indicators are known rather well, but, accordingly to our analysis, distortions of the estimations we wish to obtain are considerably less in this case than if cost values are used. This is particularly the case if one takes into account that we only use the volume of production per capita as the measure of labor expenditures.

There is one delicate aspect in comparing countries by indices in natural expressions. If we consider the degree of satisfaction of the population with respect to the consumption by of certain types of goods, it appears that quality of these goods may be lower in the presence of low consumer preference and may simultaneously have just the same significance as a product of much higher quality for consumers with higher preferences. Generally, high quality goods simply cannot be used if consumers have not been prepared for appropriate utilization. There are many examples of this fact—from watches, used as a decoration or amulet by wild tribes, to high quality, imported machines which had not found their proper use in many enterprises in the Soviet Union.

In the data–base, the use of only production indices for a commodity or raw materials output (with the exception of the consumption of raw materials, construction materials, size of one or another equipment's stock, etc.[2]) can be explained by the fact that we are not going to study the level of technological development of these countries, their production efficiency, their place in international division of labor, or other such factors. Thus, for example, from the point of view of labor expenditures it does not matter whether a particular quality of machine–tools have been from imported steel or from the steel produced domestically. It is clear that labor expenditures are even considerably higher in the second case than in the first one.

The third principle is mainly connected with the group of countries where the production of high technology commodities, as computers, robots and so on, is relatively small and is not yet leading in their economy.

Quite a large data–base was compiled using the initial premises mentioned above. It contains nearly 90 variables for 11 countries from 1951–1985. A full description of this data-base with all possible references, estimation lists, definitions, etc., can be found in Andrukovich, 1991 [2]. A short list of the figures used will be given later in this paper.

One of the key elements of this research is how a great deal of diversity in the changes of indices was synthesized into a small number of internal indicators. The purpose of these indicators is to concentrate the most significant part of the information contained in the initial data. Construction of summarized characteristics for the estimation of labor expenditure and compensation degree was made on the basis of the widely known method of principal component analysis, i.e. utilizing one of the factor analysis models [3,4,5,6,7,12].

We should point out that the using of natural factors in intercountry comparative analysis as well as using the models of factor analysis have rather long standing traditions ([1,8,9,10,11,12] and others.). Of course, the ideology of factor analysis is based on the fact that changes of one or another variable are explained by the influence of some latent unavailable factors. The importance of these factors for the objects (countries in our case) is as high as the value of those variables' significance. This dependence is most striking for the growth factor by depicting the relevant increase of many variables in time or from object to object.

[2]Exceptions are: "number of tractors" and "fertilizer consumption" in agriculture as well as some indices of human factor ("TVs in use," etc.).

In the work of Russet [8] and Kyogoku [9], factor analysis was used for the estimation of the development degree of big country groups on the basis of a great amount of variables. Consequently, the results obtained for the first factor (the first main component) were compared with the national income rate per capita. The authors stress that the ordering of countries by the value of such an integral index was, in many cases, more adequate than ordering by national income per capita.

Certainly, we cannot and do not want to assert that the calculation of formal indices is preferable to using natural correlations arising out of the process of economic and industrial activities and having been realized as a cost of one or another commodity; for example, as that "weight" which this commodity contributes to national income. However, we think that the formal approach to analysis of different information contained in our data (and also taking into account using natural, but not cost figures) enables us to value the degree of difference and resemblance between the selected countries from a rather new point of view. In addition, uniformity of integral indexes' calculation methods can be considered as a positive aspect of this approach.

Calculations were carried out in the following way: after substantial considerations all groups of variables were divided into 11 groups with 5–7 variables in each and the research of these groups' changes over time was conducted as a whole on 385 observations. These observations represent 11 (number of countries) time series with 35 observations in each one (from 1951 to 1985).[3]

The 11 groups included:

(1) Energy resources (coal, oil, gas) output and production of common energy and electric power, from 1951.
(2) Metal ores output, melting of metals and cement production, from 1951.
(3) Agriculture (gross yield including grain, potato and cotton, livestock as cattle, cultivated and irrigated area, fertilizer consumption and number of tractors), from 1951.
(4) Chemical industry (production of plastics and resins, synthetic and non–synthetic fibers and yarn, wood pulp), from 1951.
(5) Heavy engineering industry (production of machine–tools, tractors, electric and diesel locomotives, lorries, etc.), from 1951.

[3]With the exception of two groups—heavy engineering industry and production of domestic goods for long-term use, where the length of time series consist of 26 and 29 points respectively, and the total number of observations are 282 and 319.

(6) Production of consumer durables (television sets, passenger cars, refrigerators, watches, etc.), from 1960.
(7) Residential construction (area and quantity of constructed dwellings) and Health care (number of doctors and hospital beds), from 1951.
(8) Food industry (production of meat, butter, eggs, wheat flour, etc.), from 1951.
(9) Light industry (production of woven fabric, footwear, etc.), from 1951.
(10) Education (numbers of children and students in I and II degree schools, number of book titles, etc.), from 1951.
(11) Mass communication diffused among the population (number of radios, TV sets, telephones, etc.), from 1951.

We calculated two or three principal components from each of these groups and then the first components from each calculation were combined into two groups using the hierarchical procedure of principal component construction. One of them depicts material factor (for the initial six groups of variables), while the second depicts human factor (for the last 5 groups of variables). Technical details connected with the comparison of the principal components calculated for different groups of figures, is given in Stocklitsky, et al [10].

Industrial Factor

Now let us analyze the results. The reader is reminded that the main goal of this research is to determine of some connection between the degree of development of the industrial and human components of productive resources in the USSR and East European countries during the post–war period.

