AD-A009 126

EXECUTIVE SUMMARY: THE SRI-WEFA SOVIET ECONOMETRIC MODEL: PHASE ONE DOCUMENTATION

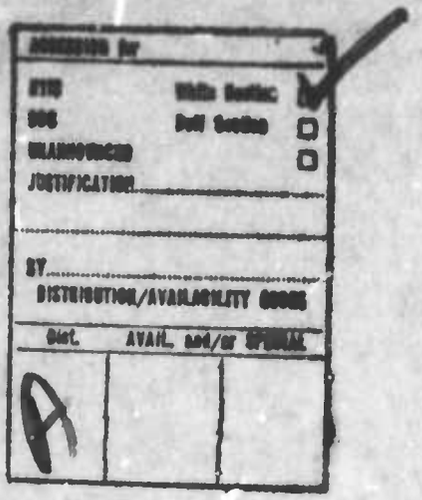
Herbert S. Levine, et al

Stanford Research Institute

Prepared for:

Defense Advanced Research Projects Agency

March 1975



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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SSC-TN-2970-2	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER AD-A009126
4. TITLE (and Subtitle) EXECUTIVE SUMMARY: THE SRI-WEFA SOVIET ECONOMETRIC MODEL: PHASE ONE DOCUMENTATION (U)		5. TYPE OF REPORT & PERIOD COVERED Technical Note 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Herbert S. Levine Donald W. Green		8. CONTRACT OR GRANT NUMBER(s) MDA903-74-C-0165
9. PERFORMING ORGANIZATION NAME AND ADDRESS Stanford Research Institute/Strategic Studies Center 1611 N. Kent Street, Arlington, VA 22209		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS SRI Project 2970
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Advanced Research Projects Agency 1400 Wilson Boulevard Arlington, VA 22209		12. REPORT DATE Final March 1975 13. NUMBER OF PAGES ~~22~~ 23
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

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

18. SUPPLEMENTARY NOTES

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

Economics
Industries
USSR
Models
Forecast Models

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

This paper presents a summary of "The SRI-WEFA Soviet Econometric Model: Phase One Documentation," which examines the results of Phase ONE of work on an econometric model of the Soviet Union. In this paper, the research plan is explained, followed by a discussion of the structure of the model. The next section gives some results of the modelling effort, examining two hypothetical scenarios and including an ex-post forecast for 1973.

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STRATEGIC STUDIES CENTER

SRI Project 2970

Technical Note
SSC-TN-2970-2

November 1974
March 1975
Final

Executive Summary

THE SRI–WEFA SOVIET ECONOMETRIC MODEL: PHASE ONE DOCUMENTATION

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CONTRACT MDA903-74-C-0165

ARPA Order No. 2585

Approved:

Richard B. Foster, Director
Strategic Studies Center

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This Technical Note is in partial fulfillment of Contract MDA903-74-C-0165.

FOREWORD

This study marks the combination of the fields of Soviet economic analysis and modern econometric modeling, two areas which are of increasing importance in understanding today's complex world. Joined by economists from Wharton Econometric Forecasting Associates, whose wide range of experience includes some work with modeling socialist economies, the Strategic Studies Center, as part of its Soviet and comparative economics program, has undertaken the construction of the first large-scale econometric model of the Soviet Union. This paper presents a summary of the first phase of the model, including a description of the structure of the model and the results of experiments in simulation and forecasting.

The authors would like to acknowledge the inputs and critiques of Dr. Christopher I. Higgins, visiting professor at the University of Pennsylvania, Dr. Lawrence R. Klein of Wharton Econometric Forecasting Associates and Professor of Economics at the University of Pennsylvania, Dr. F. Gerard Adams of Wharton EFA and Professor of Economics at the University of Pennsylvania, Dr. Ross S. Preston, Wharton EFA and the Department of Economics at the University of Pennsylvania, Mr. M. Mark Earle, Jr. of Stanford Research Institute, Dr. Mitsuo Saito, visiting professor at the University of Pennsylvania, and Charles Movit, Research Analyst, SRI/SSC.

The authors would also like to thank the many Soviet specialists and econometric specialists who took part in the three colloquia on the model held this past year.

