

U. S. AIR FORCE

# PROJECT RAND

## RESEARCH MEMORANDUM

PRICES OF TRACTORS, TRUCKS AND AUTOMOBILES,  
U.S.S.R., 1928-1949

Richard Moorsteen

RM-1121

23 July 1953

Assigned to \_\_\_\_\_

This is a working paper. It may be expanded, modified, or withdrawn at any time. The views, conclusions, and recommendations expressed herein do not necessarily reflect the official views or policies of the United States Air Force.

---

*The* **RAND** *Corporation*

1700 MAIN ST. • SANTA MONICA • CALIFORNIA

---



NOTE: This memorandum was prepared as part of a larger project being conducted for The RAND Corporation under the direction of Professor Abram Bergson.



TABLE OF CONTENTS

|                                                                                                                    | <u>Page</u> |
|--------------------------------------------------------------------------------------------------------------------|-------------|
| I. Introduction . . . . .                                                                                          | 1           |
| II. Sources of Price Quotations. . . . .                                                                           | 5           |
| III. Selection of Items and Coverage. . . . .                                                                      | 9           |
| IV. Comparability . . . . .                                                                                        | 19          |
| V. Index Number Formulas . . . . .                                                                                 | 28          |
| VI. Weighting . . . . .                                                                                            | 34          |
| VII. Results and Observations . . . . .                                                                            | 43          |
| Appendix A. Production of Tractors and Automotive Vehicles<br>in the U.S.S.R., 1928-1950. . . . .                  | 45          |
| Appendix B. Sources of the Prices Used in the Tractor and<br>Truck and Automobile Price Indexes. . . . .           | 55          |
| Appendix C. Value Weights Used in Computing the Price Indexes. . . . .                                             | 58          |
| Appendix D. Technical Descriptions of Soviet Trucks, Automobiles<br>and Tractors. . . . .                          | 64          |
| Appendix E. Estimated Prices of the Universal for 1935 and 1937. . . . .                                           | 72          |
| Appendix F. Production Costs of Soviet Tractors. . . . .                                                           | 80          |
| Appendix G. Prices Used in Soviet Investment Data. . . . .                                                         | 84          |
| Appendix H. Price Levels of Soviet Tractors in the Intervals<br>Between the Benchmark Years . . . . .              | 87          |
| Appendix I. Price Levels of Soviet Trucks and Automobiles in<br>the Intervals Between the Benchmark Years. . . . . | 108         |
| Appendix J. Comparability of New and Old Soviet Truck Models,<br>1945-1949 . . . . .                               | 127         |
| Appendix K. Price Indexes per Unit of Drawbar Horse-power of<br>Soviet Tractors, 1928-1949 . . . . .               | 133         |
| Appendix L. Abbreviations Used in Citations Other Than for<br>Price Sources. . . . .                               | 142         |

Tables

|                                                                                    | <u>Page</u> |
|------------------------------------------------------------------------------------|-------------|
| Table I Prices of Soviet Tractors. . . . .                                         | 11          |
| Table II Soviet Prices of Trucks and Automobiles. . . . .                          | 16          |
| Table III Value Weights Used in Tractor Price Indexes. . . . .                     | 35          |
| Table IV Value Weights Used in Truck and Automobile<br>Price Indexes. . . . .      | 36          |
| Table V Price Relatives of Soviet Tractors, 1928-1949. . . . .                     | 40          |
| Table VI Price Indexes of Soviet Tractors, 1928-1949. . . . .                      | 40          |
| Table VII Price Relatives for Soviet Trucks and Automobiles,<br>1928-1949. . . . . | 42          |
| Table VIII Price Indexes of Soviet Trucks and Automobiles,<br>1928-1949. . . . .   | 42a         |

Appendix Tables

|                     |                                                                         |       |
|---------------------|-------------------------------------------------------------------------|-------|
| Appendix Table I    | Production of Tractors, USSR, 1928-1941. . . . .                        | 46-47 |
| Appendix Table II   | Production of Trucks and Automobiles,<br>USSR, 1928-1941. . . . .       | 51-52 |
| Appendix Table III  | Value Weights Used in Tractor Price Indexes. . . . .                    | 60    |
| Appendix Table IV   | Value Weights Used in Truck and Automobile<br>Price Indexes. . . . .    | 61    |
| Appendix Table V    | Planned Deliveries of Tractors to Agriculture,<br>USSR, 1947. . . . .   | 62    |
| Appendix Table VI   |                                                                         |       |
| Appendix Table VII  | Technical Characteristics of Soviet Trucks . . . . .                    | 65-67 |
| Appendix Table VIII | Technical Characteristics of Soviet<br>Passenger Automobiles. . . . .   | 68    |
| Appendix Table IX   | Technical Characteristics of Soviet Tractors. . . . .                   | 69-71 |
| Appendix Table X    | Planned Investments in Tractors by Soviet<br>Agriculture, 1935. . . . . | 73    |
| Appendix Table XI   | Production Cost Per Unit of Soviet Tractors<br>in 1935 . . . . .        | 81    |

Appendix Tables

|                      |                                                                                                       | <u>Page</u> |
|----------------------|-------------------------------------------------------------------------------------------------------|-------------|
| Appendix Table XII   | Production Cost of Soviet Tractors,<br>1930-1935. . . . .                                             | 82          |
| Appendix Table XIII  | Estimated Prices and Price Relatives<br>of Soviet Tractors, 1928-1949. . . . .                        | .88-90      |
| Appendix Table XIV   | Estimated Price Levels of Soviet<br>Tractors, 1928-1949. . . . .                                      | .90-91      |
| Appendix Table XV    | Investments in Tractors By Soviet<br>Agriculture, 1933. . . . .                                       | 100         |
| Appendix Table XVI   | Investment in Tractors By Soviet<br>Agriculture, 1934. . . . .                                        | 102         |
| Appendix Table XVII  | Estimated Prices and Price Relatives of<br>Trucks and Automobiles, USSR, 1928-1949. . .               | .110-112    |
| Appendix Table XVIII | Estimated Price Indexes of Trucks and<br>Automobiles, USSR, 1928-1949. . . . .                        | 113         |
| Appendix Table XIX   | Investments in Trucks and Automobiles<br>by Soviet Agriculture, 1933. . . . .                         | 116         |
| Appendix Table XX    | Actual and Approximated Output Regimens<br>of Trucks and Automobiles, USSR, 1933. . . .               | 117         |
| Appendix Table XXI   | Investments in Trucks and Automobiles by<br>Soviet Agriculture, 1934. . . . .                         | 120         |
| Appendix Table XXII  | Actual and Approximated Output Regimens of<br>Trucks and Automobiles, USSR, 1934. . . . .             | 121         |
| Appendix Table XXIII | Given-Year Value Weights for Trucks and<br>Automobiles, 1938-1940. . . . .                            | 124         |
| Appendix Table XXIV  | Given-Year Weights for Trucks and<br>Automobiles, 1940-1948. . . . .                                  | 126         |
| Appendix Table XXV   | Prices and Price Relatives of Soviet<br>Trucks 1949. . . . .                                          | 128         |
| Appendix Table XXVI  | Prices and Price Indexes Per Unit of<br>Drawbar Horse-power of Soviet Tractors,<br>1928-1949. . . . . | 134         |
| Appendix Table XXVII | Drawbar Horse-power Ratings of Soviet<br>Tractors. . . . .                                            | 135         |





## I. INTRODUCTION

This memorandum sets forth and explains data on wholesale price movements of tractors, trucks and automobiles in the U.S.S.R. from 1928 through 1949. It is a part of a larger inquiry, which will describe wholesale price movements of all civilian machinery in the Soviet Union for the same period. This larger study, in turn, is intended to be combined eventually with similar studies dealing with the other sectors of the Soviet economy. The resultant of such a combination would be a description of wholesale price movements in general and would provide a basis for the calculation of various deflators for components of national income data in current rubles.

In Soviet statistical practice, the machines examined in this study are usually divided into two categories: tractors; and trucks and automobiles. This subdivision is maintained in the present inquiry. Although production of these machines has usually fallen under the same ministerial jurisdiction in Soviet economic administration, price behavior in the two categories does not show any close relationship. For this reason, separate price indexes have been computed for the two groups of machines, and, for the most part, the discussion of the following sections treats each group separately.

The machines customarily considered under the appellation "tractors" in Soviet usage include only wheeled and tracklaying tractors. The machines usually treated under the appellation "trucks and automobiles" include load-carrying trucks, passenger cars, fire engines, autobuses, ambulances, motorcycles and bicycles. The price indexes for "trucks and automobiles" computed in the present study are based on prices for the first three of these latter items; but it is believed that the indexes must nevertheless reflect the price behavior of the category as a whole, as these three items have been by far the most important in terms of value of production.

The two categories of machines under consideration here are among the most important elements of machine building generally in the Soviet Union. For example, a Soviet source <sup>1/</sup> states that in terms of value of production in "unchanging 1926/27 rubles", tractors, in 1935, constituted 6.4% of all machinery produced, while trucks and automobiles made up 9.9%. In the years immediately subsequent -- i.e., 1936 and 1937 -- the relative importance of tractors declined, while the relative importance of automobiles increased. Together, they may have accounted for something over 21% of all machinery produced in 1937 <sup>2/</sup>. Again the comparison is in terms of 1926/27 rubles.

The foregoing does not take account of plants devoted to the repair and reconstruction of tractors. This kind of work, which is counted a part of the output of the engineering industry in Soviet statistical usage, may have made up another 2 or 3% of total machinery production. There is reason to believe that prices of tractor parts, and therefore, presumably, tractor rehabilitation, did not always move with prices of tractors themselves. The price movements of tractor parts are reserved for a separate study.

This memorandum focuses on certain benchmark years for which price levels could be determined with a high degree of reliability. These are, for tractors, 1928, 1935, 1937, 1941, 1945, and 1949; for trucks and automobiles, 1928, 1929, 1935, 1937, 1941, 1945 and 1949.

---

<sup>1/</sup> Planovoe Khozyaistvo (Planned Economy)

<sup>2/</sup> A. Gerschenkron, in his A Dollar Index of Soviet Machinery Output, 1927/8 to 1937, The RAND Corporation, Santa Monica, California, 1951, p. 73, found that these two groups of machines in terms of dollar values constituted about 35% of the value of items going into his index of gross value of output. Items of machine building omitted from his index, but included in Soviet usage, probably accounted for 25% of all production. This would reduce the relative share of automobiles and tractors in terms of dollar prices to 26% of all output, a figure more or less in agreement with the one given in the text.

In addition, however, I have attempted to establish price levels for the years intermediate to the benchmark years. In the case of tractors, some such determination was possible for every intermediate year. In the case of trucks and automobiles, it was possible for all the intermediate years except 1931 and 1932. These price index calculations are based on rather scattered information and must be considered estimates, of less reliability, for the most part, than the determinations for the benchmark years. For this reason, they have been set forth separately in Appendix H, for tractors, and Appendix I, for trucks and automobiles. The derivations of the estimates and appraisals of their reliability are given in the same appendixes.

In all, five separate price indexes have been computed for each category of machine. All of the indexes for a given category are based on the same price data and vary only in the weighting systems used to average the price relatives. The reasons for adopting this procedure and the specific weighting systems employed are set forth later in the memorandum.

In general, the prices used in this study are transfer prices of the producer, including costs of production, planned profit or loss and turnover tax. Although the prices were quoted in the Soviet sources on varying bases, corrections have been made where necessary in order that all price comparisons be for prices at the factory of the producer (frankozavod). As used, therefore, all prices are believed to be net of packing, tare, delivery to the forwarder, loading, shipping and other distribution costs.

Various considerations relevant to the interpretation of Soviet handbook prices, particularly the degree to which the quoted prices actually apply in practice, have been set down in an earlier RAND memorandum and need not be repeated here.<sup>3/</sup> The question was raised in a study of road building and

---

<sup>3/</sup> A. Bergson and L. Turgeon, Prices of Ordinary Rolled Steel in the Soviet Union, 1928-1950, RAND RM-767, 1952, p. 4-5.

construction machine prices <sup>4/</sup> of opportunities for evasion of price regulations by means of "custom" orders. Problems of enforcing price regulations may be less in the case of trucks and tractors than in that of other kinds of machinery, because the standardization of models and the mass production techniques used must tend to minimize the number of orders filled on a custom basis. Thus such evasion of the regulations as does occur must take the form of open violation of the very explicit Soviet laws governing wholesale transactions.

Some confusion as to the meaning of postwar prices for Soviet passenger cars arises in the light of the curious fact that retail prices for these cars are about half of their wholesale prices. It is believed that the wholesale prices quoted in the price handbooks used in this study are the actual wholesale transfer prices for the vehicles in question, and that the low retail prices must represent some kind of premium for selected purchasers; however, there is little evidence on this score one way or another.

The subsequent discussion proceeds as follows: Section II describes the sources of price quotations used in this report. Section III discusses the selection of items to be included in the indexes and the resulting coverage of the categories represented. Problems of comparability are taken up in Section IV. The index number formula used is given in Section V. Section VI explains the computation of the value weights and discusses the effects of changing weight years. The results of the study are commented on in Section VII.