As previously alluded to, initial indicators were combined into some summarized characteristics for each of the 11 countries using a linear factor analysis model. The results of these process can be presented in two types of joint diagrams. The first shows the summarized characteristics for all 11 countries simultaneously; for example, these countries are compared with each other by energy resources output or by level of metallic ore output, etc. The second type of diagram can be considered as a kind of "portrait" of each country individually. From the point of view of human and material factors' correlation research, these results are intermediate. Therefore, we will mention only those results that we think are connected with the goal of this investigation. In particular, we should point out that 6 groups of figures, characterizing material factor can be divided into two parts. The first

part includes energy resources and metallic ores output, and agriculture—these are traditional sectors of production where technological processes are already established and the growth in resource criteria (mainly quality) develops relatively slowly. The chemical industry, heavy engineering industry and production of domestic goods for long–term use can be related to the contemporary sectors of production with rapidly changing and complicated technologies, and high demands of labor resources with respect to quality and qualification.

Certainly, as with any other classification, the one given above is not perfectly absolute and expresses only part of the objects' real virtues. Thus, division of these sectors by the degree of ecological danger or by dependence on mineral resources, etc. may give a completely different picture. Including agriculture in the out-of-date sector may only be temporary, particularly if the prospects provided by "gene–engineering" will eventually be adequately realized. For the duration of our investigation, we assume our division to be rather adequate for the goal of this work.

The countries shown in Table 9.1 have rank first, second and third with respect to the 6 components of material factor in the mid–1960s, 1970s and 1980s. In spite of using indicators per capita, the USA and the USSR have some priori advantages over other countries because of the size of their population, territory, and quantity and variety of mineral resources. These factors explain the great diversity of industrial development in these countries. The USA is leading in four of the six sectors included in the investigation; the exceptions are the chemical industry in the 1980s and the heavy engineering and consumer durables industries throughout the study period. The USSR holds second place in energy production, ore output and melt of metals, agriculture from the middle of 70s and third place in the volume of heavy engineering production per capita. At the same time, the USSR takes third or fourth places from the bottom of the list in production of chemicals and domestic goods for long-term use.

Concerning the countries of Eastern Europe as well as Japan, Great Britain, and the former FRG, it is evident that they occupy rather high positions more or less sporadically because of the above mentioned differences in size from USA and USSR. Their potentialities are insufficient for developing all industrial spheres effectively. The widest range of these sectors is covered by the FRG, while Japan appears in the fewest. The main achievement of these two countries are in the spheres of "the second level" manufacturing industry where development is ensured by import of construction materials and energy resources. Among East European countries, only

Table 9.1. The list of the countries occupying the first three places of the industrial factor's component during the 60s, 70s and 80s.

Names of component	Ranking	Years		
		1960s	1970s	1980s
Agriculture	1	USA	USA	USA
	2	USSR	USSR	USSR
	3	BUL	BUL	BUL
Energy	1	USA	USA	USA
	2	GB	USSR	USSR
	3	FRG	ROM	GB
Ores, Metals	1	USA	USA	USA
	2	USSR	USSR	USSR
	3	FRG	JAP	BUL
Chemistry	1	USA	USA	FRG
	2	JAP	FRG	USA
	3	FRG	GDR	GDR
Heavy	1	FRG	FRG	FRG
Machine Tool	2	GB	JAP	JAP
(Engineering)	3	USA	USSR	USSR
Domestic Goods	1	FRG	JAP	JAP
for long–term	2	USA	FRG	GDR
use	3	JAP	USA	FRG

the former GDR succeeded to occupy high places in production of chemical and domestic goods for long-term use; Bulgaria in agriculture, ore output and metallurgy; and, Romania in energy resources output in the mid 70s. As it expected, developed countries like the USA, FRG, Japan, and Great Britain are in leading positions in technological spheres like machine building and chemistry.

The graphics of integral material factor changes for 11 countries in the period from 1960 to 1985 are given in Figure 9.2. The high position of the USA in this picture can be explained by the mentioned wide spectrum and high level of industrial activities. Different levels of development of certain spheres included into this research evens the role of this factor for the FRG, Japan, the USSR and the GDR.