Richard B. Foster
Director
Strategic Studies Center

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THE SRI-WEFA SOVIET ECONOMETRIC MODEL: PHASE ONE

--EXECUTIVE SUMMARY--

Introduction

The object of our project is the construction of an econometric model of the Soviet Union, one that would serve as a flexible tool of policy analysis through the assessment of the impact of Soviet plans, other administrative instruments, and external stimuli on the Soviet economy, and through scenario simulation, and short- and medium-term forecasting.

In its nature, an econometric model of a given economy is a quantitative, mathematical depiction of its economic relationships as specified by economic analysis. The construction of such a model involves the statistical estimation of technical, statutory, and behavioral relations which describe the structure of the economy; while economic theory serves to specify the form of these relations and to appraise the reasonableness of the quantitative estimates of the relationships which are obtained. The success of the modelling experiment then depends upon the reliability of the data, the appropriateness of the statistical estimating procedures, and the theoretical specifications employed.

There exists by now a rather extensive accumulation of experience with the modelling of Western market economies. A large body of useful data are available, and effective statistical estimating techniques have been developed. From the theoretical side, these models are usually demand oriented with utility and profit maximization and cost minimization behavior presumed to operate within the competitive environment of markets. In approaching the task of modelling the Soviet economy, certain differences stand out. The data base, though more substantial than is commonly believed, is not as great as that in most Western nations. And from the theoretical side, the economy is essentially supply oriented, and decisions are not primarily made in competitive markets, but within the environment of a centrally planned, command economy.

What We Did

In light of this background, in this first phase of our work on the Soviet econometric model, we undertook and accomplished the following tasks. First, we pursued the assembling of a data base, appropriate for the construction of an econometric model In this effort, we received substantial and invaluable aid from several sources, including a number of United States Government offices.

One of the decisions which had to be made in regard to data involved the choice between official Soviet data and Western reconstructions of Soviet data. For many relationships we preferred to use official Soviet data, but for some, we chose to use Western reconstructions. One such example was the sectoral output growth series, used in the production functions, so crucial in a supply-oriented economy. This was done because we felt Western recalculations, which reflect net value added, provide more insightful measures of the growth path of real output than do Soviet sectoral growth series, which reflect gross value of output.

In all, we presently have over 650 variables in our databank including data directly from the source, transformations of such data, and variables defined specifically for the model (dummy variables, etc.). The complete set of variables in our databank are alphabetically listed at the end of Appendix B.* Not all of these variables have been used directly in Phase One of the model. The 178 variables which have been directly used in the model are listed separately in the report Appendix A, pp. A6-A9.*

The second task involved the specification of the model. The basic structure of the model will be sketched out below (it is discussed in detail in Section 2 of our Report). Here let it be said that for the specification of the technical and behavioral relationships, we drew on the body of theoretical analysis of the Soviet economy, primarily that which has been developed in the West, but also that which

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* All mention to sections, appendices, etc., of the "report" refer to a draft final report by D. W. Green and C. Higgins, "The SRI-WEFA Soviet Econometric Model: Phase One Documentation," SSC-TN-2970-1 (September 1974).

comes, especially in recent years, from the Soviet Union. We also drew directly on the community of Soviet economic specialists in the United States, including a few recent Soviet emigre economists, through several symposia and direct consultantships. Furthermore, in the presence of specification and statistical estimation of several economic relationships, we were able to augment the existing body of theory on the operation of the Soviet economy.

The third task comprised the statistical estimation of the economic relationships specified in the model. For this work we used standard statistical estimating techniques. By the time the specification and estimating tasks were completed, the model consisted of 81 behavioral, statutory, and technical (mostly production function) equations, plus 32 definitions, or identities (see the table on p. A1 of Appendix A).

In the fourth task, the model was solved in the form of dynamic simulation. In addition to the 113 endogenous variables· i.e., those solved within the model, we used 65 exogenous variables, whose values had to be set outside of the model. Many of these are dummy variables indicating shifts in certain relationships in given years. About 25 of the exogenous variables, however, relate to regular activities outside of the model which have significant effects on the behavior of the modelled economy. Primary among these is the set of planned government budgetary expenditures and revenues announced each December in the plan and budget reports for the forthcoming year Thus, our model is related to Soviet plans: it is driven by plan budget data and it contains, through a series of dummy and other exogenous variables, explicit reference to the economic impact of Soviet annual and five-year plans. The exogenous variables also include agricultural weather variables and foreign trade, demographic, and specialized education variables. The model was solved as an interrelated set of equations from initial values of lagged variables

and exogenous inputs. The solution is dynamic in the sense that one year's values plus the given levels of exogenous variables lead into the following year's solution. The modelled paths of the 113 endogenous variables were plotted over the sample period, 1961-1972, and were then compared with the actually observed paths. The nature of the results is indicated below. The results are discussed in detail in the Report, pp 29-32.