---

<sup>4/</sup> R. Moorsteen, Prices of Road Building and Construction Machines, U.S.S.R., 1928-1949, RAND RM-1037, 1953, p. 3.

## II. SOURCES OF PRICE QUOTATIONS

1928 prices: Prices for this year are taken from two sources:

S. P. Sereda and M. A. Sirinova (supervisors), Universal'ny Spravochnik Tsen (General Purpose Handbook of Prices), Moskovskii rabochii, Moscow-Leningrad, 1928 (hereafter referred to as SMG-28). Prices are given here for two trucks identified only as being of 1.5 ton and 3.5 ton load capacities. Other information, as described in Section IV, made identification of these truck models possible. These prices were apparently gathered by the editors from producing enterprises, and are assumed to be prices at the factory (franko-zavod).

SSSR, Vysshii Sovet Narodnogo Khozyaistva, Materialy k Pyatilenemu Planu Promyshlennosti, 1928/9-1932/3, tom III, Perspektivy Razvitiya Metallurgii Chernykh Metallov, (Materials for the Five Year Plan in Industry, 1928/9-1932/3, volume III, Prospects for Developing Ferrous Metallurgy), Leningrad, 1929 (hereafter referred to as PRM 29). This large work contains prices for 58 items, including many machines, to be used in calculating the amount of ferrous metals required for each 1000 rubles worth of production. Prices for two tractors are given. However, neither the date nor terms of the prices is stated. As it is Soviet statistical practice to calculate the volume of industrial production in terms of prices at the factory, it was assumed that such prices were used here. Other evidence (set forth in Appendix B) aided in identifying the tractors and indicated that their prices were effective, at least, in 1927/8.

1929 prices: Narodnyi Kommissariat Pochtii Telegrafov, Tsentralnaya Kommissiya po Inventarisatsii Osnovogo Imushchestva, Spravochnik-Ukazatel' Tsen i Srednykh Srokov Sluzhby, Izdatel'stvo NKPT, Moscow, 1929 (Handbook-Index of Prices and Average Terms of Service), (hereafter referred to as CCC 29). This handbook

was issued by the ministry of post offices and telegraphy and contains prices of items purchased by its various branches. The automobile prices taken from it are quoted therein without elaboration as to the terms of sale. Certain prices elsewhere in the book are specifically qualified as being net of charges for delivery (i.e., apparently net of packing, tare, delivery to the forwarder, etc.). The prices so qualified were also described as being "current". If as is assumed here these two characteristics apply to the automobile quotations as well, the prices as quoted are comparable with other prices used -- i.e., franko-zavod -- and are prices of 1929.

1935 prices: Prices for this year were found in an official price setting decree of STO, no. 204 of March 16, 1935, published in Nashe Stroitel'stvo (Our Construction), no. 8, 1935, p. 36, the organ of the Ministry of Construction. This decree sets "transfer" (otpusknye) prices for certain items of machinery to be effective as of January 1, 1935, without, however, elaborating as to their terms. It has been assumed that they are prices at the factory, as this was the customary form of quotation for machinery at this time.

1937 prices: Prices for this year are taken from two sources:

Trest-Mosgortop, Spravochnik Tsennik (Price Handbook), Moscow, 1936, (hereafter referred to as STM-36). These are prices of April 1, 1936. They are inclusive of the trading margin of the distributing organizations, which in the case of trucks and tractors is 2% of the factory transfer price. Prices used from this source have accordingly been reduced by 2%. The purpose of the handbook is to collect prices of items purchased by the enterprises of the Moscow Fuel Trust (Trest-Mosgortop) for the use of its buying departments; it is thus clear that the prices in it, at least to the knowledge of the authors, are prices at which goods are actually available.

Planovaya komissiya pri mosoblispolkome (Mosoblplan) Spravochnik Tsenn na stroitel'nye materialy, oborudovanie i transportnye sredstva po moskovskoi

oblasti na 1937 g. (Handbook of Prices of Construction Materials, Equipment, and Means of Transport in the Moscow Oblast in 1937), moskovskii rabochii, 1937 (hereafter referred to as SMS-37). These are prices at the factory, to be used in making estimates in planning construction. The date on which these prices actually became effective is not given in the source; however, in every instance where the same item is priced in both SMS-37 and STMG-36, the prices, net of the trading margin of STMG-36, are identical. From this it has been inferred that the prices of SMS-37 were effective as of April 1, 1936, and that the prices of STMG-36 were still in effect early in 1937.

1941 prices: Leningradskaya Oblastnaya Planovaya Kommissia, Spravochnik tsen na stroitel'nye materialy, oborudovanie i transport, no. 34, 1941, (Price Handbook for Construction Materials, Equipment and Transport, no. 34), Leningrad, 1941, (hereafter referred to as SLS 41). This source gives prices at the factory, effective January 1, 1941, to be used in making building estimates.

1945 prices: Ministerstvo Finansov, Tsentral'noe Statisticheskoe Upravlenie, Gosplana, SSSR, Tsennik dlya sostavleniya smet na stroitel'stvo (v tsenakh 1945 goda). Chast' IV Oborudovanie (Price Handbook for Making Estimates in Construction [In prices of 1945], Part IV Equipment), Gosplanizdat, 1947, Moscow (hereafter referred to as SUSN-45). The prices in this source for tractors and automotive products are factory prices established at various times from 1940 through 1945. The prices given here for fire engines are termed in the source "temporary". All these prices, however, appear to have been effective as of December 31, 1945.

1949 prices: Tsennik dlya sostavleniya smet v tsenakh 1949 goda, Chast' III Oborudovanie (Price Handbook for Making Estimates in Prices of 1949, Part III Equipment); Gosstatizdat, Moscow, 1949 (hereafter referred to as SUSN-49). This book contains prices, FOB the depot of the seller (franko-vagon), for use in making construction estimates. They were effective as of December 17, 1948.

A 1945 price handbook <sup>5/</sup> of prices for another category of machinery, hoisting and handling equipment, quotes prices on both bases, that is factory and FOB; for these items FOB prices averaged about 2% above factory prices. Price relatives for 1949 were therefore reduced by 2% in the present study, to allow for this difference in the form of quotation.

---

<sup>5/</sup> Harkomtyazhmash, SSSR, Glavnoe Upravlenie Pod'emno-Transportnogo Mashinostroeniya, Pod'emno-Transportnoe Oborudovanie, Spravochnik Preiskurant, (Lifting-Handling Equipment, Price Handbook) Mashgiz.



### III. SELECTION OF ITEMS AND COVERAGE

#### A. Tractors

The selection of items to be included in the tractor price indexes was based mainly on the availability of data. For the years 1935-1949, price relatives were computed and included in the indexes wherever the price information permitted the construction of such relatives for strictly comparable tractor models. With the available price information price comparisons are possible also between similar, but nonidentical, models. But the relatives computed on this basis were found to be closely consistent with the relatives computed for identical models. For this reason it was not necessary to attempt the inclusion of such information in the components of the indexes. For 1928, a year for which changes in the output regimen prevent rigorous comparability, prices for the only two tractor models produced were compared with prices for similar machines produced in 1937. Problems of comparability raised by this procedure are discussed in Section IV, below.

In general, this method of selection resulted in two price relatives for each year, one for wheeled tractors and one for track-laying tractors. The only exception to this is the year 1935. In 1935, three price relatives, one for tracklaying and two for wheeled tractors, were computed and used. In order to do this, it was necessary to estimate the price of one model, the Universal, in the years 1935, 1936 and 1937, as no price quotations for the machine are available for these years. This unusual procedure was employed because there is reason to believe that prices of the two different wheeled tractors produced in these years did not move together, and because information available seemed to permit such estimation with a fairly high degree of reliability. The 1937 estimated price for the Universal also permitted the construction of price relatives for wheeled tractors for the years 1945 and

1949, which would otherwise have been impossible; this was deemed desirable because of evidence that prices of wheeled and track-laying tractors did not move together in the postwar period.<sup>6/</sup>

At one time or another in the period covered by the indexes, 1928 through 1949, there were actually three models of wheeled tractors produced in the Soviet Union: the FP or Fordson-Putilovets 10/20, the International 15/30 <sup>7/</sup> and the Universal 10/20. Prices for these tractors for the various years are given in Table I, which may also be used as a rough guide to the period of production of each. The Fordson-Putilovets was produced from 1923 until 1933.<sup>8/</sup> Production of the International was begun in 1930, suspended in mid-1937 and recommenced in 1948.<sup>9/</sup> The Universal was first produced in 1934; it was apparently suspended from production at the end of 1937, then reintroduced in early 1945.<sup>10/</sup>

---

<sup>6/</sup> The methods of estimation and the raison d'etre of this step are offered in detail in Appendix E.

<sup>7/</sup> Before the war, this tractor was also called the "STZ" or "KhTZ" or "SKhTZ" after the Stalingrad and Kharkov tractor factories, where it was produced.

<sup>8/</sup> V. A. Korobov, Traktory, Avtomobili i Sel'sko-Khozyaistvennyye Dvigateli (Tractors, Automotive Vehicles and Agricultural Engines), Moscow, 1950, p. 9; and SS 35, p. 55 (for explanation of abbreviations used in citations other than price quotations, see Appendix L ).

<sup>9/</sup> Korobov, op.cit., p. 9, and ATD, No. 18, 1937, p. 495.

<sup>10/</sup> Korobov, op.cit., p. 9, and Itogi, p. 21, which state that all Soviet "tractor factories" had converted to the exclusive production of crawlers "by the end of the Second Five Year Plan" -- i.e., the end of 1937. This, on the face of it, would seem to include the Universal, which was a wheeled, row-crop cultivator. However, it was produced at the Kirov works in Leningrad, which was not a "tractor factory" but a producer of a variety of large machines, including cranes, turbines, locomotives, etc. A large number of "cultivating tractors", an appellation reserved to the Universal in Soviet usage prior to 1938, were produced in 1938 (cf. SSKh 1939, p. 12), but these may have been track-layers, as the 1938 plan contemplated the production of a 15 DHP crawler for this function (cf. ARI, May-June, 1938, p. 28). The Moscow News of March 28, 1945, carried a story on the Vladimir tractor factory stating that the factory had produced thus far 500 cultivating tractors; an accompanying picture showed an assembly line of Universals. This suggests early 1945 as the date at which production of the Universal was resumed.

Table I

PRICES OF SOVIET TRACTORS<sup>a/</sup>

| Tractor                       | Rubles      |             |             |             |             |             |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                               | <u>1928</u> | <u>1935</u> | <u>1937</u> | <u>1941</u> | <u>1945</u> | <u>1949</u> |
| <u>Wheeled</u>                |             |             |             |             |             |             |
| Fordson-Putilovets 10/20      | 3450        | —           | —           | —           | —           | —           |
| International 15/30           | —           | 3525        | 4025        | 3825        | —           | na          |
| Universal 10/20               | —           | (3169)      | (2683)      | —           | 20000       | 20000       |
| <u>Track-Laying</u>           |             |             |             |             |             |             |
| Kommunar 50 BHP <sup>b/</sup> | 19080       | —           | —           | —           | —           | —           |
| NATI 50 BHP <sup>b/</sup>     | —           | —           | na          | 9000        | 22000       | 29000       |
| Stalinets S-60                | —           | 18000       | 15000       | 14000       | —           | —           |
| Stalinets S-65                | —           | —           | na          | 19000       | na          | —           |
| Stalinets S-80                | —           | —           | —           | —           | —           | 66000       |
| Kirovets D-35                 | —           | —           | —           | —           | —           | 40000       |

<sup>a/</sup> Sources of these price quotations and the dates on which they became effective are given in Appendix B. The sign "—" indicates that the tractor was not produced in that year. The sign "na" indicates that the tractor was produced, but no price quotation was found. Prices enclosed in parentheses are estimated, as explained in Appendix E.

<sup>b/</sup> These are nominal belt horse-power ratings. The NATI actually developed a maximum belt horse-power of 52; cf. Appendix D, in which technical descriptions of these tractors are given.

So far as wheeled tractors are concerned, this study covers prices for the following tractors, by years (Table I):<sup>11/</sup> For 1928, the Fordson-Putilovets, the only wheeled tractor produced; for 1935, the International and the

<sup>11/</sup> The precise fashion in which price relatives were computed from the prices is set forth in Section IV, which also discusses the problems of comparability raised thereby.

Universal, the only wheeled tractors produced; for 1945, the Universal, the only wheeled tractor produced; for 1949, the Universal, although in this year both the Universal and the International were produced. Thus I cover all production of wheeled tractors for the benchmark years 1928 through 1945, and one of the two models produced in 1949. No information is available to indicate whether the 1949 prices of the Universal and International bear similar relations to their 1937 prices. This is the more unfortunate in that the 1949 price of the Universal appears to be out of proportion to its probable production cost, as well as to the prices of other tractor models.