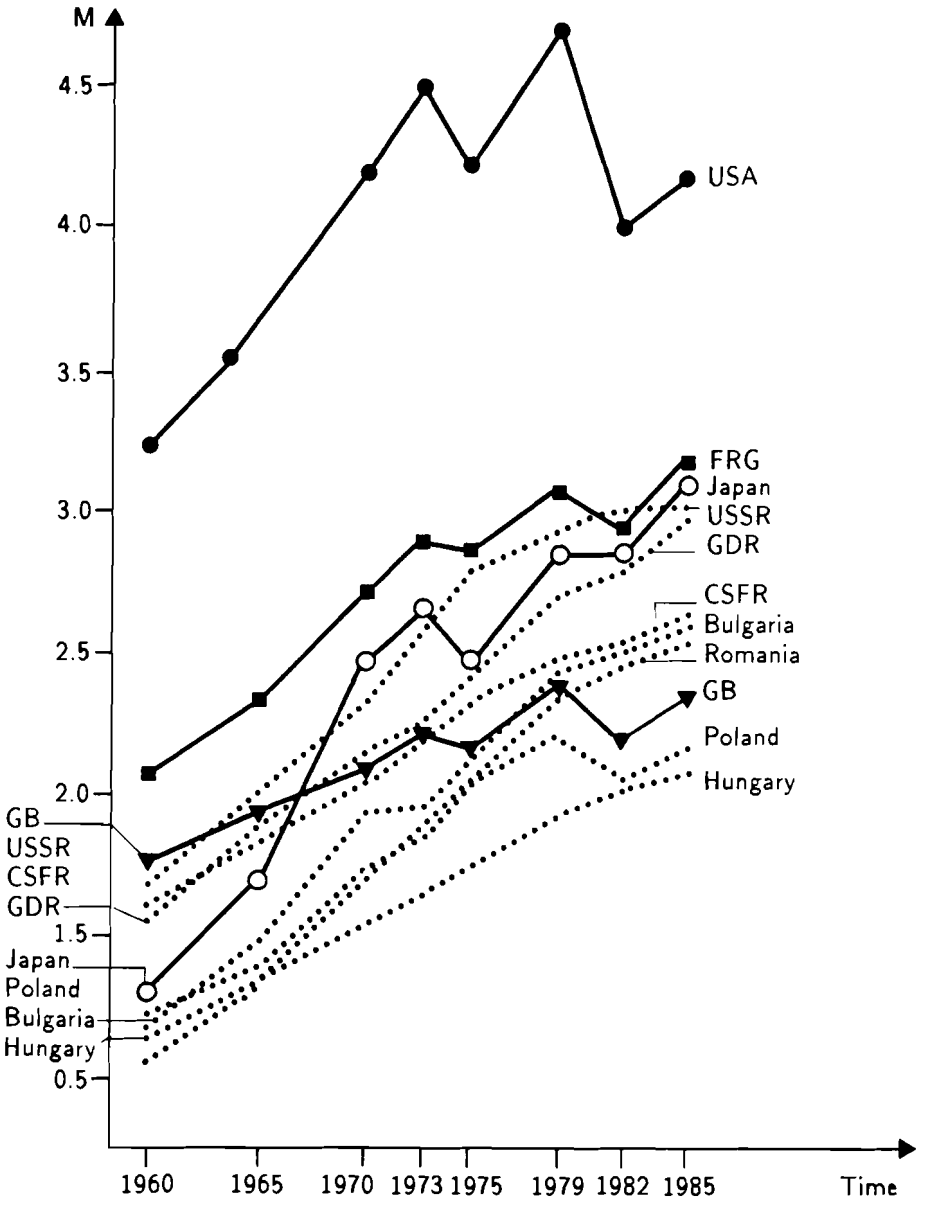

Figure 9.2. Trends of growth of industrial factor, 1960–1985. The years correspond to those, when the trends' change had been maximum.

Table 9.2. The list of the countries ranking first to third in human factors' component during the 1960s, 1970s and 1980s.

Names of component	Ranking	Years		
		1960s	1970s	1980s
Food Manufacturing	1	POL	GDR	GDR
	2	GDR	CSFR	CSFR
	3	CSFR	POL	FRG
Light Industry	1	USA	CSFR	CSFR
	2	CSFR	HUN	BUL
	3	HUN	BUL	HUN
Residential Construction and Health Care	1	FRG	USSR	USSR
	2	USSR	FRG	FRG
	3	USA	JAP	JAP
Education	1	JAP	USA	JAP
	2	USA	JAP	USA
	3	GB	USSR	FRG
Mass Communication	1	USA	USA	USA
	2	GB	GB	GB
	3	FRG	FRG	FRG

Human Factor and its Correlation with Material Factor

Components of human factor can also be divided into two groups determining the degree of satisfaction of some "primary" and "secondary" human needs. Food and light industries, residential construction and health care are included in the first group. The second group contains education and mass communication means. This classification, as the previous one for material factor, is not perfectly comprehensive. Thus, housing construction that meets the minimal needs of the population (i.e. at least to have some kind of room or flat) characterizes only the "primary" needs of human beings and ensures, relatively speaking, only "simple" reproduction of labor resources. A private house or big comfortable flat is one of the factors being necessary for qualitative development of labor resources, in some sense, its "extended reproduction". This also applies to health care development, which applies to the treatment of a sick people in the first case, but would anticipate and prevent disease in advance in the "extended case".

In Table 9.2, there is a ranking of the first three countries for each of the six constituents of human factor in the 60s, 70s, and 80s. Considering the three indicators for qualitative social conditions, FRG and Japan are the two Western developed countries that appear in the first three places with respect to the level of residential construction and health care, while the USA and Great Britain occupy the third and fourth places from the bottom of the list the middle of the 80s. West Germany's and Japan's second and third places can be explained by two reasons: the necessity to restore housing after World War II (as for Japan, also by the necessity to change the patriarchal way of life to a modern one) and the impossibility to import in these spheres. At the same time, needs for food and goods are mainly covered by international trade in all the developed countries.

The results of priorities on education and the prevalence of mass communication are quite obvious in these countries—only the USSR succeeded to take third place in education in the 70s, while the USA, Great Britain, FRG and Japan are leading in these spheres during the entire period.

If we draw an analogy with processes of material production financing, we can interpret the compensation received by labor resources through food and light industry products to have the character of current production costs, while the development of education and information infrastructure is analog to investments. In the USSR and East European countries, precisely this side of human factor development was at a low level for the whole period of study. As a result, human factor potential is now exhausted and is unable to engage in measures for transition to new types of economic relations, development of modern spheres of production, introduction of new technologies, and so on.

In Figure 9.3, there is a representation of changes in human factor for 11 countries for the period from 1951 to 1985. This picture gives rather complete information about countries for this factor. We stress that the figures of human factor are not important just by themselves for this research work. Their correlation with the development of material factor is central to our investigation. We consider material and human factors as the labor resource's expenditure and compensation payed back to labor resources for their expenditures. Therefore, just their correlation is important for us and not one or the other precise value.

In Figure 9.4, there is a graphic depiction of 11 countries by average values of material (M) and human (H) factors in the mid 1960s, 1970s, and 1980s. We calculated the regression's parameters separately for each temporal interval through four points taking the proportion between M and