In the fifth task, we examined the performance of the Soviet economy under two alternative scenarios. In the first of these, we solved the model over the period 1961-72 with alternative levels for the exogenous weather variables in 1963, "producing" in this way a normal agricultural harvest in that year rather than the disaster they had. And in the second, we solved the model, again over the sample period 1961-1972, with higher values for the exogenous Soviet defense expenditures in the years 1965-1967. Some illustrative results from these scenarios are given below in this summary. Detailed discussion of them is found in Section 4 of the Report.

In the sixth, and final, task, the model was solved, as an extrapolation beyond the sample period, for the year 1973. This was in the nature of an "ex-post forecast." It gave us the opportunity to observe the accuracy of the model in a forecasting mode and thus provided guidance for further work in improving the model for future use in forward projections. Some observations on the results of this forecast are given below in this summary. The forecast is discussed in some detail in Section 5 of the Report.

Structure of the Model

In our model, we are concerned with the entire macro-economy, with the output and use of Soviet gross national product. On the supply side, we have disaggre-

gated GNP into the outputs of five productive sectors:

Industry
Agriculture
Construction
Transport and Communication
Government, Services, and Trade

On the demand side, we have disaggregated GNP by end-use into:

Consumption. (4 categories)
Investment. (3 categories)
Government Spending. (4 categories)
Net Exports. (8 categories)
Residual

The core of the model consists of seven major blocks of relationships:

1. Factor Supply Equations
2. Sectoral Production Functions
3. Capital Investment Functions
4. Income, Wage and Price Equations
5 Consumption Functions
6. Foreign Trade Equations
7. Residual Analysis

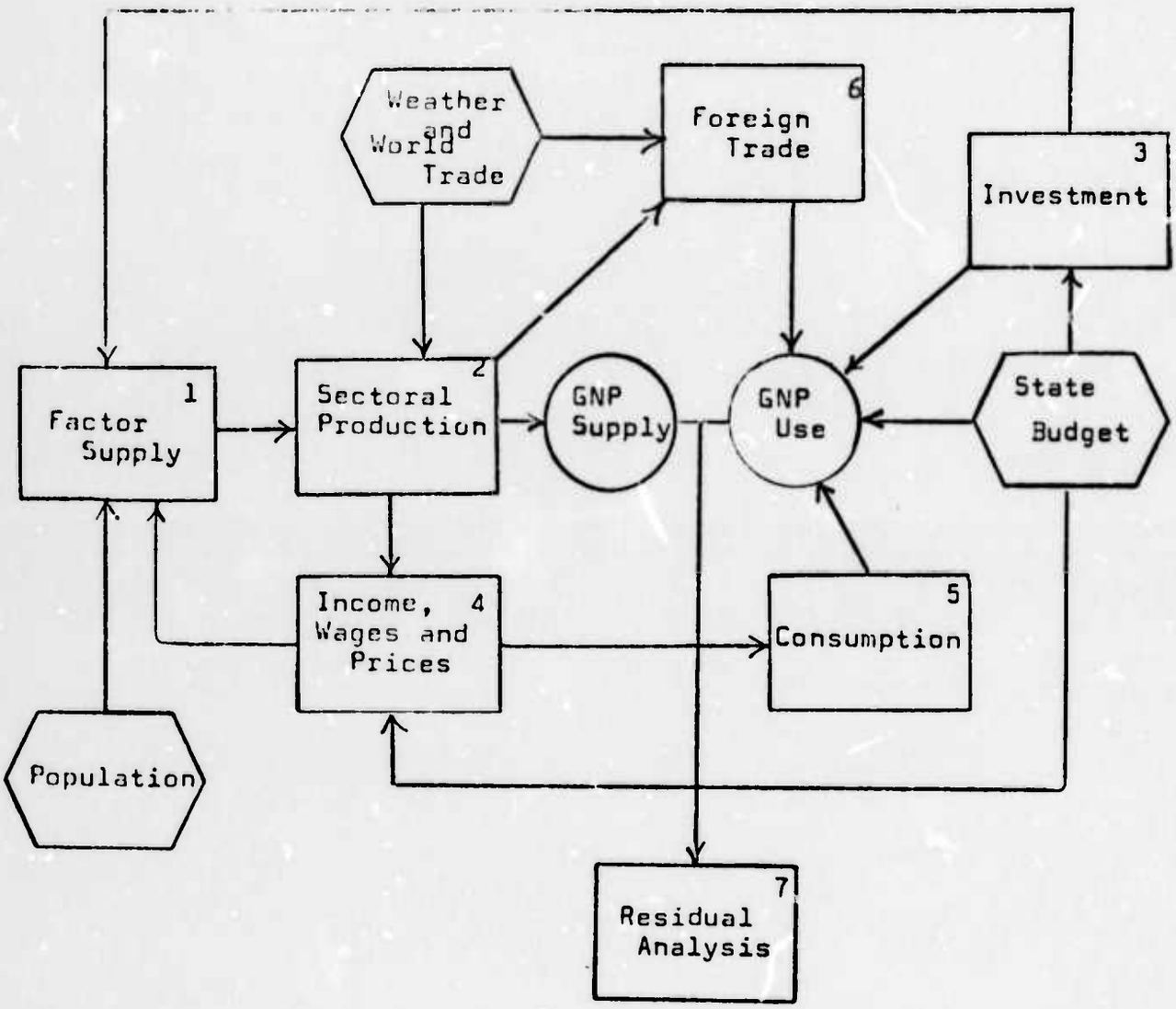
A brief indication of the contents of each block follows. The links among the blocks of relationships are diagrammed in Figure 1 below. A more detailed analysis is presented in the Report, pp. 11-19, and a complete listing of the 113 equations is provided in Appendix A of the Report.