The only track-laying tractor produced in 1928 was the Kommunar 50 B.H.P. From 1935 through 1937, production of track-layers was dominated by the Stalinets S-60, also called the ChTZ after the Chelyabinsk tractor factory, where it was made. In 1937 a new crawler of somewhat less power, the NATI, was introduced. At the same time, the Stalinets S-60 was replaced by the Stalinets S-65, a similar machine which, however, burned diesel oil instead of kerosene. From 1937 until the German invasion, production of crawlers was concentrated mainly in the NATI and Stalinets S-65. Information on tractor production during the war is lacking, but there is evidence to suggest that the NATI, at least, was in production in 1944 <sup>12/</sup> and was continued as perhaps the most important single tractor model in the Soviet Union through 1949. A new Stalinets, the S-80, a powerful, diesel powered machine, was introduced in 1946, and was the only other important crawler produced from 1946 through 1949.

For crawlers for 1928 this study is based on the price of the Kommunar 50 B.H.P., and hence covers all production of crawlers in that year. For the years 1935 through 1941 I include prices quoted for the Stalinets S-60, and, for subsequent years (by linkage) prices for the NATI. As there is independent

---

<sup>12/</sup> For example, a new price for it was established in mid-1944, as stated in Appendix B. See Appendix C for data on the tractor regimen of the years 1945-1949.

evidence that prices of the Stalinets in its later variants moved closely with those of the NATI during these years,<sup>13/</sup> it is felt that the prices used for track-layers for each year reflects the price level of this whole section of production reliably.

As stated above, the index numbers for 1941 rely on 1941 prices for the wheeled tractor, International, and the track-layer, Stalinets S-60, although neither tractor appears to have been in production after 1937. The exact meaning to be ascribed price quotations for tractors three years out of production is not clear. Such quotations are particularly ambiguous during an extreme sellers' market, such as existed in the Soviet Union at the time, because it is improbable that any large quantities of the machines were still up for sale so long after their suspension from production. It is of interest, however, that the percentage change in the prices of the two machines between 1937 and 1941 were of the same order of magnitude -- a decrease of 5.0% in the case of the International and of 6.7% in the case of the Stalinets S-60. This suggests the possibility that some kind of across-the-board price decrease occurred for tractors; in this case the prices of tractors actually produced in 1941 would, presumably, have been affected to the same extent as those not produced. This would also explain how Soviet economic planners obtained 1941 prices for the non-available tractor models.<sup>14/</sup> In any case, no feasible

---

<sup>13/</sup> A price for the Stalinets S-65 was quoted for 1941; the same tractor, with an engine of increased compression, the Stalinets S-80, was priced for 1949. The 1949 relative, based on 1941, for the NATI was 322; for the variants of the Stalinets, 347. If allowance is made for the advance over the S-65 represented by the S-80, the two relatives would probably be even closer together. Technical descriptions of the two versions of the Stalinets are presented in Appendix D. An estimate of the cost differences of these two models would be difficult to establish, but 10% seems a fair guess. This figure was suggested in private conversation by N. Jasny.

<sup>14/</sup> The 1941 prices are from SLS 41. This handbook was designed for use in making estimates in construction. The 1941 prices for the International and Stalinets S-60 may have been useful in calculating depreciation and amortization costs. It is also possible that some trade in used machines is conducted in the Soviet Union. Such a trade might require current prices for machines not available new to be used in conjunction with official depreciation norms in the establishment of the used value of the machine.

alternative to using these phantom 1941 prices presents itself. A comparison of the 1937 price of the Stalinets S-60 with the 1941 price of the Stalinets S-65 does not seem practicable, for example, because of value implications peculiar to the Soviet Union of substituting diesel fuel for kerosene.

In summary, then, the items represented in the price indexes for tractors cover all the important models produced in the years 1928 and 1935. Coverage for 1941, as explained above, is by inference only. For 1945, the only two important tractors are covered, while for 1949, two of the four main models produced are covered. In the case of 1949, the third important tractor model also seems adequately represented by the index, as explained above (fn. 13). Because of the paucity of production data for years after 1937, it is difficult to say with precision what this coverage means in terms of the proportion of total value of production included. In view of the coincidence of price movements for different track-layers, however, the indexes are believed to be very closely representative for all years, with the possible exception of 1949. The omission of the International in this year, it is felt, may have resulted in an overstatement of the true price level. Such an overstatement, if it occurred, could have a maximum magnitude for the index with 1937 value weights of about 13%.<sup>15/</sup>

---

<sup>15/</sup> This is because the price relative for Universals, which showed such a remarkable increase over apparent prewar levels, was weighted by output of all wheeled tractors in computing the 1949 index numbers. An estimated minimum increase for the International would be the increase that actually occurred in prices of crawlers -- i.e., to about three times the 1937 level. The price of the Universal increased to more than seven times its 1937 level.

## B. Trucks and Automobiles

As with tractors, the selection of items to be included in the price indexes of trucks and automobiles was based on the availability of information. All items for which price quotations in a number of years could be found and which could be adequately identified in the production statistics for the computation of weights were included in the indexes. For the years 1928, 1929 and 1935, only prices of trucks were available. For subsequent years, trucks, passenger automobiles and fire engines are represented in the indexes. As trucks dominate Soviet automotive production, it is not felt that the omission of passenger cars and fire engines in the years 1928, 1929 and 1935 detract seriously from the representativeness of the index. In particular, the omissions can have no appreciable effect on the indexes for weight years 1928<sup>15</sup> and 1932, because production of passenger cars and fire engines was nil or negligible in them.

Trucks are represented in the index by 1.5 ton trucks and 3.0 ton trucks (Table II). In addition, in those indexes whose weighting systems permitted, 4.0 ton trucks are represented for the years 1941 and 1949, and gas-generating trucks for the years 1941, 1945 and 1949.<sup>16/</sup> Production of the trucks represented in the indexes accounted for 75% to 95% of all truck production in the period 1928-1937. Truck output figures by kind are not available after this date. It is known that in later years, especially since the war, the Soviet Union has increased the number of truck models produced.<sup>17/</sup> It is believed,

---

<sup>15/</sup> Products were only included in the indexes if the items they represented were produced in the year of the weights used. Thus, for example, gas-generators were included for the years 1941 and 1945 only in the index using 1941 base year weights and in the index using given year weights, production of these trucks being negligible in earlier weight years. See section VI.

<sup>17/</sup> An authoritative Soviet source, Bol'shaya Sovetskaya Entsiklopediya (The Great Soviet Encyclopedia), 2nd edition, vol. 1, Moscow, 1949, p. 260, states that 24 models of automotive vehicles were in production in 1948-49. Of these, at least five were "passenger" cars, at least four more were buses, trolley buses or ambulances, while two others were fire engines. This leaves at most 13 trucks. The six most important of these were specifically considered in calculating the 1949 price relative (Appendix L).

scheduled to be Gaz M-1's.<sup>19/</sup> While this is a small coverage, errors arising on this account can have little effect on the indexes for motor vehicles as a whole. This is because of the limited importance of the category "passenger cars". This category accounted for zero to 20% of total automotive vehicle production numerically in the period 1928-1941, and from zero to 15% of total production value-wise.

In terms of automotive production as a whole, the items included in the index, along with the variants of the basic models they represent, made up about 85% of the value of all automotive production in 1937. For this reason it is believed that the index can be taken as rather closely reflecting the behavior of automotive prices in the period covered.

---

<sup>19/</sup> Soviet classification, which has been preserved in this study, divides motor vehicles into two categories: "light" (legkii) and "load-carrying" (gruzovyi). These are roughly analagous to our categories of "passenger" and "truck". One important exception is that a small truck, the 0.5 ton "pick-up" is considered to be "light". Thus pick-up trucks are represented in the indexes by the relatives for passenger cars. In the 1941 plan, pick-ups were to account for 2000 of the 9000 "light" cars.



## IV. COMPARABILITY

A. Tractors

The two tractor price relatives used for 1928 were based on the price of the Fordson-Putilovets, a small, wheeled tractor, and on the price of the Kom-munar 50 BHP, a medium tracklaying model (Table I, above, p. 11). The former of these was discontinued in 1933, the latter, in 1932. It was thus not possible to make a direct computation of 1937-based relatives for them, nor was price information available of a kind that would permit the construction of price relatives for them by linkage. Instead, therefore, it was necessary to compare them with machines for which price quotations existed in later years.

In the case of the Fordson-Putilovets, the comparison made was with the International. Both of these are wheeled, "general"<sup>20/</sup> tractors, copied after American models produced during the late nineteen-twenties.<sup>21/</sup> The International, however, is a larger, more powerful machine. Allowance for this difference was made by increasing the price relative of the Fordson-Putilovets by a factor of 2.0<sup>22/</sup>

---

<sup>20/</sup> That is, neither were "all-purpose" or row-crop cultivating tractors.

<sup>21/</sup> The Fordson-Putilovets produced in the Soviet Union at this time was a copy of the Fordson produced in the United States from 1920 through 1928; cf. A. A. Dmitriev "Neobkhodimo Ispravit' Oshibku" (It is Necessary to Correct an Error) in Puti Mekhanizatsii Sel'skogo Khozyaistva (Methods of Mechanizing Agriculture), p. 16-22, and the Cooperative Tractor Catalogs for 1920 through 1928. The International was a copy of the International Harvester Co.'s 15/30, produced in the United States from 1922 to 1928;

<sup>22/</sup> Technical descriptions of these machines are given in Appendix D. The comparison may be summarized by saying that the two machines burn the same fuel, kerosene, and were designed to do about the same kind of work, the International, however, being more powerful, heavier, and, no doubt, more costly than the Fordson-Putilovets. More concretely, the drawbar horsepower of the International as produced in the Soviet Union is 15, that of the Fordson-Putilovets, 8 (Dmitriev, op.cit., p. 19), or a little over half that of the International. Similarly, the International (Soviet model) weighs 3000 kilograms, a little more than double the 1370 kilograms of the Fordson-Putilovets (cf. Appendix D). The price of the International (American model) in the United States FOB the factory on April 1, 1923, was \$1250, that of the Fordson in the same year, \$625, or exactly half that of the International. See Cooperative Tractor Catalog, 1923, p. 156. These considerations led to the selection of 2.0 as a factor expressive of the value ratio of the International to the Fordson-Putilovets.

The Kommunar 50 b.h.p. is similar to the NATI in that both are kerosene burning tracklayers with engines of about the same power. The NATI has certain important advantages, the chief among them being that it weighs some 40% less than the Kommunar 50.<sup>23/</sup> As a consequence it delivers substantially more power to the drawbar,<sup>24/</sup> develops its power at less cost in fuel, moves more easily over sodden terrains, etc. To allow for these inferiorities in the Kommunar 50, the price relatives for it computed by direct comparison with the price of the NATI have been increased by 21.5%, which is the power differential of the two machines in drawbar horsepower. This is believed to be a conservative allowance. Inasmuch as the earliest price quotation for the NATI is for 1941, this relative was computed on a 1937 base by linkage with the 1941/1937 price relative of the Stalinets S-60.<sup>25/</sup>

Price relatives for 1935 were computed by comparing the 1935 prices of the International and Universal, in the case of wheeled tractors, and of the Stalinets S-60, in the case of tracklayers, with their respective 1937 prices. For 1941, price relatives were computed by comparing the 1941 prices of the International and Stalinets S-60 with their 1937 prices. Price relatives for wheeled tractors for 1945 and 1949 were derived by comparing the 1945 and 1949 prices of the Universal with its 1937 price. Price relatives for tracklayers for 1945 and 1949 were computed by comparing the prices of the NATI for these years with its 1941

---

<sup>23/</sup> Technical descriptions of the Kommunar 50 and the NATI are given in Appendix D.

<sup>24/</sup> The drawbar horsepower of the Kommunar 50 is rated in Soviet sources as 28. See SS 35, p. 55, for example. The NATI is rated at 34 d.h.p. See Economic Commission for Europe, The European Tractor Industry in the Setting of the World Market, Geneva, 1952, Appendix I, p. 20, which gives manufacturers' ratings.

<sup>25/</sup> I.e., the 1941 price of the NATI was taken to stand at the same level, relative to 1937, as the 1941 price of the Stalinets S-60. The rationale behind this procedure is discussed above, Section III.

price and then transforming the resulting relatives on a 1941 base to relatives on a 1937 base by linkage with the 1941/1937 price relative of the Stalinets S-60. All of these price relatives, therefore, were obtained by comparing prices of identical tractor models. As it is Soviet practice to continue the production of specific tractor models over long periods without modification,<sup>26/</sup> it is felt that virtually no problem of comparability is raised by these comparisons.

---

<sup>26/</sup> See, for example, N. Jasny, Soviet Prices of Producers' Goods, Stanford, 1952, p. 129, and SUSN 49, p. 251. The latter seems to indicate that the NATI as produced in 1949, in accord with technical specifications confirmed in 1948, is identical with the machine as first approved for production, late in November, 1936.

## B. Trucks and Automobiles

With automotive vehicles, as with tractors, the Soviet Union has concentrated production on a few basic designs. But in the course of the period covered by the price indexes, the basic models produced have been completely changed.

The price quotations used in compiling the automotive price indexes are presented in Table II, page 16, which may serve also as a graphic summary of the sometimes intricate series of comparisons described in the succeeding paragraphs.