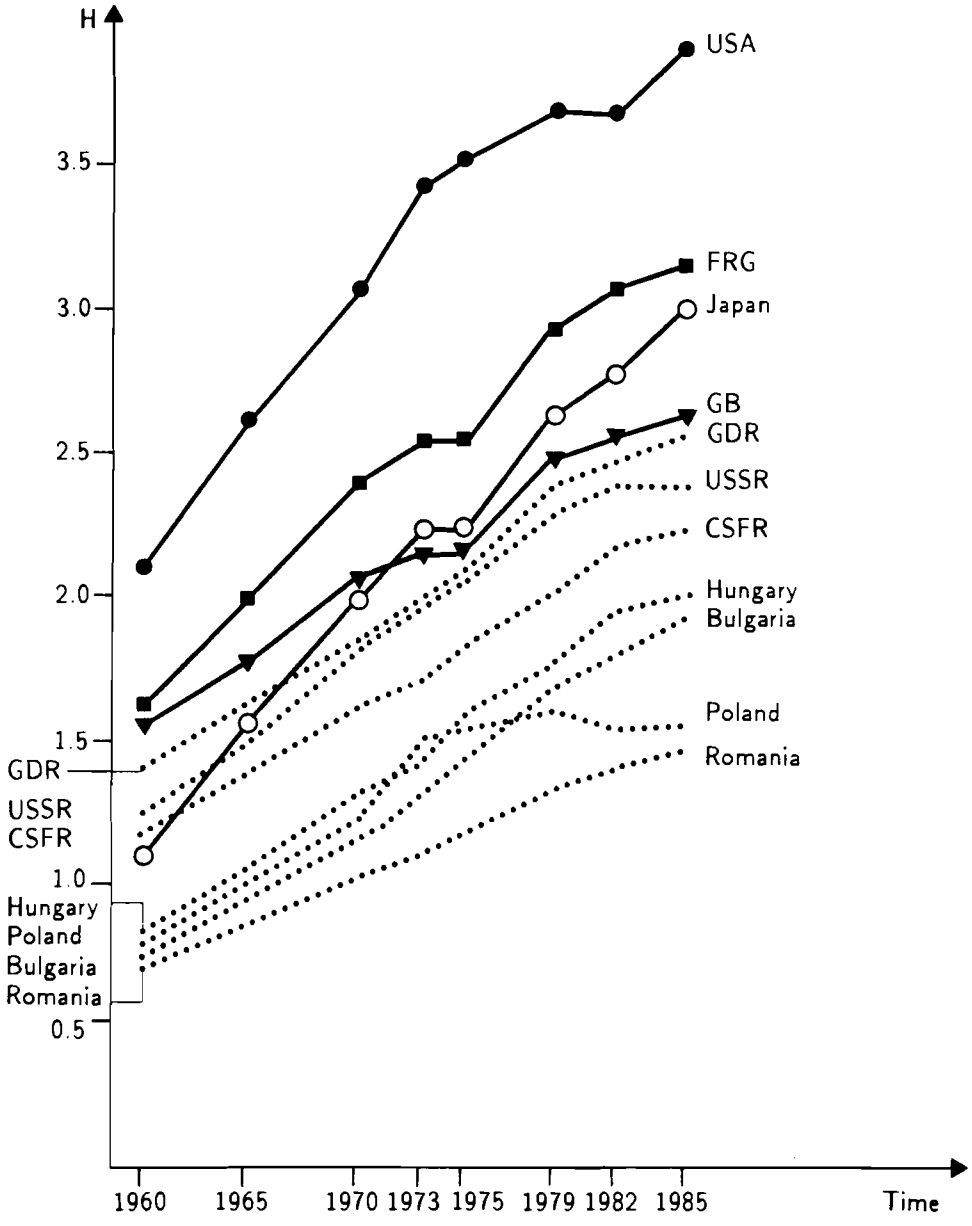

Figure 9.3. Trends of growth of a human factor, 1951–1985. The time interval corresponds to that in Figure 9.2.

H for developed countries as a type of standard. These regression lines determine the best proportions for these factors on average.

These pictures clearly show that human factor development tends to lag behind material factor growth with increasing progression in the East European countries and in the USSR; namely, compensation for labor resources is continually becoming less adequate. In time, this tendency brings them to exhaustion. Obviously, this process is one of the provides reasons for production growth decline or stagnation in East European countries and the USSR by the middle of the 1980s. As shown in Table 9.1, this fact is more evident in those industrial spheres where the level of qualitative development of the labor resource is playing the most important role.

As mentioned above, obtained values of factors have a relative character and it is difficult to express these deviations in real values. One of the ways to put them into concrete expressions is a comparison of these deviations with the human factor (H-factor) average yearly growth which can be measured on the graphics given in Figure 9.3. Let us point out that there are different approaches to such comparative methods. For example, H-factor average yearly growth can be considered during that period of time when these deviations are measured, for example, in the middle of the 60s, 70s, and 80s for each country individually. However, H-factor average yearly growth in the present country for the entire time interval of research is the most appropriate method. Such average increases in events separate H-factor fluctuations in different years. This enables us to obtain more stable estimations. Besides, as it is evident from Figure 9.3, H-factor changes for the majority of countries have practically linear character with the exception of the early 80s. So, such estimation appears to be rather accurate. Estimations obtained with these methods are portrayed in Table 9.3.

The most difficult position for labor resources had developed in Romania as well as in Bulgaria by the middle of 1980s, where the recent change of political and economic structures had been made in the presence of the greatest social instabilities. As is indicated by the results, their future economic and social development will be rather difficult. Only the GDR succeeded to achieve some suitable positions among all East European countries. As to the USSR, estimation of this country's failure to keep its positions by the middle of 80s was probably understated as it is clear from Figure 9.3; human factor values did not change in this country by the end of the 1970s (i.e. its growth was considerably lower by this time than in the previous time interval.