The factor supply block contains equations on employment, labor participation rates, urban-rural population, capital stock, and agricultural livestock and current purchases. Each of these sub-groups requires, of course, a different specification. As an example of one of these specifications, the labor participation rate and urban-rural distribution of population are specified as dependent upon wage differentials, relative housing scarcities, and past harvests.

In the production function block, we have estimated a production function, relating output to the levels of inputs, for each of the five production sectors.

FIGURE 1

The Core of the SRI-WEFA Model



Endogenous components represented by rectangles.

Exogenous variables and partially exogenous components represented by hexagons.

For two sectors, industry and transport/communication, the labor force is disaggregated into specialist and non-specialist employees. And for agriculture we successfully applied a two-step procedure: (1) a production function for "potential output" was obtained by connecting agricultural output peaks, (2) deviations from "potential output" were then related to two weather indexes and to certain measures of factor input intensities.

In the investment function block, we have again estimated a function for each of the production sectors, with an additional separate investment function for the housing sector. The investment functions in our model, in general, relate current year's investment to the previous year's investment, planned budget financing, the level of gross profits, budget outlays on defense, and the current and preceding harvests. Of special note is the "crisis response" of investment in agriculture in the year following a harvest failure. We also have estimated a series of sectoral inventory equations, which for comparative purposes are not included here, but are included in the residual analysis block.

In regard to the income, wage and price block, money income of households is determined largely by employment and money wage rates, with adjustments for transfer payments and direct taxes. The (long-run) real wage is generally related to changes in productivity with large adjustments in years of major wage reforms; money wages are influenced by past prices. Current non-food prices are essentially marked-up on the industrial money wage, and food prices are modelled to reflect short-run scarcities.

The consumption function block contains an overall consumption equation, and separate equations for the four consumption sub-categories. Consumption expenditures are related to disposable income and are subjected to supply constraints from agricultural and industrial production. We experimented with alternative equations which are more supply determined: consumption as an end-use residual, and as determined through delivery variables calculated from an aggregated version of the 1966 input-output table.

In the foreign trade block, four trading regions are distinguished: the six CMEA East European economies, other centrally planned economies, the developed West, and the less developed countries. Soviet exports and imports, by the four regions and by several commodity categories, are related primarily to levels of domestic and foreign production, and in a more limited way to prices. In the equation for wheat imports from the developed West, Soviet harvest failures play a prominent role.