The Soviet 1.5 ton truck until the end of 1931 was the Amo F-15, a copy of the 1.5 ton Fiat. In 1932 it was replaced by the Gaz AA, a copy of the Ford AA 1.5 ton; from 1938 this truck was also supplied with a copy of the Ford B engine, in which form it was called the Gaz MM.<sup>27/</sup> The Soviet 3.0 ton truck in 1928 and 1929 was the Ya.Z. This truck, in two design variants, the Ya.3 and Ya.4 with load capacities of 3.0-3.5 tons, was produced from 1925 through 1929. In 1930 it was replaced by the 2.5 ton Amo series, the Amo 2, Amo 3 and Amo 4. The Amo was discontinued in 1933, when it was replaced by the Zis-5, a 3.0 ton truck which is apparently still produced at this writing.

The price relatives used for 1.5 ton trucks in the present inquiry are based on comparisons of the 1937 price of the Gaz AA with the prices of the Amo F-15 for the years 1928 and 1929; with prices of the Gaz AA for the years 1935, 1941, and 1945; and with the price of the Gaz MM for the year 1949.

---

<sup>27/</sup> The geneology and foreign counterparts of Soviet trucks are explained in a series of three articles by D. B. Shimkin entitled "The Automobile Industry That's Behind the Iron Curtain," in Automotive Industries, Feb. 1, Feb. 15, and April 1, 1948.

The price relatives for 3.0 ton trucks are based on comparisons of the 1937 price of the Zis 5 with the prices of the Ya.Z. <sup>28/</sup> for the years 1928 and 1929; and with the prices of the Zis 5 for subsequent years.

The price relatives computed for 1928 and 1929, as described in the preceding paragraph, must lead to an understatement of the indexes of the extent of the price decreases which occurred between those years and the year 1935, by which time production of the more recent truck models had been completely established. In this connection the following features should be kept in mind:

The Amo F-15 was about 15% lighter, 10% shorter and 25% less powerful than the Gaz AA. In addition, its fuel consumption was greater and its braking system mechanically inferior. At the same time, it did substantially the same work as the Gaz AA, and, for most ~~tasks~~, the two trucks could be interchanged. <sup>29/</sup>

The Ya.Z. in 1928-29, although built to carry loads up to 3.5 tons, was powered by the same engine as the Amo F-15. It was thus substantially underpowered, having only about a third the horsepower of the Zis 5. Other specifications of the Ya.Z. are not known, but it is clear in any case that it compared quite unfavorably with the Zis 5.

It would seem to be indicated as well that the Ya.Z. compared considerably less favorably with the Zis 5 than did the Amo F-15 with the Gaz AA. Further, the 1928 price of the Amo F-15 is 2.1 times the 1937 price of the Gaz AA,

---

<sup>28/</sup> SMG 28, p. 447, quotes a price for a truck described only as a "3.5 ton truck with tires," produced by the "Avtotrest," or Automotive Trust. This must have been one of the Ya.Z. series, as the only other Soviet truck at that time was the Amo F-15, a 1.5 ton truck. CCC 29, p. 142, quotes a price for a truck identified only as a "Ya.Z. 3.0 ton." These two trucks must, therefore, be the Ya.3 and Ya.4. It is not known what differences existed between these two machines, other than rated load capacity. Since most Soviet sources refer to them indiscriminately as the "Ya.Z.", it is assumed that they are substantially the same truck.

<sup>29/</sup> Technical descriptions of the trucks discussed in this section are given in Appendix D.

whereas the 1928 price of the Ya.Z. is only 1.8 times the 1937 price of the Zis 5. <sup>30/</sup> In an effort to correct for these discrepancies in comparability, the following procedures were adopted: 1) The 1928 price relative for 1.5 ton trucks as computed from the 1928 price for the Amo F-15 was increased by 15%, to allow for the inferiority of this truck vis-a-vis the Gaz AA. <sup>31/</sup> 2) This price relative was taken to reflect the price level of all trucks in 1928, the lesser price relative for the Ya.Z. notwithstanding. This is to allow for the still greater inferiority of the Ya.Z. vis-a-vis the Zis 5. 3) The price relatives for 1929 were derived from the 1928 relatives by deducting from the 1928 relative the percentage change in price that actually occurred between 1928 and 1929 for each item. <sup>32/</sup>

Prices for gas-generating trucks were available only for 1941 and succeeding years. It was held desirable to take some account of these prices, in spite of the absence of a base-year price, because of a certain independence of movement exhibited by them. Specifically, they remained constant between the years 1941 and 1945, while other truck prices advanced from 17 to 25%. <sup>33/</sup> They were introduced into the indexes whose weighting systems permitted <sup>34/</sup> by linkage with their gasoline-burning counterparts; thus the Zis 21 relative was linked to the Zis 5 relative, the Gaz 42 relative to the Gaz AA relative.

<sup>30/</sup> The price relatives used in computing the indexes are found in Table VII of Section VI.

<sup>31/</sup> It is difficult to surmise the "true" value ratio for these trucks in the Soviet context. It was considered, in selecting the factor finally used, that the weights of two similar machines will generally be the physical characteristic mostly closely representative of production costs, and hence, perhaps, of value.

<sup>32/</sup> The net effect of these corrections as opposed to using the prices as given is to raise the price index numbers for 1928 and 1929 by about 25% in the case of the index using 1937 base year weights, and by about 20% in the case of the index using given year weights.

<sup>33/</sup> Their price movements appear more or less to have coincided with those of other trucks after 1945. See Appendix L.

<sup>34/</sup> I.e., they were included in the index using 1941 base-year weights and the index using given-year weights. See fn. 11, Section III above.

Inasmuch as these trucks were relatively new in production in 1941, the relatives were linked to the 1945 relatives of the counterparts, rather than to the 1941 relatives.<sup>35/</sup> This was done in the belief that the "normal" price of an item is not the one at which it is introduced, but rather one which prevails after it is as well established in production as other comparable items. The results of this procedure, in contrast to the alternative procedure of linking in prices of gas-generators by means of their 1941 standing, is to raise the 1941 and 1945 index numbers by about 6%;<sup>36/</sup> the result in contrast to the alternatives of omitting representation of gas-generators altogether, is to raise the standing of the 1941 index numbers by only about 6%.

New versions of most of the basic Soviet trucks were introduced after the war. The most important changes in design were limited to improvements in the engines. The new engines were heavier and of higher compression than the old ones, with a consequent gain in the power and speed of the truck. Other specifications for the most part underwent minor changes or were not changed at all.

All of the 1949 price quotations for trucks, with one exception, are for new versions, not priced in earlier years. In addition, a 1949 price is quoted for the Zis 5, a 3.0 ton truck priced in earlier benchmark years as well. The 1949 prices of the new models, relative to the 1937 prices of their immediate predecessors, stand substantially higher than the relative 1949 price of the Zis 5. This difference in relative price is felt only in part to reflect the

---

<sup>35/</sup> For example, the price of the gasoline burning Zis 5 in 1945 was 125% of its 1937 price. Accordingly, the 1945 price of the Zis 21, a gas-generating version of the Zis 5, was taken to stand at 125% of 1937. In consequence, the 1941 price of the Zis 21 had to be taken at 125% of 1937 as well, since no price change occurred between 1941 and 1945. If the linkage had been with the 1941 price level of the Zis 5, i.e. 100% of 1937, the 1945 standing of the Zis 21 would also have been 100%, or substantially below the general level of automotive prices.

<sup>36/</sup> The 1949 standing is raised slightly as well, of course. See Appendix L for a discussion of this aspect.

increase in real cost and value of improving the machines. There is evidence to indicate that the introduction of these improvements was also the occasion for an increase in the relative price of the basic models concerned. The general level of truck prices in 1949, then, must be taken as higher than the level indicated by ~~the 1949 price relative of the older Zis 5.~~ ~~A detailed discussion~~ of the comparability problems raised here and the magnitude of the adjustments deemed appropriate for them is reserved to Appendix J of this memorandum. Suffice it to say here that the effort was to obtain price relatives on a basis of acceptable comparability for the three basic truck types: the 1.5 ton type, represented in 1949 by the Gaz MM, a new model; the 3.0 ton type, represented by the Zis 5, an old model, and the Zis 150, a new model; and the 4.0 ton type, represented by the Zis 151, a new model. Price relatives for 1949 were obtained as follows: 1) The price relative computed from a direct comparison of the 1949 price of the Gaz MM with the 1937 price of the Gaz AA is reduced by 10%. The resultant is taken as the price relative for 1.5 ton trucks. 2) The price relative computed by comparing the 1949 and 1937 prices of the Zis 5 is increased by 4.5%. The resultant is taken as the price relative for 3.0 ton trucks, gas-generating as well as ordinary. 3) The price relative computed by comparing the 1949 price of the Zis 151 with the 1937 price of the Zis 6, is reduced by 17%. The resultant is taken as the price relative for 4.0 ton trucks.

The price relatives for passenger cars used were computed from prices in 1937, 1941 and 1945 for the Gaz M-1 and in 1949 for the Pobeda, or Gaz M-20, which replaced the Gaz M-1 in 1946. The Pobeda embodies certain improvements in general design and also increased engine compression by comparison with the Gaz M-1. It was felt that these advances were of a magnitude of roughly the same order as those embodied in the Gaz MM truck by comparison with the Gaz AA



truck. Accordingly, the same correction was applied in the case of the Gaz M-1: Gaz M-20 comparison as in the case of the Gaz AA: Gaz MM comparison: the price relative computed by direct comparison of the 1937 price of the Gaz M-1 with the 1949 price of the Gaz M-20 was reduced by 10% and the result taken as the price relative for passenger cars for that year.

It is not known if the models of the Gaz AA fire engine prices are identical for all years. The name of the machine priced was changed from "Gaz AA" to "PMG-31" in 1945, but it was stated in SUSN 45 that this model was produced "instead of" the GAZ AA.<sup>37/</sup> It was still mounted on the GAZ AA chassis. There may have been some improvement in the equipment of the machine that resulted in this change of nomenclature, but this is not clear from the descriptions given in the various price handbooks. Thus the machines compared were basically the same, but again some exaggeration of the 1945 and 1949 price level may have occurred.

In summary, then, for tractors, comparability was obtained for the benchmark years 1935, 1941, 1945 and 1949 by comparing prices for identical models only. For 1928, comparability was obtained by comparing prices for similar machines and making such adjustments as seemed necessary to compensate for their differences. For automotive products, comparability was assured by comparing prices of strictly identical models for the benchmark years 1935, 1941 and 1945. For the benchmark years 1928, 1929 and 1949, comparisons were made between prices of similar models, while adjustments were made to compensate for important differences of design.

## V. INDEX NUMBER FORMULAS

Price indexes were computed for both tractors and automotive products using 1937 value weights. The price index formula used is:

$$\frac{\sum \left[ \frac{P_1}{P_{1937}} \cdot \bar{P}_{1937} Q_{1937} \right]}{\sum \left[ \bar{P}_{1937} Q_{1937} \right]} \quad (1)$$

where  $\frac{P_1}{P_{1937}}$  is the price relative based on 1937 and taken to reflect the relative price level of the item in the given year;

$\bar{P}_{1937}$  is the price of the item in 1937;

$Q_{1937}$  is the quantity of the item produced in 1937.

The nature of the difference between " $\bar{P}_{1937}$ ", the 1937 price of the item, and " $P_{1937}$ ", the denominator of the price relative, arises from the fact that it was not possible to compute a price relative for every given year for every item. In spite of this, it was often felt that another price relative was sufficiently representative of the price level of the item in the given year to justify its inclusion in the computation of the index number. For example, no 1949 price for the wheeled tractor International is available, although this tractor was an important item of production in 1937. On the assumption that the 1949 price level of the wheeled tractor Universal is reflective of the 1949 price level of the International as well, the item is included in the computation of the 1949 index number. In this instance,  $\frac{P_1}{P_{1937}}$  is the price

relative of the Universal, whereas  $\bar{P}_{1937}$  is the 1937 price of the International and  $\bar{P}_{1937} Q_{1937}$  is the value of the Internationals produced in 1937. At the same time, it was clearly desirable to include the Universal itself in computing the 1949 index number; in this case, " $P_{1937}$ " and " $\bar{P}_{1937}$ " are identical; i.e., both refer to the 1937 price of the Universal.

Consider the elements of expression (1):

$$\left[ \frac{P_1}{\bar{P}_{1937}} \cdot \bar{P}_{1937} \right] \quad (2)$$

Where " $P_{1937}$ " and " $\bar{P}_{1937}$ " are the same, these reduce to " $P_1$ ".

Where " $P_{1937}$ " and " $\bar{P}_{1937}$ " are unlike, it is assumed that the price relative reflects the price level of the item in the given year. Thus the product (2) still may be interpreted as a price of the item in the given year, albeit a price synthesized in the absence of an actual price quotation. Employing such an interpretation, the index number formula (1) is equivalent to:

$$\frac{\sum [P_1 Q_{1937}]}{\sum [\bar{P}_{1937} Q_{1937}]} \quad , \quad (3)$$

where  $P_1$  is the price of the item in the given year, actual or synthetic;

$P_{1937}$  is the actual price in 1937;

$Q_{1937}$  is the actual production of the item in 1937.