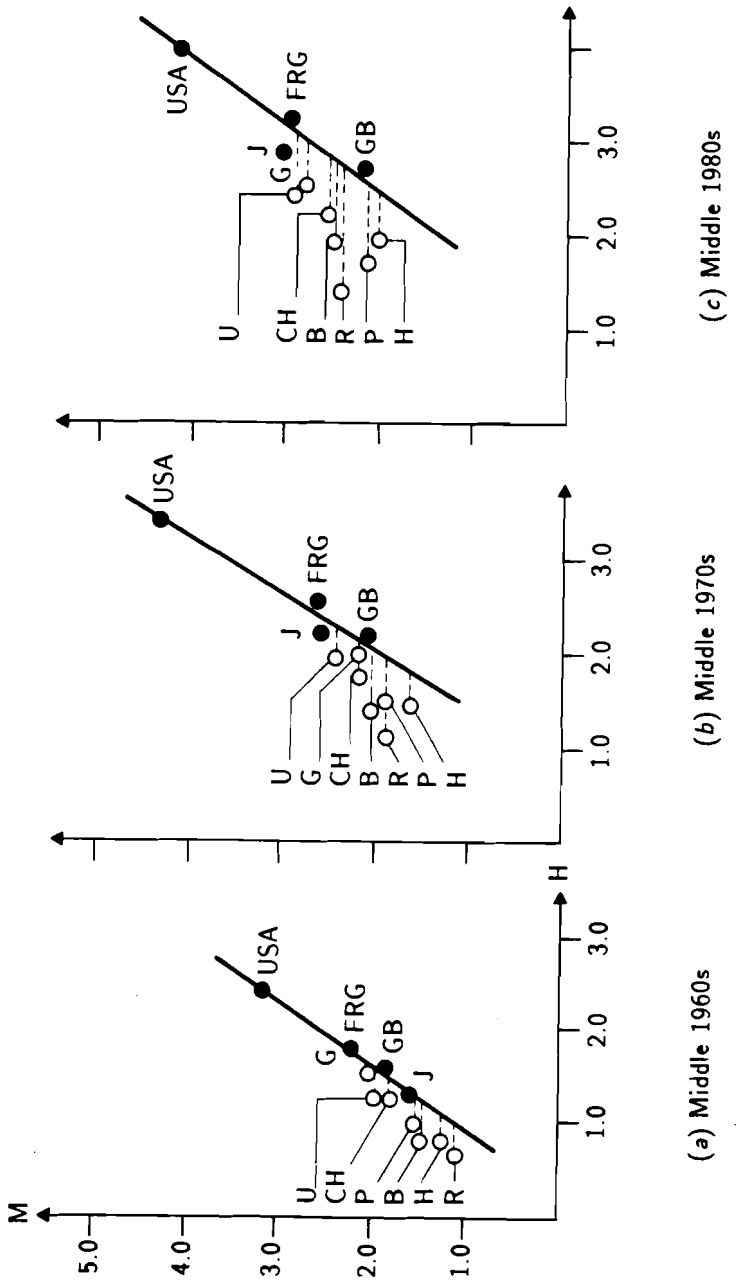

Figure 9.4. Lags of the human factor to USSR and Eastern European countries for mid 60s, 70s, 80s.

Note: B—Bulgaria, CH—ČSFR, G—GDR, H—Hungary, J—Japan, P —Poland, R—Romania, U—USSR.

Table 9.3. The human factor lags with respect to its optimal level compared to the value of the industrial factor in the mid 1960s, 1970s, and 1980s.

	Average growth per year in H value	Deviation from optimal rate					
		mid 60s		mid 70s		mid 80s	
		in		in		in	
		H value	years	H value	years	H value	years
Bulgaria	0.044	0.42	9-10	0.64	14-15	0.80	18-19
Hungary	0.045	0.32	7-8	0.36	8-9	0.44	9-10
GDR	0.052	0	0	0.12	2-3	0.40	9-10
Poland	0.031	0.24	7-8	0.54	17-18	0.86	27-28
Romania	0.033	0.40	11-12	1.20	35-36	1.20	35-36
USSR	0.051	0.24	4-5	0.30	6-7	0.56	10-11
CSFR	0.044	0.20	4-5	0.38	8-9	0.54	12-13

Conclusion

In conclusion, the obtained estimations should not be considered as estimations of time intervals that would be necessary for one or another country to eliminate deviations on labor resource expenditure and compensation. This process will be longer because the increase of labor resource potential will also demand an increase in industrial production. Only a change in the qualitative level of labor resources will likely ensure the possible accelerated development of modern industry.

Notes

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Part III

Appendix A: Varying Methods and Measurements: The Case of Research and Development

R & D in the Past and Future Transition: Analyzing Japanese Post-War Development

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Introduction

This paper describes several major shifts in terms of research and development (R&D) investment in Japanese manufacturing companies since World War II. In other words, the aims of R&D investment have shifted along with the phase shifts in development of Japanese industry: import substitution, fulfilling the growing domestic demand, promotion of export, avoiding trade friction, and so on.

However, Japanese companies are now investing more in R&D than in plant and equipment. High-tech firms are spending on average 80% more on R&D than on plant and equipment. When R&D expenses are greater than capital investment at many companies, we need to rethink what manufacturing companies are. Today leading Japanese firms have entered the stage where they survive by adapting to the changing environment, based on consistent, dependable R&D. The corporate archetype is, therefore, chang-

ing from *a producing organization* to *thinking organization.* However, why is this possible?

One reason is that factory robots and other forms of *soft automation* have been installed, sharply reducing industry's need for capital expenditure Such flexible machinery is merely reprogrammed, rather than replaced, when a factory is being switched over to making a new product. The change-over is completed in hours instead of weeks; the cost of doing so is marginal.

A second reason is that several world crises have endangered Japan's low-tech manufacturing sector. In order to survive, many manufacturing firms have had to abandon much of their old core businesses and, where possible, hasten into higher-value markets. In the process, they are having to add all sorts of high-tech components to their products.

As far as the post-war development of the Japanese R&D is concerned, our analysis reveals the following three distinctive periods: *technology importation in 1961-1975; technology development for economic growth in 1975-1985*; and *new transition after 1985.* In the *first* period of 1961-1975, the major purpose of the R&D effort was to *digest* the imported technologies. In the *second* period of 1975-1985, successful R&D resulted in capital investment, which led to *economic growth.* In the period *after 1985*, the R&D expenditure is *surpassing* capital investment in many Japanese manufacturing companies.

In order to analyze these structural changes in the past thirty years, we have to be careful in choosing an appropriate level and method of analysis for each period which is different from another in its characteristics. In the first period of technology importation, digesting imported technologies should be a national effort. Therefore, an analysis is made at national level. In the second period of inducing capital investment, the causal link can be investigated only at individual project level. Thus, an analysis is made on the R&D project level. In the third period of transition, it is concerned with the definitional aspect of the manufacturing company. Therefore, the level of analysis is naturally at the firm.

In what follows, each of the three periods will be analyzed one after another, using different analytical methods. And it will be shown that the R&D in each period is structurally different from that in other periods. The final section describes the unique features of the manufacturing technology which is making the third transition possible.