In the residual analysis block of the core, other end-use categories, including capital repair, inventory investment, science, and administration are estimated. We have also estimated an equation for an end-use residual category, which conceptually includes state grain reserves, other undisclosed items, ruble-dollar conversion errors and statistical discrepancy.

Some Results

As was stated, the model has been solved in a number of variants. The solution based on the actual values of the exogenous variables over the sample period, 1961-1972, is considered the basic version of the model. This version performed in quite a satisfactory manner, in the sense that the simulation errors, the discrepancies between estimated and actual values of the endogenous variables, were no larger than those generally found in such modelling efforts for advanced Western countries with recently constructed data bases, for the developing countries, and for other socialist countries. As can be seen in the error statistics presented on p. 30 of the Report, most of the errors are under 3% -- a very respectable performance. This phase of the research effort demonstrates that despite the planned, command nature of the Soviet economy, statistical regularities which can be modelled do exist.

We worked through two counterfactual scenarios over the sample period. These scenarios are analyzed in Section 4 of the Report, and a series of charts are presented showing the movement of the relevant variables in both the basic version of the model and the scenarios. Here, we will discuss the two scenarios at some length, and will present one set of charts for each scenario for illustrative purposes (in the charts, the + signs indicate the scenario path, and the * signs indicate the basic version path).

In the first scenario, we substitute average weather for the cold winter and dry summer of 1963, with the result that agricultural output, Figure 2: Chart I.1, is higher for 1963 in the scenario. It is, however, lower for the rest of the simulation period. The reason for this apparent paradox is given in Chart I.2 for agricultural investment. Investment is higher for 1963 for the scenario path because of decentralized investment by state and collective farms; however, scenario investment in agriculture falls behind in 1964-5 because of the absence of "crisis response" by the Soviet leadership and never catches up to the basic simulation path. The impact of diminished capital on agricultural production would have been even more severe except for the augmentation of the agricultural labor force, which results from the absence of the outmigration of rural population, which in the basic version was stimulated by the harvest failure. Because of this decrease in agricultural output and increase in agricultural labor, the average labor productivity is less on the scenario path and consequently the agricultural wage rate is diminished.

Despite the longrun fall in agricultural output, scenario GNP is higher by 1968. This results from increased employment and capital stock in the nonagricultural sectors. The increase in non-agricultural employment is somewhat surprising since urban population is initially less on the scenario path. However,

FIGURE 2.

SCENARIO I. ABSENCE OF 1963 HARVEST FAILURE
COMPARED WITH BASIC SIMULATED PATH

SIMULATION COLUMN.: WHOLE MODEL
SCENARIO I COLUMN.: REMOVE 1963 HARVEST FAILURE DYN WHOLE

VARIABLE GRAPHED: XATOT TOTAL AGRICULTURAL OUTPUT M.1965 RUBLES

DATE	SIMULATION (*)	SCENARIO I (+)	DIFFERENCE (TIE = X)	%DIFFERENCE
1961	51556.8	51556.8	0.0	0.0
1962	52269.3	52269.3	0.0	0.0
1963	46996.8	53193.5	-6196.7	-13.19
1964	54085.0	53707.5	377.5	0.70
1965	57024.5	55914.8	1109.6	1.95
1966	63107.0	61707.3	1399.7	2.22
1967	61072.0	59798.0	1273.9	2.09
1968	64599.9	63858.0	741.9	1.15
1969	66064.7	65631.6	433.1	0.66
1970	71047.2	70441.5	605.7	0.85
1971	70606.7	69959.7	647.0	0.92
1972	65703.9	65225.5	478.4	0.73

GRAPH RANGE OF VALUES: 46996.8 TO 71047.2

CHART I.1

SUMMARY STATISTICS:
MEAN ABSOLUTE ERROR.....: 1105.3
MEAN ABSOLUTE PERCENTAGE ERROR....: 2.04
ROOT MEAN SQUARED ERROR.....: 1938.8
ROOT MEAN SQUARED PERCENTAGE ERROR: 3.99