Three other price indexes using constant weights have been computed for each category. The weight years employed are 1928, 1932, and 1941. In order to facilitate comparisons with the 1937 weighted index, these indexes have been shifted to a base of 1937 by dividing each index number by the index number for 1937. Thus the complete index number formula used is:

$$\frac{\sum \left[ \frac{P_1}{P_o} \cdot \bar{P}_o Q_o \right]}{\sum [P_o Q_o]} \div \frac{\sum \left[ \frac{P_{1937}}{P_o} \cdot \bar{P}_o Q_o \right]}{\sum [P_o Q_o]} \quad (4)$$

where the symbols have the same meaning as in (1), the subscript "o" referring to the weight year of the index. It is at once clear that both members of this quotient can be simplified, using the same argument by which (3) was obtained from (1) in the preceding paragraph. It is also possible to cancel out the denominators of both fractions. In this fashion, we obtain:

$$\frac{\sum [P_1 Q_o]}{\sum [P_{1937} Q_o]} \quad (5)$$

Where  $P_1$  is the price, actual or synthetic, in the given year;

$P_{1937}$  is the price, actual or synthetic, in 1937;

$Q_o$  is the quantity actually produced in the weight year of the price index.

The formulas actually used in computing the constant weight price indexes are (3) and (5). It was considered necessary to set forth the derivations of these formulae in order to make explicit the assumptions underlying the computations. In addition, it was felt that the derivation of (5) would clarify the interpretation, in terms of index number theory, of the apparently hybrid index number formula in (5). This is done by relating it to the well-known base-year weighted form; i.e., (3). The formula (5) has the advantage, for present purposes, of permitting the construction of constant weight price indexes for weight years for which no price data are available, like 1932.

One important implication of the choice of a constant weight formula should be noted at this point. If an index computed by means of this formula is used to deflate a value index, the resultant will be a quantity index weighted by prices of the given year. Thus each relative of the resulting quantity index will indicate a specific and well-known relationship of the variable as between the given and base years. But the relationship between relatives for different given years will be ambiguous, each having been computed with the aid of a separate weighting system. Where price movements of all items included in the price index more or less coincide, which is to say that relative — as opposed to absolute — prices remain about constant, the consequences of this are minor. In the case of Soviet machinery prices, as will be seen momentarily, such coincidence is not found. For this reason price indexes for several weight years have been computed. This, it is hoped, will throw into relief the effects of the weighting method employed and aid in interpreting any results obtained by use of the price indexes.

As a further means of dealing with the problem posed in the preceding paragraph, an attempt has been made also to construct price indexes using given-year value weights. The result of deflating a value index by such a price index would be a quantity index weighted by prices of the base year of the price index. Unfortunately, there are serious difficulties attached to compiling a price index for Soviet machinery weighted in this manner. Paramount among these is the paucity of production data for years later than 1941. Nevertheless, an attempt at such an index for tractors and one for trucks is offered in the present memorandum. The index number formula used in that connection is as follows:

---

$$\frac{\sum P_1 Q_1}{\sum P_{1937} Q_1}, \quad (6)$$

where  $P_1$  is the actual price in the given year;

$P_{1937}$  is the price, actual or synthetic, in 1937;

$Q_1$  is the quantity produced in the given year.

This formula is derivable from the conventional given-year, value weighted price index formula:

$$\frac{\sum P_1 Q_1}{\sum \frac{P_{37}}{P_1} \cdot P_1 Q_1} \quad (7)$$

The choice of a base year for the above formula is important. As already remarked, the use of this kind of index as a deflator for value series results in quantity series weighted by prices of the base year. The year 1937 has been selected as the base year in harmony with its use as base year in other studies of Soviet prices. The implications of this choice of a base year demand an appraisal beyond the scope of the present discussion. Suffice it to say that no single base year will provide a deflator — and ultimately, therefore, a quantity series — accurately reflective of the true scarcity relations prevailing in all the years covered by the indexes offered here.<sup>38/</sup>

The effort in the case of all the price indexes computed has been to arrive at index numbers representative of calendar years. The prices used in compiling the indexes, however, were not always effective over the whole of the calendar years in question. The procedure, where price levels changed

---

<sup>38/</sup> Another, rather hybrid, given-year weighted price index for tractors is set forth in Appendix K. It is a price index per unit of drawbar horsepower, covering the same period as the other indexes.

during calendar years, has been to construct an index number reflective of the entire year by averaging the relative price levels which prevailed, weighted by the duration in months of each price level. Where all prices changed on the same date, this was done by averaging index numbers. Where prices changed on different days, the price relatives were averaged and the index numbers computed from the calendar year price relatives.<sup>39/</sup>

---

<sup>39/</sup> Where the date upon which a given price became effective is not known, it is assumed to have taken effect on the first day of the month of the price-setting decree. For example, a decree establishing the price of Zis-5 trucks was issued on June 24, 1944. This price is assumed to have taken effect on June 1, 1944.

## VI. WEIGHTING

The value weights used in compiling the 1937 constant weight indexes were computed by multiplying production in 1937 of each item by its actual 1937 price. These weights are 1937 value weights in the fully conventional sense of the term and are identical with the denominators of expressions (1) and (3) of the preceding section. Value weights for the other constant weight indexes, as actually employed in this study, are equivalent to the denominator of expression (5) of the preceding section.<sup>40/</sup> Thus they are not conventional base-year value weights, but rather the production of the weight year valued in prices of 1937. Value weights used in the given year weight indexes were computed by valuing production in the given year at given year prices; they are equivalent to the numerators of expressions (6) and (7) of the preceding section.

The value weights employed are summarized in Table III for tractors and in Table IV for trucks and automobiles. In these tables, the value weight assigned to each item is expressed as a percentage of the sum of all the value weights. This is in order to facilitate comparisons between the weighting systems of the different indexes. The value weights in rubles from which

---

<sup>40/</sup> Formula (5) is: 
$$\frac{\sum P_1 Q_0}{\sum P_{37} Q_0}$$

which is equivalent mathematically to:

$$\frac{\sum \frac{P_1}{P_{37}} P_{37} Q_0}{\sum P_{37} Q_0} \quad (8)$$

This equivalence is used in the subsequent discussion because it permits expression of the weights in value terms. The expression in terms of values is useful in that it permits the quantification of all weights in terms of a single variable, rubles, thus facilitating comparisons between the different weighting systems.



these percentages were computed are presented in Appendix C. This appendix also gives the derivation of the value weights.

In the case of tractors, weights are shown for crawlers as a whole and for two sub-groups of wheeled tractors, one including the International and the Fordson-Putilovets, the other including the Universal. These weights were applied to the price relatives as explained in Section III.

TABLE III  
VALUE WEIGHTS USED IN TRACTOR PRICE INDEXES<sup>a/</sup>  
 (in percent)

| Constant Weight Indexes           |             |      |      |      |      |
|-----------------------------------|-------------|------|------|------|------|
| Item                              | Weight Year |      |      |      |      |
|                                   | 1928        | 1932 | 1937 | 1941 |      |
| Tracklaying Tractors              | 40          | 5    | 68   | 100  |      |
| Wheeled Tractors:                 |             |      |      |      |      |
| International, Fordson-Putilovets | 60          | 95   | 19   | —    |      |
| Universal                         | —           | —    | 13   | —    |      |
| Given-Year Weight Index           |             |      |      |      |      |
|                                   | 1928        | 1935 | 1941 | 1945 | 1949 |
| Tracklaying Tractors              | 44          | 54   | 100  | 80   | 91   |
| Wheeled Tractors:                 |             |      |      |      |      |
| International, Fordson-Putilovets | 56          | 40   | —    | —    | { 9  |
| Universal                         | —           | 6    | —    | 20   |      |

<sup>a/</sup> The sign "—" indicates that the tractor was not produced in the year and hence not included in the corresponding index or index number.

TABLE IV  
VALUE WEIGHTS USED IN TRUCK AND AUTOMOBILE PRICE INDEXES<sup>a/</sup>

(in percent)

Constant Weight Indexes

| Item           | Weight Year |               |      |      |
|----------------|-------------|---------------|------|------|
|                | 1928        | 1932          | 1937 | 1941 |
| 1.5 ton trucks | 78          | 22            | 47   | 49   |
| 3.0 ton trucks | 22          | 76            | 38   | 40   |
| 4.0 ton trucks | —           | —             | 3    | 3    |
| Fire Engines   | —           | 2             | 1    | 1    |
| Passenger Cars | —           | <del>##</del> | 11   | 7    |

Given-Year Weight Index

|                | 1928 | 1935 | 1941 | 1945 | 1949 |
|----------------|------|------|------|------|------|
| 1.5 ton trucks | 78   | 42   | 49   | 51   | 47   |
| 3.0 ton trucks | 22   | 58   | 40   | 42   | 38   |
| 4.0 ton trucks | —    | —    | 3    | 3    | 3    |
| Fire Engines   | —    | —    | 1    | 1    | 1    |
| Passenger Cars | —    | —    | 7    | 3    | 12   |

a/ The sign "a" indicates that the item was omitted from the index or index number. The sign "##" indicates that the magnitude is less than 0.5.

For the years through 1937, production breakdowns by models are available for tractors from Soviet sources. Such comprehensive data have not been found for later years, but information sufficient for the estimation of the weight groups used here is available. This information, together with the estimation procedures employed, is set forth in Appendix C.

The weights used for trucks in the truck and automobile indexes are based on actual production data for the models represented as reported in Soviet statistical sources for the weight years 1928 and 1932. In the case of 1937, the truck production breakdown by models was estimated from data giving total truck production for the whole year and production by model for the first ten months of the year; it is not felt that any significant error has resulted from this procedure.<sup>41/</sup> For the years after 1937, only the total number of trucks and the total number of passenger cars produced is known. It is nonetheless desirable to reflect these changes in regimen in weight years subsequent to 1937, because the passenger car displays substantial independence in its price behavior. This is observable in the price relatives for automotive products set forth in Table VII. It was assumed, therefore, in compiling weights for years after 1937, that the value proportions of the different truck models and of fire engines of 1937 were maintained. This assumption is doubtless in error, but the following considerations lead to the belief that no serious damage is done to the resulting indexes by employing it:

(1) An error of 100% in the estimate of fire engine production could produce a change in the indexes of only 1 or 2%.

(2) The prices of the most important trucks moved together closely, with the result that changes in the regimen used for weighting would not greatly influence the final index. The sole exception to this second consideration is the singularity in 1941 prices of gas-generating trucks already noted. Although the 1941 Plan does not give a model breakdown of planned truck production, it does state that some 30% of the trucks were to have been gas-generators. As the prices of gas-generators as a group did

---

<sup>41/</sup> Details of the estimation procedure are given in Appendix A.

move together, it was possible to reflect this one deviation from the general rule in the appropriate index numbers in the manner described in Section IV.

The chassis used for fire engines in the Soviet Union are chassis of the Gaz AA for 1.5 ton fire engines and of the Zis 5 for 3.0 ton fire engines. Although only a single price relative was used to represent price movements of both models of fire engine, and weights used were computed on the basis of production of both models; i.e., the weight equals the price of the 1.5 ton fire engine times production of all fire engines. This procedure suggests that the weight given to fire engines may be slightly too low, but the resulting error can have only a negligible effect on the indexes.

Soviet production data for passenger cars are not broken down by kinds. Value of passenger car output for the weight years was estimated, therefore, by multiplying total passenger car production by the price of the Pobeda. The Pobeda is intermediate in size among Soviet light cars, the Gaz A, the Kim and the Moskvich being smaller, the Gaz 11-73, the Zis 101 and the Zis 110 being larger; for this reason it was felt that this procedure probably resulted in a usable approximation to the true value weights.<sup>42/</sup>

The price relatives for tractors as computed are presented in Table V. With the exception of the price changes occurring between 1935 and 1937 the movements of relatives for the two kinds of tractors are seen to be always in the same direction. The magnitudes of change after 1941, on the other hand, vary greatly. The price relative for tracklayers declined between 1935 and 1936, while the price relative for wheeled tractors increased. The general trend of Soviet machine prices at this time seems to have been upward, in conjunction with the effort to bring prices into line with costs through the elimination of subsidies

---

<sup>42/</sup> Soviet passenger cars are described in detail in Appendix D

and the strengthening of khozraschet (economic accountability). The price relative for 1935 for tracklayers was calculated from prices quoted for the Stalinets S-60, produced at the Chelyabinsk tractor factory. This tractor came into large scale production only in 1934, from which time, however, it virtually preempted the field of tracklaying tractor production. For this reason, no doubt, its production costs in the years immediately subsequent to 1924 fell more rapidly than those of other tractors. By 1935 its wholesale price was some 45% above production costs, whereas the wholesale price of the International, the other main tractor produced at this time, was only some 12-16%<sup>43/</sup> above production costs. By contrast, the prices for these two tractors after the 1936 price reform exceeded 1935 production costs by 21% for the Stalinets and by 28-32% for the International. Thus the contrary movement of these two prices between 1935 and 1936 must represent the establishment at least temporarily of a more consistent cost-price relationship for the different tractor models.<sup>44/</sup>

Price movements for wheeled and tracklaying tractors in the post-war period diverge widely. Specifically, wheeled tractors show a seven-fold increase in price over the 1937 level, whereas crawlers show only a three-fold increase. It is not believed that this disparity can be explained wholly on the basis of production costs, but no complete explanation for the disproportion in price changes is known.

<sup>43/</sup> i.e., 12% above costs for the Stalingrad tractor factory, 16% above for the Kharkov tractor factory.