Technology Importation: R&D for Digesting Imported Technology in 1961–1975

Within a few decades after World War II, Japan could lift herself up from the label of being the "highly imported technology country" to that of the "technology oriented nation" which is carrying out innovative technical research and which is a net exporter of high technology products to other advanced countries. As we know, after World War II, Japanese industry was completely destroyed and the technological capacity was left far behind that of other nations. The only one major input for R&D and technology rebuilding came from imported technology. But unlike many other countries, imported technologies were carefully screened, adopted, adapted, and became good seeds for Japan's advanced technology of today.

As early as in 1964, MITI conducted a survey which showed the percentage share of R&D expenditure for digesting imported technology in the total R&D expenditures in each industrial sector (See Table 10.1). This survey covered 2,080 companies whose R&D expenditure was higher than 100 million Yen and comprised 72% of the total manufacturing, mining, and utilities sectors in terms of sales. As is shown in Table 10.1, as high as *72%* of the R&D expenditures in chemical fiber is spent for digesting the imported technology. In general, the *material industry* spent a higher share on R&D for digestion: *69%* in rubber, and *47%* in textile. However, the *fabrication industry* also spent a fair amount of R&D for the digestion: *41%* in communication/electronics, *21%* in electrical machinery, and *17%* in ordinary machinery.

In average, the manufacturing sector spent as much as *28%* of their R&D expenditure for digesting the imported technologies in 1964. This shows that, even in the early post-war period, Japanese industry had a long-term plan for developing their R&D potential instead of just copying the foreign technology.

How long did this digestion period last? In order to answer this question, a correlation analysis between technology import payments and R&D investment is conducted [1]. The amount of payment for technology importation is available from the Bank of Japan for every year since 1961. In order to discover structural changes in this relation, a *moving correlation coefficient* is calculated in each five year period starting from the first five years of observation data and moves upward chronologically every year. For example, a correlation analysis will be applied for 1961–1965, 1962–1966, 1963–1967,

Table 10.1. Ratio of R&D Expenditure for Technology Digestion to the Total R&D Expenditure in each Industrial Sector (in %; Fiscal year 1964)

Food Manufacturing	1
Textile	47
Lumber & Wood Products	29
Pulp & Paper	8
Chemicals	33
Chemical Fiber	72
Paint	5
Pharmaceuticals	7
Other chemical products	4
Petroleum Products & Coal	15
Rubber	69
Glass	15
Cement & Ceramics	7
Iron & Steel	18
Non-ferrous Metals	16
Metal Products	15
Ordinary Machinery	17
Electric Machinery	21
Communication/Electronics	41
Automobile	15
Ship-building	4
Other Transportation Machinery	16
Precision Machinery	7
Other Manufacturing	1
Average	28

Source: AIST–MITI, FY 1964.

and so on. In order to show the structural changes during the observation period more clearly, its R^2 in each five year period is shown in Table 10.2. As shown in the table, the moving correlation coefficient is kept above *0.90* until the period of *1971–1975;* therefore, almost all R&D expenditures can be explained by technology import payment. In other words, the main purpose of R&D was to digest the imported technology.

However, an interesting point started since the period of *1972–1976*, in which R^2 began to fall and dropped as low as *0.53* in *1975–1979*. This implies

Table 10.2. Time-series of moving correlation coefficient

time period	R^2
1961-1965	0.98
1962-1966	0.99
1963-1967	0.99
1964-1968	1.00
1965-1969	0.99
1966-1970	1.00
1967-1971	0.99
1968-1972	0.96
1969-1973	0.93
1970-1974	0.95
1971-1975	0.99
1972-1976	0.85
1973-1977	0.89
1974-1978	0.73
1975-1979	0.53
1976-1980	0.75

that R&D relied heavily on technology importation at the early stage, but gradually decreased its dependency. By means of digestion, these imported technologies were utilized and enabled Japan to move into the following stage of development. That is to say, Japan was more capable in producing many technologies for domestic use and exportation.

Technology Development for Economic Growth: R&D for Inducing Capital Investment in 1975–1985

The dynamic relation between R&D as an input and economic growth as an output is supposed to be as follows: new technologies produced by R&D induce a new requirement for capital investment; the increased capacity brought about by capital investment leads to an increase in production; and the increase of production in new sectors provokes a restructuring of an entire economy.

It is almost impossible to trace this whole chain of causal relations in a country's economy. Therefore, an attempt to trace this causality on an individual project basis is made by NISTEP (National Institute of Science and Technology Policy)[2]. Among those projects which were conducted by the Japanese companies in the period of 1975–1985 and whose R&D investment were larger than one billion yen, twenty–eight are selected for our analysis. The distribution of the period of R&D has a peak at *4–6* years, and that of the time period between initiation of R&D and initiation of marketing the product has a peak at *5–6* years.

This survey asked companies about the amount of capital investment that was a resultant of individual R&D investment. Among the successful projects of our sample, the data of capital investment are obtained for eleven. The regression analysis between R&D expenditure (denoted by x) and capital investment (denoted by y) of individual projects yields:

$$\ln y = \underset{(.148)}{1.254} \ln x \underset{(.303)}{-0.743}, \qquad R^2 = 0.888$$

Therefore, the *elasticity* of R&D to capital investment is far above 1.00, reflecting that the R&D investment has an accelerating multiplier effect. Therefore, this result indicates that the R&D investment has a positive contribution to economic growth through the increased capital investment.

In order to differentiate this period of 1975–1985 from the period before 1975, a similar analysis is made in the database which was collected by JATES (Japan Association of Techno-Economic Society) in 1978 [3]. This database included *20* successful projects which had been conducted from 1961 to 1975. The regression analysis yielded:

$$\ln y = \underset{(.214)}{1.272} \ln x \underset{(.568)}{-0.743}, \qquad R^2 = 0.663$$

This implies that a multiplier effect of R&D investment was less deterministic. In other words, the success in R&D did not necessarily induce the capital investment.