VARIABLE GRAPHED: IA PRODUCTIVE INVESTMENT IN AGRICULTURE B.1970 RUBLES

DATE	SIMULATION (*)	SCENARIO I (+)	DIFFERENCE (TIE = X)	%DIFFERENCE
1961	5.9	5.9	0.0	0.0
1962	6.5	6.5	0.0	0.0
1963	7.0	7.1	-0.1	-1.25
1964	8.3	7.9	0.4	4.69
1965	9.1	8.6	0.4	4.54
1966	9.9	9.5	0.4	3.78
1967	10.6	10.2	0.4	4.00
1968	11.5	11.1	0.4	3.09
1969	12.7	12.3	0.4	3.16
1970	14.1	13.6	0.5	3.25
1971	15.0	15.0	0.5	3.35
1972	16.6	16.0	0.6	3.42

GRAPH RANGE OF VALUES: 5.9 TO 16.6

CHART I.2

SUMMARY STATISTICS:
MEAN ABSOLUTE ERROR.....: 0.3
MEAN ABSOLUTE PERCENTAGE ERROR....: 2.08
ROOT MEAN SQUARED ERROR.....: 0.4
ROOT MEAN SQUARED PERCENTAGE ERROR: 3.26

the participation rate of the urban population rises because of an increase in the industrial real wage. In turn, the industrial real wage is raised because the scenario market price for agricultural commodities is below that in the basic version. The removal of the harvest failure boosts gross profits, which in turn raises investment in industry, construction, transport and communications, and services and trade. By the end of the 1960's, this additional capital stock has raised production in the nonagricultural sectors and outweighed the decline in agriculture.

Finally, Soviet exports of food to CMEA economies are larger in 1963-65 under the scenario, but smaller thereafter as agricultural production falls behind. Imports of wheat and wheat flour from the West are much less in 1964 without the harvest failure but are greater from 1965 on because of the lower scenario production. Other trade flows are also affected but the third intriguing result concerns imports of machinery and manufactures from the West. These imports are greater in 1963 and 1964, but less from 1965 on, partially in compensation for the increased wheat imports from the West.

The second scenario concerns Soviet defense expenditures. The actual path of Soviet defense expenditures in the postwar period remains quite a controversial issue among Western analysts. Most likely, additional defense expenditures are concealed in the financing component of the State budget or elsewhere; however, there is no concensus as to the magnitude of that concealed expenditure or about its movement over time. If that covert component varies considerably over the 1960's, then we have not fully accounted for defense impacts upon the Soviet economy in our model construction. Nevertheless, we have been successful in deriving significant defense impacts, particularly upon investment and consumer durables, using only the nonpersonnel component of the official series for defense expenditures.

Many Western analysts have suggested that a major buildup in military hardware took place from 1965 to 1967 without any substantial rise in the official budget. Certainly, in our work we have noted anomalies in just this period; e.g., a shortfall in industrial investment below its predicted level and a drop in factor productivity in Soviet industry. Consequently, we felt that an interesting scenario would be to augment the official defense budget by, say, 2 billion rubles for each year 1965-1967 and examine the impact upon the national economy.

In Figure 3: Chart II.1, we note with some surprise the magnitude of the defense impact upon total investment when all the direct and indirect effects are taken into account. Investment falls by nearly as much as defense rises. This impact is felt upon all nonagricultural sectors with a 0.9 B. ruble fall in industrial investment (Chart II.2), a 0.3 B. ruble fall in transport/communications investment, a 0.4 B. ruble fall in housing investment, and a 0.3 B. ruble fall in services/trade investment for the years 1965-1967. There was also a very small reduction in investment in the construction industry. As a consequence of lower non-agricultural capital, GNP is reduced, the reduction rising to 1.8 billion rubles by 1969, falling off to 1.3 billion rubles in 1972.

This diminished capital stock produces a very interesting longrun impact on our model of the Soviet economy. Average labor productivity is less in Soviet industry and this restrains the rise in the industrial wage. This lowers money incomes and household consumption, thereby adjusting on the demand side to the reduction in GNP supplied. For consumption of durable goods, we see first the crowding-out effects of defense spending in 1965-1967, and then the delayed income effect from 1968 onwards. This reduction in urban incomes slows the population drift away from agriculture, this lowers slightly nonagricultural employment and raises agricultural employment and agricultural output. The reduction in Soviet GNP serves over the longrun to lower total imports by slightly less than 1% and total exports by about 0.2%.