<sup>44/</sup> The information on production costs of tractors on which this discussion is based is found in Avtotraktornoe Delo, No. 5, 1936, p. 137, in an article by S.Ya.Sarikyan, "Production costs of tractors." Some further discussion of this article and its implications is offered in Appendix F of this memorandum.

TABLE V

PRICE RELATIVES OF SOVIET TRACTORS, 1928-1949<sup>a/</sup>

(1937 = 100)

| Item                              | 1928  | 1935  | 1937  | 1941 | 1945  | 1949  |
|-----------------------------------|-------|-------|-------|------|-------|-------|
| Tracklaying Tractors              | 240.4 | 120.0 | 100.0 | 93.3 | 228.1 | 294.8 |
| Wheeled Tractors:                 |       |       |       |      |       |       |
| International, Fordson-Putilovets | 171.4 | 87.6  | 100.0 | 95.0 | na    | na    |
| Universal                         | na    | 118.1 | 100.0 | na   | 745.4 | 730.8 |

<sup>a/</sup> These relatives are computed from the prices of Table I, in the manner described in Section IV. They incorporate the adjustments to the prices as quoted in the various sources described in Section II, but no adjustment for calendar years. Price relatives used in computing the given-year weighted index are reciprocals of the relatives given in the table.

TABLE VI

PRICE INDEXES OF SOVIET TRACTORS, 1928-1949<sup>a/</sup>

## Constant Weight Indexes

| Weight Year | 1928 | 1935 | 1937 | 1941 | 1945 | 1949 |
|-------------|------|------|------|------|------|------|
| 1928        | 199  | 101  | 100  | 94   | 537  | 555  |
| 1932        | 175  | 89   | 100  | 95   | 718  | 708  |
| 1937        | 218  | 113  | 100  | 94   | 396  | 437  |
| 1941        | 240  | 120  | 100  | 93   | 228  | 295  |

## Given-Year Weighted Index

|       | 1928 | 1935 | 1937 | 1941 | 1945 | 1949 |
|-------|------|------|------|------|------|------|
| Index | 199  | 104  | 100  | 93   | 266  | 318  |

<sup>a/</sup> These indexes are computed from the value weights as given in Appendix C, and the price relatives shown in Table V. The price levels refer to whole calendar years, computed by the method discussed in Section V.

The constant weight indexes reflect in varying degrees the price behavior of the different kinds of tractors. Thus the relatives of the index of weight year 1932 coincide closely with the price relatives for wheeled tractors, while the relatives of the 1941 weighted index coincide exactly with the price relatives for tracklaying tractors. The indexes for weight years 1928 and 1937 are intermediate to those for weight years 1932 and 1941.

The index using given-year weights, as would be expected, agrees now with one, now with another constant weight index through the year 1941. For later years, it strikes a compromise between the constant weight indexes, but in general it may be said to reflect the relative unimportance of wheeled tractors in this period. It should be noted, in this connection, that authoritative information about the postwar tractor production regimen in the Soviet Union is lacking. Thus the given year weights for these years had to be estimated and undoubtedly contain some degree of error. It is believed that the weights as estimated for 1945 are fairly accurate; those for 1949 must be considered rather more conjectural. In every instance, reservations should be maintained in the use and interpretation of the index numbers obtained by means of these weights.

The prices of Soviet trucks and automobiles showed more uniformity of movement than did those of tractors. In particular, as appears in Table VII, the price relatives for ordinary 1.5 ton and 3.0 ton trucks, by far the most important automotive products in the Soviet Union, moved closely together.<sup>45/</sup> In consequence, the price indexes computed for trucks and automobiles, as shown in Table VIII, are very similar, in spite of changes in the weighting systems.

<sup>45/</sup> For the years 1928 and 1949, of course, a part of the coincidence is due to assumptions about the relative values of the machines priced, as explained in Section IV. This does not vitiate the observed coincidence of price behavior, however, as these assumptions were introduced to correct for deficiencies in comparability. Even if the prices for these two kinds of truck quoted in Table II are used as is, no correction being attempted for comparability, the greatest difference in price level relative to 1937 between them would not exceed 20%.

TABLE VII

PRICE RELATIVES FOR SOVIET TRUCKS AND AUTOMOBILES, 1928-1949<sup>a/</sup>

| Item                                         | 1928  | 1929  | 1935  | 1937  | 1941                | 1945                | 1949  |
|----------------------------------------------|-------|-------|-------|-------|---------------------|---------------------|-------|
| 1.5 ton trucks, ordinary                     | 213.7 | 213.4 | 83.3  | 100.0 | 104.1               | 121.5               | 252.6 |
| 1.5 ton trucks, gas-generating <sup>b/</sup> | na    | na    | na    | na    | 121.5               | 121.5               | na    |
| 3.0 ton trucks, ordinary                     | 213.7 | 207.8 | 100.0 | 100.0 | 100.0               | 125.0               | 245.9 |
| 3.0 ton trucks, gas-generating <sup>b/</sup> | na    | na    | na    | na    | 125.0               | 125.0               |       |
| 4.0 ton trucks                               | na    | na    | na    | 100.0 | 126.4               | na                  | 314.5 |
| Fire Engines                                 | na    | na    | na    | 100.0 | 172.9               | 258.8               | 355.5 |
| Passenger Cars                               | na    | na    | na    | 100.0 | 111.8 <sup>c/</sup> | 111.8 <sup>c/</sup> | 342.5 |

<sup>a/</sup> These relatives are computed from the prices of Table I, in the manner described in Section IV. They incorporate the adjustments to the prices as quoted in the various sources described in Section II, but no adjustment for calendar years. Price relatives used in computing the given-year weighted index are reciprocals of the relatives in Table VII.

<sup>b/</sup> These price relatives were computed by linkage on the assumption that the 1945 price level of the gas-generating models was the same as the 1945 price level for the gasoline-burning counterparts.

<sup>c/</sup> See Table II, fn. b, for qualifications as to the reliability of these relatives.



TABLE VIII

PRICE INDEXES FOR SOVIET TRUCKS AND AUTOMOBILES, 1928-1949<sup>a/</sup>Constant Weight Indexes

| <u>Weight Year</u> | <u>1928</u>    | <u>1929</u> | <u>1935</u> | <u>1937</u> | <u>1941</u> | <u>1945</u> | <u>1949</u> |
|--------------------|----------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1928               | 214            | 204         | 87          | 100         | 103         | 113         | 251         |
| 1932               | 213            | 202         | 96          | 100         | 103         | 125         | 250         |
| 1937               | <del>223</del> | 203         | 91          | 100         | 105         | 118         | 263         |
| 1941               | 213            | 203         | 91          | 100         | 111         | 119         | 259         |

Given-Year Weighted Index

|       | <u>1928</u> | <u>1935</u> | <u>1937</u> | <u>1941</u> | <u>1945</u> | <u>1949</u> |
|-------|-------------|-------------|-------------|-------------|-------------|-------------|
| Index | 213         | 92          | 100         | 111         | 119         | 260         |

---

<sup>a/</sup> These indexes are computed from the value weights as given in Appendix A, and the price relatives shown in Table VII. In every case, they are for the calendar year, adjusted for this purpose by the method described in Section V. In the case of the index numbers for 1929, the index as computed from the price relatives in Table VII was lowered by 3.8% in each case, as a general decrease in the price of trucks of 15.2% is known to have occurred effective October 1, 1929 (Metall, No. 2, 1930, p. 124.)

## VII. RESULTS AND OBSERVATIONS

Referring to the index using constant 1937 value weights, the calculations show that tractor prices in 1928 stand at 218 percent, taking 1937 as 100. In 1935 they stand at 113; in 1941, at 94; in 1945, at 396; and in 1949, at 437.

In the case of trucks and automobiles, again referring to the index using constant 1937 value weights, the price level was, in 1928, 213 percent of 1937. By 1935 it had fallen to 91 percent. In 1941, it stands at 105 percent; in 1945, at 118; and in 1949, at 252.

As stated earlier, index numbers describing price behavior between the bench mark years are presented and explained separately, in Appendixes H and I.

A comparison may be made of movements of prices of trucks, automobiles and tractors with those of road building and construction machines, and of ordinary and quality rolled steel, as computed in previous RAND studies. Price indexes for all of these products, based on 1937 and using 1937 value weights are given in Table IX.

TABLE IX

PRICE INDEXES OF TRUCKS AND AUTOMOBILES, TRACTORS, ROAD BUILDING AND CONSTRUCTION MACHINES, QUALITY AND ORDINARY ROLLED STEEL, U.S.S.R., SELECTED YEARS<sup>a/</sup>

| Item                                       | 1928 | 1935 | 1941 | 1945 | 1949 |
|--------------------------------------------|------|------|------|------|------|
| 1. Road Building and Construction Machines | 83   | na   | 86   | 86   | 129  |
| 2. Trucks and Automobiles                  | 213  | 91   | 105  | 118  | 252  |
| 3. Tractors                                | 189  | 113  | 94   | 396  | 437  |
| 4. Quality Rolled Steel                    | 58   | 59   | 113  | 113  | 245  |
| 5. Ordinary Rolled Steel                   | 60   | 57   | 131  | 131  | 405  |

<sup>a/</sup> The source of Row 1 is Table III of an earlier study by the present writer, Prices of Road Building and Construction Machines, USSR, 1928-1949. Rows 2 and 3 are taken from Tables VI and VIII of the present memorandum. Row 4 is based on A. Bergson and L. Turgeon, Prices of Quality Rolled Steel in the Soviet Union, 1928-1950, RM-778, 1952, pp. 20-21. Row 5 is based on A. Bergson and L. Turgeon, Prices of Ordinary Rolled Steel in the Soviet Union, 1928-1950, RM767, 1952, pp. 32, 34-35. The symbol "na" indicates that no index number for the year in question was computed.

The most striking thing about the comparative price movements in Table ~~XXI~~ is the apparent lack of correspondence between price behavior in the different categories. Nor do prices of the three categories of machines seem to have much more in common with each other than they do with those of the rolled steels. In particular, the policy of maintaining 1941 prices in 1945, which was pursued in the case of rolled steel, was also followed in the case of road and construction machines, but abandoned in the instance of trucks, automobiles and tractors.

By contrast, prices of similar items of machinery, as has been observed above in the case of trucks and tracklaying tractors, and in an earlier RAND study<sup>46/</sup> in the case of road and construction machines, show more uniformity of behavior.

It is not intended to attempt an explanation of these pricing phenomena at this time. When a more complete history of Soviet price behavior is available, such an attempt might cast a considerable light on the rationale underlying Soviet economic planning. All that may be said at this point is that there was no uniformity in the price behaviour of different categories of industrial production during the period of the five year plans in the Soviet Union.

---

<sup>46/</sup> R. Moorsteen, Prices of Road Building and Construction Machines, USSR, 1928-1949, RM-1037, p. 14.

## APPENDIX A

PRODUCTION OF TRACTORS AND AUTOMOTIVE VEHICLES IN THE  
U.S.S.R., 1928-1950

Production data for use in constructing value weights were gleaned from well known Soviet statistical sources and from articles in Soviet periodicals and newspapers. Important lacunae in data from these sources were filled by estimation. The data are presented in Appendix Tables I and II.

# APPENDIX TABLE I

## PRODUCTION OF TRACTORS, USSR, 1928-1950<sup>a/</sup>

| Item                           | 1928 | 1929 | 1930 | 1931   | 1932   | 1933   | 1934   | 1935    | 1936    | 1937   |
|--------------------------------|------|------|------|--------|--------|--------|--------|---------|---------|--------|
| All tractors <sup>b/</sup>     | 1272 | 3281 | 9097 | 38,105 | 50,640 | 78,138 | 94,452 | 113,566 | 112,416 | 51,150 |
| Wheeled tractors:              |      |      |      |        |        |        |        |         |         |        |
| 10/20 horsepower <sup>c/</sup> | 1115 | 3040 | 8536 | 18,974 | 4,220  | 4,468  | 3,167  | 12,385  | 18,486  | 17,949 |
| International 15/30            | —    | —    | 53   | 18,513 | 45,932 | 71,567 | 80,680 | 79,351  | 64,880  | 17,646 |
| Tracklaying tractors:          |      |      |      |        |        |        |        |         |         |        |
| NATI, 50 b.h.p.                | —    | —    | —    | —      | —      | —      | —      | —       | —       | 2,550  |
| Kommunar, 50 b.h.p.            | 157  | 87   | 320  | 208    | —      | —      | —      | —       | —       | —      |
| Stalinets, S-60                | —    | —    | —    | 6      | 24     | 1,652  | 10,100 | 20,463  | 29,049  | 8,007  |
| Kommunar, 70 b.h.p.            | —    | 144  | 188  | 23     | —      | —      | —      | —       | —       | —      |
| Kommunar, 90 b.h.p.            | —    | —    | —    | 378    | 464    | 451    | 495    | (360)   | (3,170) | —      |
| Kommunar, 110 b.h.p.           | —    | —    | —    | 3      | —      | —      | —      | —       | —       | —      |
| Stalinets, S-65                | —    | —    | —    | —      | —      | —      | —      | 7       | 10      | 4,998  |

a/ The sign "—" indicates zero production. Figures enclosed in parentheses are estimates. The sign "na" indicates that production data were not available.

b/ For the years 1945-1950, the figures are in units of 15 d.h.p.

c/ Including rubber-tired towing tractors. Both towing and ordinary 10/20 tractors were Fordson-Putilovets's through 1933 and Universals thereafter.