Japanese R&D in a New Transition: From a Producing to a Thinking Organization after 1985

The traditional archetype of a *manufacturing company* is a group of people who produce high-quality products at the lowest possible cost, using the most advanced equipment. According to recent statistics, however, research and development expenses account for more than equipment investment in many high-tech companies. Among the *50* companies that had the largest R&D expenditure in 1987, the R&D expenditures in many companies exceeded the spending for capital investment. In as many as *twenty-seven* companies out of this sample of fifty, R&D investment began to surpass capital investment.

In order to avoid the bias which might be brought about by yearly fluctuations in annual capital investment, each company's recent three year average from 1985 through 1987 is calculated, and compared with its three year average of R&D expenditure during the same period. The ratio of R&D expenditure to capital investment is calculated for each company. These ratios, for example, are *2.04* for Hitachi and *1.30* for NEC. In other words, these companies are spending *104%* or *30%* more on R&D than on plant and equipment.

The listing of companies by R&D expenditure inevitably includes companies such as NTT (Nippon Telegraph and Telephone Corporation) and *Tokyo Electric Power Co.*, that primarily provide services. In these non-manufacturing companies, the capital expenditure is much larger than the R&D expenditure, thus, the R&D/Capital investment ratio is not larger than *0.10*. If these non-manufacturing companies are excluded, the *average R&D/Capital ratio of the top 50 Japanese manufacturing companies* equals *1.29*. In other words, on average, the major Japanese manufacturing companies are spending *29%* more on R&D than equipment.

However, what is more important is that this change has occurred only recently. The time series data in the *national totals of all the Japanese manufacturing companies* are shown in Table 10.3. In Table 10.3, there are two kinds of data for capital investment: (B) and (C). Among other things, capital investment (B) includes the investment for equipment and facilities which are related to R&D, such as construction of research laboratories and purchase of large testing equipment. However, these investments are included in the R&D expenditure (A), in the form of the depreciation costs of these facilities. Therefore, double counting exists in R&D and capital

Table 10.3. Time-series of R&D expenditure compared with capital investment of all the Japanese manufacturing companies.

Year	R&D Expenditure (billion)	Capital Investment billion		R&D/Capital Ratio	
	(A)	(B)	(C)	(A/B)	(A/C)
1980	2,896	4,651	4,372	0.62	0.66
1981	3,374	5,161	4,784	0.65	0.71
1982	3,756	5,099	4,727	0.74	0.79
1983	4,257	4,762	4,352	0.89	0.98
1984	4,777	5,788	5,285	0.83	0.90
1985	5,544	6,110	5,469	0.91	1.01
1986	5,740	4,896	4,343	1.17	1.32
1987	6,101	4,860	4,151	1.26	1.47

Source: MITI for capital investment, and Prime Minister's Office for R&D expenditure.

investment, as far as the investments on those items are concerned. In order to avoid such double counting, the average percentage of these investments in total capital investment is estimated in each year, as far as the sampled manufacturing companies are concerned. Using these coefficients, we can estimate the capital investment which excludes the investment for R&D activities, as shown in capital investment (C). Therefore, comparing R&D expenditure (A) with capital investment (C) is reasonable at least in terms of costs which are involved in R&D activities.

As shown in the table, the reversal had taken place already in 1985. In 1985, *5.54 trillion* yen is allocated for R&D expenditure and *5.47 trillion* yen for capital investment. In 1986, these figures were *Y5.74* trillion and *Y4.34* trillion, respectively. In 1987, they were already at *Y6.1 trillion* and *Y4.15 trillion.* The ratio of R&D to capital investment was *0.66* in 1980, and *0.90* in 1984. However, the ratio became *1.01* in 1985, *1.32* in 1986, and reached as high as *1.47* in 1987, meaning that the Japanese manufacturing companies are spending *47%* more on R&D than on machinery and equipment.

We are interested in the time trend of the distribution of these ratios for individual companies because the phenomena of R&D expenditure surpassing the capital investment has more meaning when it is referred to in the context of individual companies, while not so much with respect to the total of all the manufacturing companies. We are also interested in how general

Table 10.4. Shift in cumulative distribution curves of R&D/Capital investment rations among the largest 50 manufacturing companies.

Range of R&D/ Capital Ratio	Percentile of manufacturing companies		
	1985 (in %)	1986 (in %)	1987 (in %)
$\leq$0.2	20	13	15
$\leq$0.4	42	28	23
$\leq$0.6	54	38	34
$\leq$0.8	60	53	47
$\leq$1.0	74	66	57
$\leq$1.2	88	74	66
$\leq$1.4	92	77	72
$\leq$1.6	94	85	81
$\leq$1.8	94	87	81
$\leq$2.0	94	92	87
$\leq$5.0	100	100	100

Note: The largest 50 manufacturing companies are selected based on their total sales in each year. Source: Japan Companies Handbook

this phenomenon is throughout the major Japanese manufacturing companies, not only in the R&D intensive companies. It might be argued that the choice of fifty companies in terms of their R&D expenditures might bias the results in favor of R&D expense vis-a-vis capital investment. Therefore, the *total sales* of companies was selected as a criterion for choosing the fifty manufacturing companies, in order to eliminate the biases and to be neutral. Thus, the time shift in cumulative distribution curves of the R&D/Capital investment ratios among the largest 50 manufacturing companies with the largest total sales are shown in Table 10.4. As is depicted in the table, the reversal is getting more and more common in Japanese manufacturing companies. In 1987, the curve looks almost linear, meaning that the ratio is almost uniformly distributed among the fifty companies.

A closer look at Table 10.3 reveals, however, that the reversal is attained by the opposite movements of these two expenditures: capital investment decreased continuously since 1985, while R&D investment has grown since 1980. Then, these two curves cross in 1986.

The recent growth in R&D investment is presumably attributable to increased investment in long-term research, and increased product development costs for secondary businesses. In other words, the recent rapid increase in R&D investment comes from the two factors: an increase *in depth*, to-

ward more fundamental research; and, an increase *in breadth*, toward more encompassing research [4].