FIGURE 3.

SCENARIO II. A SOVIET DEFENSE BUILDUP 1965-1967
COMPARED WITH BASIC SIMULATED PATH

SIMULATION COLUMN: WHOLE MODEL
SCENARIO II COLUMN: SOVIET MODEL

VARIABLE GRAPHED: ITOTAL INVESTMENT, NATIONAL ECONOMY B.1970 RUBLES

DATE	SIMULATION (*)	SCENARIO II (+)	DIFFERENCE (TIE = X)	%DIFFERENCE
1961	44.3	44.3	0.0	0.0
1962	46.5	46.5	0.0	0.0
1963	48.7	48.7	0.0	0.0
1964	53.4	53.4	0.0	0.0
1965	57.4	55.5	1.9	3.25
1966	61.2	59.3	1.9	3.10
1967	65.9	64.0	1.9	2.86
1968	70.2	70.1	0.0	0.05
1969	75.7	75.6	0.0	0.05
1970	82.0	82.0	0.0	0.05
1971	88.1	88.0	0.0	0.05
1972	93.5	93.5	0.0	0.05

GRAPH RANGE OF VALUES: 44.3 TO 93.5

CHART II.1

SUMMARY STATISTICS:
MEAN ABSOLUTE ERROR.....: 0.5
MEAN ABSOLUTE PERCENTAGE ERROR....: 0.79
ROOT MEAN SQUARED ERROR.....: 0.9
ROOT MEAN SQUARED PERCENTAGE ERROR: 1.34

VARIABLE GRAPHED: IIN INVESTMENT, INDUSTRY B.1970 RUBLES

DATE	SIMULATION (*)	SCENARIO II (+)	DIFFERENCE (TIE = X)	%DIFFERENCE
1961	15.9	15.9	0.0	0.0
1962	16.9	16.9	0.0	0.0
1963	17.9	17.9	0.0	0.0
1964	19.9	19.9	0.0	0.0
1965	20.9	20.0	0.9	4.26
1966	21.7	20.8	0.9	4.09
1967	23.0	22.1	0.9	3.80
1968	24.5	24.5	0.0	0.17
1969	26.8	26.8	0.0	0.16
1970	29.5	29.4	0.0	0.16
1971	31.1	31.0	0.0	0.16
1972	34.0	33.9	0.1	0.16

GRAPH RANGE OF VALUES: 15.9 TO 34.0

CHART II.2

SUMMARY STATISTICS:
MEAN ABSOLUTE ERROR.....: 0.2
MEAN ABSOLUTE PERCENTAGE ERROR....: 1.06
ROOT MEAN SQUARED ERROR.....: 0.4
ROOT MEAN SQUARED PERCENTAGE ERROR: 2.03

In these two scenarios and others that we have run, the model has demonstrated quite reasonable behavior. However, the user of the model must be careful in scenario analysis not to push the system unreasonably far from the historical values for exogenous variables. We feel that our analysis has produced a model which simulates Soviet economic behavior quite well in the neighborhood of the historical path. But to drive the model far from that historical path makes the strong assumption that behavior would be unchanged in quite different circumstances. In the case of the second scenario, for example, a 2 billion ruble increase in defense spending is comparable to actually observed annual changes. However, a 10 billion ruble increase in 1965 would be quite far from the historical record. In such a case, certain components of the model (particularly the investment functions) would have to be reestimated in order for any confidence to be placed in the path traced by the model.

The results of our "ex post forecast" for 1973 are presented and analyzed in the Report, pp. 40-45. In general, we are pleased with this initial forecasting effort: the forecast is rather close to the preliminary data on the Soviet economy in 1973, particularly on the production side. For all sectors other than construction, we predict sectoral growth rates that are slightly below those in the preliminary data. The high growth rate in construction activity results from our large increase in forecasted investment in the construction industry. On the use side, we predict more investment and less consumption than are indicated in the preliminary figures. Our low forecasts for food and soft goods consumption reflect the agricultural constraint from 1972; this constraint was not so severe in 1973, primarily because of expanded imports from the West. The sharp rise of investment (9.2%) predicted by the model is generated by the inertia of official defense expenditures and a predicted 12% rise in gross profits.