APPENDIX TABLE I (CONT'D)<sup>a/</sup>

| Item                           | 1940   | 1941   | 1945    | 1946   | 1947   | 1948    | 1949    | 1950    |
|--------------------------------|--------|--------|---------|--------|--------|---------|---------|---------|
| All tractors <sup>b/</sup>     | 31,100 | 28,000 | 17,908  | 30,802 | 64,377 | 131,218 | 203,603 | 250,432 |
| Wheeled tractors:              |        |        |         |        |        |         |         |         |
| 10/20 horsepower <sup>c/</sup> | —      | —      | (2,000) | na     | na     | na      | na      | na      |
| International 15/30            | —      | —      | —       | —      | —      | na      | na      | na      |
| Tracklaying tractors:          |        |        |         |        |        |         |         |         |
| NATI, 50 b.h.p.                | na     | na     | (7,100) | na     | na     | na      | na      | na      |
| Kommunar, 50 b.h.p.            | na     | na     | na      | na     | na     | na      | na      | na      |
| Stalinets, S-60                | na     | na     | na      | na     | na     | na      | na      | na      |
| Kommunar, 70 b.h.p.            | na     | na     | na      | na     | na     | na      | na      | na      |
| Kommunar, 90 b.h.p.            | na     | na     | na      | na     | na     | na      | na      | na      |
| Kommunar, 110 b.h.p.           | na     | na     | na      | na     | na     | na      | na      | na      |
| Stalinets, S-65                | na     | na     | na      | na     | na     | na      | na      | na      |

The sources of the data presented in Appendix Table I follow. Abbreviations used in citations are explained in Appendix L.

1. All tractors

1928-1935: SS 36, p. 160.

1936: 37 Plan, p. 83.

1937: Tretii Plan, p. 206.

1940: E. Lokshin, Promyshlennost' SSSR v novoi Stalinskoi Pyatiletke (Industry of the USSR during the New Stalin Five Year Plan), Moscow, 1946, p. 40, as cited "Postwar Economic Reconstruction and Development, USSR," Appendix, p. 3, by A. Bergson, J. Blackman and A. Erlich, in Annals of the American Academy of Political and Social Science, May 1949.

1945-1950: These are estimates based on the statement, "During 1946-1949, industry produced more than 430,000 tractors (in 15 h.p. units)... Taking as 100 production of tractors in 1946: 1946 equals 100; 1947, 209; 1948, 426; 1949, 661." (Voprosy Ekonomiki, No. 5, 1950, p. 42); and on the percentage increase in tractor production from 1945 to 1946, 72%, and from 1949 to 1950, 23%, given by I. Kuzminov in "Nepreryvnyi Pod'em Narodno-Khozyaistva SSSR—Zakon Sotsializma" (The Unceasing Growth of the National Economy of the USSR — A Law of Socialism) in Voprosy Ekonomiki, No. 6, 1951, p. 30.

2. Wheeled tractors, 10/20:

1928-1936: As in preceding item.

1937: SSKh 1939, p. 12. This source gives production by model in 1937 in terms of percents of total output. The appropriate percentage was applied to the figure for all tractors produced found in Tretii Plan, p. 206. To this was added the 150 towing tractors produced (Itogi, p. 77) which were not included in the SSKh 1939 account.

1940-1941: On the basis of evidence presented in the text (Section III, fn.16) it is believed that this tractor was not produced in these years.

1945: Production was estimated on the basis of production for the first three months of this year of 500 (see: fn.16, Section III). This quarterly rate was multiplied by four.

3. Wheeled Tractors, 15/30:

1928-1937: As in preceding item.

1940-1947: Korobov, Traktory, Avtomobili i Sel'sko-Khozyaisvennye Dvigateli (Tractors, Automotive Vehicles and Agricultural Engines), Moscow, 1950, p. 9.

4. Tracklaying Tractors, NATI:

1928-1936: ATD, No. 18, 1937, p. 495, which states that production of this model began only in the third quarter of 1937.

1937: As in preceding item.

1945: This estimate is based on the assumption that only two tractor models were produced in 1945, the NATI and the Universal, as these are the only tractors for which prices were quoted for the year. Taking the d.h.p. of the Universal at 10, the estimated production was converted into 15 d.h.p. units and subtracted from the total output figure. The difference, in 15 d.h.p. units, was converted into physical units of NATI, by taking the d.h.p. of the NATI at 35.

5. Tracklaying Tractors, Other 50 Belt H.P.:

1928-1934: SS 35, p. 55.



6. Tracklaying Tractors, Stalinets S-60:

1928-1934: SS 35, p. 55.

1935-1936: 37 Plan, p. 82-3.

1937: As in item 2.

1940-1945: SSKh 1939, p. 12, which states that this tractor was discontinued in 1937.

7. Tracklaying Tractors, 70 Belt H.P.:

As in item 5.

8. Tracklaying Tractors, 90 Belt H.P.:

1928-1934: SS 35, p. 55.

1935-1936: 37 Plan, p. 82-3, gives total production and production of wheeled tractors and Stalinets S-60 tractors in physical units. The difference between production of the latter two groups and total production was assumed to be production of the Kommunar 90. It is not clear if the total figures in the source include towing tractors. If they do, these estimates may overstate actual production of the Kommunar 90.

1937: SSKh 1939, p. 12, which states that the Stalinets and NATI accounted for all tracklaying tractors produced.

9. Tracklaying Tractors, 110 Belt H.P.:

As in item 5.

10. Tracklaying Tractors, Stalinets S-65:

1928-1937: As in item 6.

# APPENDIX TABLE II

## PRODUCTION OF TRUCKS AND AUTOMOBILES, USSR, 1928-1939<sup>a/</sup>

| Item                          | 1928   | 1929   | 1930   | 1931   | 1932    | 1933    | 1934    | 1935    | 1936    | 1937      |
|-------------------------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|-----------|
| All trucks and autos          | 671    | 1,390  | 3,375  | 4,005  | 23,879  | 49,724  | 72,472  | 96,620  | 136,572 | 200,000   |
| All trucks:<br>of which:      | 671    | 1,248  | 3,151  | 4,005  | 23,845  | 39,465  | 55,362  | 77,666  | 132,917 | 181,800   |
| 1.5 ton                       | 580    | 1,100  | 2,089  | 1,268  | 7,477   | 16,477  | 32,186  | 44,626  | 82,612  | (119,309) |
| 2.5 ton                       | --     | --     | 416    | 1,623  | 15,149  | 20,005  | --      | --      | --      | --        |
| 3.0 ton                       | --     | --     | --     | --     | --      | 891     | 19,935  | 28,990  | 45,488  | (56,729)  |
| 4.0 ton                       | --     | --     | --     | --     | --      | 20      | 700     | 1,760   | 2,600   | (3,241)   |
| 5.0 ton                       | 91     | 148    | 646    | 1,113  | 1,183   | 1,994   | 2,450   | 2,271   | na      | na        |
| Gas-generating                | --     | --     | --     | --     | --      | --      | --      | --      | --      | --        |
| Passenger cars                | --     | 142    | 224    | --     | 34      | 10,259  | 17,110  | 18,954  | 3,655   | 18,200    |
| Fire engines:<br>of which:    | --     | 39     | 104    | 456    | 513     | 268     | 761     | 801     | na      | na        |
| 1.5 ton                       | --     | 39     | 104    | 375    | 44      | --      | 570     | 564     | na      | na        |
| 2.5 and 3.0 ton <sup>b/</sup> | --     | --     | --     | 81     | 469     | 268     | 191     | 237     | na      | na        |
| Bicycles                      | 10,847 | 20,960 | 35,370 | 80,899 | 128,415 | 132,429 | 274,533 | 322,061 | 557,500 | 540,000   |
| Motorcycles                   | --     | --     | --     | 16     | 112     | 119     | 365     | 1,202   | 6,700   | 13,200    |

<sup>a/</sup> The sign "---" indicates production of zero. Figures enclosed in parentheses are estimates. The sign "na" indicates that the datum is not available.

<sup>b/</sup> The larger fire engine was a 2.5 ton model through 1933, and a 3.0 ton model thereafter.



The sources for the data presented in Appendix Table II are as follows:

1. Trucks:

1928-1935: SS 36, p. 165.

1936: 37 Plan, p. 82-3. This source gives truck output by producing enterprise, but not by model. It is known that the Gorky plant was the sole producer of 1.5 ton trucks and that the 1.5 ton truck was the only truck it produced in this year; hence its output was taken as the figure for 1.5 ton trucks. It is known that the only trucks produced at the Moscow plant were the 3.0 ton and 4.0 ton Zis trucks and that 3.0 ton trucks were produced only at this plant. The figure for 3.0 ton trucks was estimated by applying to 1936 production the share of the Moscow plant's 1935 output going to 3.0 ton trucks. In 1935, 3.0 ton trucks accounted for over 95% of all trucks in this plant. Production of 4.0 ton trucks was estimated analogously, using the percentage of production of this size truck for 1935 at the Moscow and Yaroslavl plants in conjunction with their outputs in 1936. It is not known if the 4.0 ton truck produced in Yaroslavl is the same model as that produced in Moscow.

1937: "Rabota GYTAP za 10 mesyatsev 1937 goda" (The Work of the Automobile and Tractor Industry during 10 months of 1937) in ATD No. 18, 1937. This source also gives output by plant for the first 10 months of 1937 together with the daily rate of production during October. The total number of trucks produced in 1937 is known from Tretii Plan, p. 206. The difference between production for the year and for the first ten months was therefore allocated to plants by the proportions of their daily output in October. Production by models was then estimated by the same procedure employed for 1936.

1938: SS 39, p. 63.

1940: E. Lokshin, Promyshlennost SSSR v Novoi Stalinskoi Pyatiletke, (The Industry of the U.S.S.R. in the New Stalin Five-Year Plan), 1946, p. 40.

1941: 41 Plan, p. 45.

1945+1950: These figures are derived from an absolute figure for production in 1946 (see below) and yearly changes in output, expressed in percents, given in VP, no. 6, 1951, p. 30. The 1946 figure is obtained from Avtomobil'naya Promyshlennost' (Automotive Industry), no. 3, 1947, which states that the 1947 production plan for trucks and automobiles stood at 129% of 1940- - i.e. 189,600 - which was also indicated as representing 157% of actual output of 1946, making the latter 120,800. This total figure was divided between passenger cars and trucks in the ratio .027::.973. I am indebted to Mr. Leon Herman for the above information as well as for the estimated division of total output between cars and trucks.

## 2. Automobiles:

1928-1935: SS 36, p. 165.

1936: 37 Plan, p. 82-3.

1937: Tretii Plan, p. 206.

1938: SS 39, p. 63.

1940: Lokshin, loc.cit.

1941: 41 Plan, p. 45.

1945: As in preceding item.

## 3. Fire Engines:

1928-1934: SS35, p. 54.

1935: SC, p. 75.

## 4. Bicycles:

1928-1935: SS 36, p. 165.

1936: P.Kh. no. 3, 1937, p. 233.

1937: SKS, p. 175.

1941: 41 Plan, p. 171.

5. Motorcycles:

1928-1936: as in preceding item.

1937: P.Kh. no. 3, 1939, p. 78.

1941: Civilian production assumed nil, as no figure  
given in 41 Plan.

APPENDIX B  
SOURCES OF THE PRICES USED IN THE TRACTOR AND TRUCK  
AND AUTOMOBILE PRICE INDEXES

The prices set forth in text Tables I and II were taken from the sources listed below. The date at which the prices became effective is indicated along with the sources.

1. Tractors

1928: PRM 29, p. 799. No date is given in the source for these prices. PS 1927/8, p. 261, however, gives the value of tractor output in 1927/8 in current prices -- 6,845 thousand rubles. The value of the 1115 Fordson-Putilovets' and 157 Kommunars produced in that year at the prices of PRM 29 would be 6,842 thousand rubles; furthermore, PS 1927/8, loc.cit., gives total output of tractors as 1279 instead of 1272, the figure given in SS 35 and SS 36, which I would regard as more authoritative. In any case these figures seem to indicate that the prices in PRM 29 were effective at the latest by October 1, 1927, and continued in effect until at least October 1, 1928. There is evidence that the price of the Fordson-Putilovets remained unchanged until 1931, but that the price of the Kommunar declined by 10% on October 1, 1928. See Appendix H. The tractor index numbers for 1928 have been adjusted accordingly.

1935: Nashe Stroitel'stvo (Our Construction), No. 8, 1935, p. 36, for the Stalinets S-60. The price is there stated to have become effective January 1, 1935.

Sotsialisticheskaya Rekonstruktsia Sel'sko-Khozyaistva (Socialist Reconstruction of Agriculture), No. 3, 1935, p. 51, as cited in N. Jasny, Soviet Prices of Producers' Goods, Stanford, 1952, p. 137, for the International.

This price is merely stated to be current, in the source cited, and has been assumed to have been effective as of at least January 1, 1935, in the present study.