Manufacturing for Thinking Organization: Unique Features of Flexible Manufacturing System

Various forms of "soft automation", such as *Flexible Manufacturing System (FMS)*, reduced industry's need for capital expenditure sharply. The introduction of *FMS* has brought the situation, in which manufacturing companies will not have to worry about manufacturing anymore. Thus, the development of manufacturing technologies made possible the increase in R&D investment.

The Flexible Manufacturing System (FMS) enables a transition in production methods from the mass-production of a small product range to the small batch production of a diversified range of products. Thus a comparison of these two production systems would help clarify what exactly is FMS [5].

Process accuracy

In Japan we have a saying: the technology of mass production requires that *every 100 shots* fired must hit the same target bullseye, whereas the technology of *FMS* requires that *every single shot* fired should hit the target bulls-eye. The key difference lies in the fact that in the former cases we are talking about all 100 shots hitting the same target bullseye, whereas in the latter case each shot should hit the target, but the target may change with each shot.

In the case of a mass-production system, one can expect both a *shake down period* for the machines, and a concurrent familiarization for the worker to the machine as production experience increases. It can also be expected that once all the bugs have been ironed out of a single product mass production system, certain latent production potential which is greater than expected may be discovered. In the case of *FMS*, however, this cannot be expected.

With regard to the viewpoint of process accuracy, the technological capability level of *FMS* should be higher than that of the mass production by a *factor of one or two.* Another way of putting this is to say that *FMS* can

exist only when both machines and men are capable of a very much higher level of process accuracy than in a mere mass-production system.

Quality control

The basic idea of *Q.C. in FMS* is that the machines automatically stop when a product is found to be non-standard or out of specification. You can better understand this by supposing an unmanned factory at night. Suppose you find that a machine in the unmanned plant has turned out a whole series of substandard products, unnoticed by anyone. How will this happen and how can this be prevented?

In the *Q.C.* procedure as applied in mass-production systems, the inspection is made after the processing is finished. In the case of *Q.C.* as applied in *FMS* in which each individual product may be of different specification, the inspection should take place based on signals received before processing. For example, obviously a tool bit should be changed before it is worn out and cause reject products and so this is done by measuring the torque against present standards.

Maintenance

The maintenance of a *FMS*, which is expected to give most benefit to the management in terms of unmanned operation at night, requires a completely different concept of management from the mass-production system in which the attainment of production quality is the main object.

In other words, it is important to minimize the *down-time* of the operation in the case of day-time operations involving the workers. Conversely, in the case of *FMS*, it is important not to amass a heap of junk products during unmanned operation at night; it is preferable that the entire system should immediately stop when a substandard product is found, and wait for maintenance workers to arrive whilst the system remains stopped. The key factor for *FMS*, therefore, lies in attaining such reliability that the system stops the moment a substandard or reject product is found in the production line.

Reliability

A plant in which all the products may be individually different from one another and produced by unmanned operation, when viewed from the standpoint of reliability, would seem to be almost the ultimate technological

achievement. In other words, the technical reliability of *FMS* is a factor of one greater than that of mass-production.

The Kofu Plant of the *FANUC* company, where this new technological frontier is being opened up, has an output per employee of one hundred million yen per year. Trial calculations made to whether the plant could reduce its costs by *10%* by improving plant/equipment reliability, gave the startling result that this would result in equipment trouble as rarely as *once every four years.* This extremely high reliability is not yet common everywhere.

One the whole, it is difficult to attain such a high level of reliability. *MTBF* (Mean Time Between Failures) is far from reaching that of unmanned operation. This indicates that the wide-spread operation of unmanned factories cannot be attained if it is to be based only on existing technology. To achieve this goal, such new technology as fault detection or self-checking functions need to be developed.

Skill Requirements

At fully automated plants, the only tasks for workers are to use hoists to load a work-piece on to the guide-way to the machining center (M.C.), and to prepare computer programs for the numerically controlled (N.C.) units. In other words, worker input is in the form of two separate kinds of human labor. The manual, physical labor of using the hoist and the intellectual, cerebral work of programming.

The level of the multi-skill involved in the mass-production system is merely that a workman will either carry out different types of operations such as welding, screwing, and making electrical connections or sequentially operating a number of machines; all eventually fall within the definition of manual work.

What the workers at the fully automated plant are involved in, however, is a combination of both physical and cerebral activity. *Multi-skill* is not confined to manual work. Thus *FMS* can be regarded as a unique technical system with the underlying assumption that the *skill requirement* of workers must differ from that of workers in the mass-production system; as compared with the usual *multi-skill concept*, the requirement is a factor of one greater.

This section has reported how the introduction of Flexible Manufacturing Systems has brought about the situation in which manufacturing companies are getting rid of the burdens related to manufacturing. Thus, it has become possible for manufacturing companies to increase R&D investment that are

related to the future. The corporate archetype is, therefore, changing from a *producing organization* to a *thinking organization.*

Concluding Remarks

In this paper, we reviewed and analyzed the post-war development of Japanese R&D activity. We found that three stages of development exist: R&D for technology importation, R&D for economic growth, and R&D for thinking organization.

Since we deal with structural changes, the level of analysis differs from one to another. The method of analysis also differs. In the first period of technology importation, the effort of digesting the imported technologies is a national effort. Therefore, finding the statistical association between payment for technology import and R&D expenditure is enough to prove our hypothesis. However, what is more important is to identify when Japan left that stage. Therefore, a dynamic identification of this association is necessary, hence moving correlation analysis was used.

In the second period of economic growth, the problem is to identify the causal link by which the successful R&D resulted in inducing capital investment. Therefore, the correlation analysis is not enough, hence we used a regression analysis to measure the elasticity of R&D to capital investment.

In the third period of transition, the change has just started. Therefore, the process is far from complete, and insufficient time-series data has accumulated to apply any statistical method. Thus, a simple comparison between R&D expenditure and capital investment is made at individual firm and the manufacturing level. In order to characterize the manufacturing technology which is making this transition possible, a theoretical approach is adapted.

Notes

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Part IV

Appendix B: List of Collaborators

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