In the foreign trade sector, we predict a high growth rate for both exports and imports in 1973, but those predictions fall short of the preliminary growth rates for Soviet foreign trade. Our model, not surprisingly, does not predict the effects of detente on Soviet trade in 1972 and 1973. In using the model to forecast Soviet trade, we will have to incorporate judgmental adjustments for several of the major categories in our system. We will also need to reestimate this sector of the model taking into account the shift in foreign trade associated with detente.

The work we are undertaking in the second phase of the project involving the disaggregation into 16 producing sectors and the embedding of an input-output supplement in the model will, we expect, improve the performance of the model, particularly in regard to the foreign trade component.

In addition to the results generated by the model in its various uses, we gained numerous insights into the operation of the Soviet economy through the process of specification and estimation of particular relationships. These are discussed in Section 3 of the Report. We will here mention only several of the more salient ones.

Many of the most interesting discoveries arose during the estimation of sectoral capital formation equations. In principle, there should be simple technical relations that phase current and past investment into additions to capital stock. However, we soon recognized that the timing of project completions for certain sectors was quite sensitive to the Five-Year-Plan cycle; i.e., whether a particular year falls toward the beginning or the end of the Five-Year-Plan then in operation. After considerable experimentation , we constructed a dummy variable which best captured the impact of investment planning institutions. This variable was constructed to reflect a concentration of project completions toward the end of a Five-Year-Plan and spilling over into the initial year of the subsequent Plan, and it made special allowance for the Seven-Year-Plan (1959-1965).

The estimation of capital formation equations also identified several anomalies in the official data for sectoral capital stock, that is years in which the observed change in capital stock could not be reconciled statistically with the observed investment series. In two cases, we concluded that there had been heretofore undisclosed accounting transfers of capital stock between sectors: a transfer from industry to transport in 1958 and a transfer from industry to housing in 1962. We adjusted the corresponding capital stocks, to make each series more consistent, before estimating sectoral production functions.

In our work on the estimation of investment functions, confirming previous work by others, we found nonagricultural investment to be acutely sensitive to the level of defense expenditure (actually, the nonpersonnel component). At least in the shortrun, an increase in defense spending tends to crowd out investment in industry and the services and housing sector. In addition, we found that the level of gross profits in the economy had a positive impact upon the level of industrial investment (and total nonagricultural investment). In this regard, it is surprising that gross profits are more significant than profits retained for decentralized investment. Thus, a micro financial theory for industrial investment is not supported by our work. Furthermore, economy-wide gross profits are a better predictor than are industry gross profits. In view of these results, we lean toward the hypothesis that profits in the Soviet economy, as in Western economies, are a synthetic indicator for business conditions, including the state of the harvest. This could suggest that the Soviet financial system plays an important role in the allocation of investment, in the adjustment of aggregate demand to aggregate supply.

Finally, in the estimation of the foreign trade component of the model, we did not find any confirmation for the widely-held hypothesis that Soviet exports are determined by import needs. On the contrary, we found in the shortrun that

exports were actually somewhat less in years of domestic scarcity and high imports. An alternative hypothesis is suggested which emphasizes the importance of supply pressure; viz., in those years when taut plans require additional imports, industries which produce for both domestic and foreign users respond more to domestic needs and curtail their exports.

Conclusion

The report briefly: (1) describes the general structure of the SRI-WEFA Phase One Soviet Econometric Model; (2) lists several of the insights developed regarding the inner workings of the economy from the construction of the model; and (3) via a scenario approach demonstrates how the model can be used to improve our understanding of the operation of the Soviet economy and to generate short to mid-term forecasts of Soviet economic performance.

The model's potential value to the policy maker should be evident. But what is perhaps not so clear and what should be emphasized is that the model does not replace the specialists on particular aspects of the Soviet economy. Indeed, it depends upon these specialists -- for data, for expert estimates of levels of exogenous variables, for special information not publicly available, and for expert evaluation of preliminary model results. The relationship between the expert and the model should be a mutually beneficial one. For with the availability of the model, the experts on given sectors of the Soviet economy should be able to concentrate on developing our understanding of those sectors, with the model serving as a filtering device for incorporating expert information into the system, evaluating interactions, and determining full-system effects.