1937: STMG 36, p. 7, which states that the prices took effect April 1, 1936; and SMS 37, p. 220, which gives no date but indicates that the prices were still current in early 1937. SLS 41, p. 622-3, where those price decreases of April 1, 1937, effecting machinery are listed, omits any mention of tractors or automotive products, suggesting that these prices continued in effect past that date.

1941: SLS 41, p. 391. This same source, p. 623, indicates that the prices took effect January 1, 1941.

1945: SUSN 45, p. 177. The price of the NATI was set in a decree dated June 26, 1944 (loc.cit.) and is hence assumed to have been effective as of June 1, 1944. The price of the Universal was established by "agreement between the People's Commissariat of State Farms (N.K. Sovkhozov), the People's Commissariat of Agriculture (N.K. Aemledeliva), and the Central Administration of the Tractor Industry (Glaytraktorprom)" on the 30th of September 1944 (loc.cit.) and is hence assumed to have been effective as of September 1, 1944.

1949: SUSN 49, p. 250-1. Prices effective on January 1, 1949.

## 2. Trucks and Automobiles

1928: SMG 28, p. 447. These prices are assumed to have been effective at least from January 1, 1928.

1929: CCC 29, p. 142. These prices are assumed to have taken effect on October 1, 1928, as that was the beginning of the Soviet fiscal year 1928/9 and the date on which prices for other machines were set. For example, Metall, No. 1, 1929, in which numerous prices for railroad rolling stock are set.



1935: Nashe Stroitel'stvo (Our Construction), No. 8, 1935, p. 36.

Prices took effect January 1, 1935.

1937: STMG 36, p. 7, for passenger cars, and SMS 37, p. 220, for trucks and fire engines. Prices were effective as of April 1, 1936.

1941: SLS 41, p. 390, for trucks and fire engines. P.Kh., No. 7, 1940, p. 71, for passenger cars. This price was stated in the source to be "current" in 1940, without further qualification. In the absence of other information it was assumed to be the price for 1941 as well. (See Appendix J) The prices for trucks and fire engines took effect January 1, 1941. The price for the passenger automobile is assumed to have been effective at least from the beginning of 1940.

1945: SUSN 45, p. 276, for trucks; p. 187, for fire engines. The price of the Gaz AA, 1.5 ton truck was set September 26, 1945 and hence assumed to have been effective from September 1, 1945. The price of the Zis 5 was set June 24, 1944 and hence assumed to have been effective as of June 1, 1944. The prices of the fire engines are characterized as "temporary," a term used for prices of items in their first six to twelve months of production; such prices were not established by decree but, apparently, often became the official prices after the initial period of "mastery" (osvoenie) was completed. (See Maizenberg, op.cit.) These prices were assumed to be effective as of January 1, 1945, and to have continued until 1949. The 1941 price of the passenger car Gaz M-1 has been taken as the 1945 price as well. See Appendix J.

1949: SUSN 49, p. 245, for trucks; p. 256, for fire engines; p. 249, for passenger cars. All prices became effective January 1, 1949.

## APPENDIX C

VALUE WEIGHTS USED IN COMPUTING THE PRICE INDEXES

The value weights used for computing the two sets of price indexes are set forth, in millions of rubles, in Appendix Tables III and IV. These weights were computed from the price data of text Tables I and II and the production data of Appendix A in the fashion described in Section V. Thus the weights for the constant weight indexes are the production of the various weight years, valued at 1937 prices. The weights for the given-year weight indexes are production of the various years valued at prices of the same years.

In the case of the given-year weight index for tractors, weights for the postwar year 1949 were drawn from the planned regimen of tractor deliveries to agriculture, rather than the achieved output regimen of the industry. The regimen used was the plan for delivery of tractors to agriculture in 1947 (Appendix Table V) valued at prices of 1949. This is tantamount to the assumption that this delivery plan accurately characterized the achieved output regimen for 1949. This assumption is undoubtedly in error but it represents about the best that can be done in the absence of better information. In this connection, the following considerations are in order: (1) The delivery plan was apparently unfulfilled in 1947. Actual deliveries in 1949, on the other hand, 150,000 tractors in 15 d.h.p. units, were almost double those planned for 1947.<sup>47/</sup> (2) The 1948 plan contemplated deliveries to agriculture of 67,000 tractors in physical units, of which 10,800 were to be the large Stalinets S-80.<sup>48/</sup> Although details as to the quantities of the other tractor

<sup>47/</sup> V.E. No. 2, 1950, p. 86.

<sup>48/</sup> Economic Commission for Europe, op.cit., p. 21.

models to be supplied are lacking, the 1948 plan must have envisaged deliveries of about 160,000 tractors, in 15 H.P. units; a third of these were to be Stalinets S-80's alone, as opposed to a fourth of the 1947 plan. (3) The wheeled tractor International, which was not produced in 1947, was brought into production some time in 1948. Although its production in that year was probably small, there is no reason to assume that this continued to be true in 1949.

(4) Deliveries to agriculture constituted around 75% of all tractor production in the Soviet Union in the period 1946-1950; however, the proportion of wheeled tractors going to agriculture was undoubtedly larger, perhaps even 100%. These qualifications may be summarized in relation to the ratio of wheeled to track-laying tractors, which is the magnitude of interest in constructing the weights used here: use of the 1947 plan to approximate 1949 weights overstates the role of wheeled tractors because deliveries to agriculture of these tractors take a larger share of total output and because an expansion of the role of large tracklayers was contemplated in 1948; but this is counterbalanced, though to an unknown extent, by the reestablishment in production in 1949 of the wheeled tractor International, a machine particularly suited to mass production under Soviet conditions. While there would seem to be little possibility that the role of wheeled tractors in 1949 has been overstated, it is not too unlikely that it has been understated. If, for example, the relative importance of wheeled tractors in 1949 were double that of the estimate used, the result on the given-year weighted index number would be to increase it by about 11%.

## APPENDIX TABLE III

VALUE WEIGHTS USED IN TRACTOR PRICE INDEXES<sup>a/</sup>

(in millions of rubles)

Constant Weight Indexes

| <u>Item</u>                       | <u>Weight Year</u> |             |             |             |
|-----------------------------------|--------------------|-------------|-------------|-------------|
|                                   | <u>1928</u>        | <u>1932</u> | <u>1937</u> | <u>1941</u> |
| Tracklaying Tractors              | 1.5                | 10.8        | 246.5       | <u>b/</u>   |
| Wheeled Tractors:                 |                    |             |             |             |
| International, Fordson-Putilovets | 2.2                | 193.4       | 71.0        | --          |
| Universal                         | --                 | --          | 47.8        | --          |

Given-Year Weight Indexes

|                                   | <u>1928</u> | <u>1935</u> | <u>1941</u> | <u>1945</u> | <u>1949</u> |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|
| Tracklaying Tractors              | 3.0         | 378.2       | <u>b/</u>   | 156.2       | 1012.3      |
| Wheeled Tractors:                 |             |             |             |             |             |
| International, Fordson-Putilovets | 3.8         | 279.7       | --          | --          | } 96.0      |
| Universal                         | --          | 39.3        | --          | 40.0        |             |

<sup>a/</sup> The sign "--" indicates that the tractor was not produced in the year, and hence was not included in the corresponding index or index number.

<sup>b/</sup> It is known that only crawling tractors were produced in these years (cf. section III above), hence the price relative for crawlers was used as the index number in each case and no value weights were computed.

## APPENDIX TABLE IV

VALUE WEIGHTS USED IN TRUCK AND AUTOMOBILE PRICE INDEXES--<sup>a/</sup>

(in millions of rubles)

Constant Weight Indexes

| <u>Item</u>    | <u>Weight Year</u> |             |             |             |
|----------------|--------------------|-------------|-------------|-------------|
|                | <u>1928</u>        | <u>1932</u> | <u>1937</u> | <u>1941</u> |
| 1.5 ton trucks | 3.3                | 43.1        | 687.6       | 495.5       |
| 3.0 ton trucks | 0.9                | 151.5       | 567.3       | 408.7       |
| 4.0 ton trucks | --                 | --          | 40.5        | 29.2        |
| Fire engines   | --                 | 4.6         | 15.6        | 10.4        |
| Passenger cars | --                 | 0.3         | 154.7       | 76.5        |

Given-Year Weight Index

|                | <u>1928</u> | <u>1935</u> | <u>1941</u> | <u>1945</u> | <u>1949</u> |
|----------------|-------------|-------------|-------------|-------------|-------------|
| 1.5 ton trucks | 7.1         | 214.2       | 560.6       | 388.2       | 2633.1      |
| 3.0 ton trucks | 1.9         | 289.9       | 454.8       | 314.9       | 2136.3      |
| 4.0 ton trucks | --          | --          | 31.7        | 22.0        | 149.0       |
| Fire engines   | --          | --          | 10.6        | 7.3         | 49.7        |
| Passenger cars | --          | --          | 85.5        | 24.7        | 656.7       |

<sup>a/</sup> The sign "--" indicates that the item was omitted from the index or index number for the year.

## APPENDIX TABLE V

PLANNED DELIVERIES OF TRACTORS TO AGRICULTURE, USSR, 1947

| <u>Tractor</u> | <u>Planned Delivery</u><br><u>on 1947</u> |                                            | <u>Value at</u><br><u>1947-1948</u><br><u>Prices</u> <u>-c/</u> | <u>Value at</u><br><u>1949</u><br><u>Prices</u> <u>-c/</u> |
|----------------|-------------------------------------------|--------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------|
|                | <u>Phys.</u><br><u>Units</u> <u>-a/</u>   | <u>15 H.P.</u><br><u>Units</u> <u>--b/</u> |                                                                 |                                                            |
| Tracklaying:   |                                           |                                            |                                                                 |                                                            |
| Stalinets S-80 | 3,800                                     | 20,263                                     | 66,000                                                          | 66,000                                                     |
| Kirovets D-35  | 2,000                                     | 3,333                                      | 40,000                                                          | 40,000                                                     |
| NATI           | 23,500                                    | 53,263                                     | 22,000                                                          | 29,000                                                     |
| Wheeled:       |                                           |                                            |                                                                 |                                                            |
| Universal      | 4,800                                     | 3,200                                      | 20,000                                                          | 20,000                                                     |
| Total          | 34100                                     | 80059                                      |                                                                 |                                                            |

a/ Deliveries in physical units are from "Decree on Measures to be Taken for the Promotion of Agriculture in the Postwar Period--A Report by M. Andreev," Pravda, Feb. 28, 1947, as cited in Economic Commission for Europe, The European Tractor Industry in the Setting of the World Market, Geneva, 1952, p. 21

b/ The conversion into 15 H&P units is made on the basis of the rated draw-bar horsepower of the tractors, as given in Economic Commission for Europe, op.cit., Appendix I, p. 20, and in Kalendar'-Spravochnik 1948 (Calendar-Reference Book 1948), p. 586, a Soviet source.

c/ Prices are from text Table I. For the Stalinets S-80 and the Kirovets D-35, no price quotation prior to 1949 is known. The 1949 price was used as the 1948 price in these instances, as this seems the assumption most consonant with Soviet pricing policy in the postwar period through 1949 for items new in production, like these two tractor models. //cf. L. Maizenberg, "Sistema Optovykh Tsen i Ukrupleniye Khozrascheta" (The System of Wholesale Prices and the Strengthening of Economic Accountability) in Narodnoe Khozyaistvo SSSR 1951 (The National Economy of the USSR, 1951), which states that prices during the first years of production were expected to recoup production costs including all costs of development (osvoenie). This suggests that it is most unlikely that prices for these two tractors were lower in 1948 than in 1949, as was the case with the NATI./

As stated in Section VI, the truck output regimen for years later than 1937 is not known. This deficiency has been met with the assumption that the share of total value of output accruing to each model represented in the index is maintained in the years after 1937. The value weights shown in Appendix Table IV are calculated accordingly, on the basis of the total truck output data of Appendix Table II and the prices of text Table II.

## APPENDIX D

TECHNICAL DESCRIPTIONS OF SOVIET TRUCKS, AUTOMOBILES AND TRACTORS

Appendix Tables VII, VIII and IX present brief technical descriptions of the machines priced in constructing the price indexes of this memorandum. Problems of comparability which these descriptions help to resolve have been discussed in Section IV above. In addition to the sources of the material presented in these tables as cited, brief histories and exhaustive technical discussions of these machines are to be found in V. Korobov, Traktory, Avtomobili i Sel'sko-Khozyaisvennye Dvigateli, Moscow, 1950, and V. I. Anokhin, Sovetskie Avtomobili, Moscow, 1949.



## APPENDIX TABLE VII

Technical Characteristics of Soviet Trucks

| Characteristic                           | Gaz AA <sup>a/</sup>  | Gaz MM <sup>a/</sup> | Amo F-15 <sup>b/</sup> | Zis 5 <sup>a/</sup> | Ya.Z. <sup>c/</sup> | Amo 3 <sup>d/</sup> |
|------------------------------------------|-----------------------|----------------------|------------------------|---------------------|---------------------|---------------------|
| Year first produced                      | 1932                  | 1938                 | 1924                   | 1933                | 1925                | 1931                |
| Axles                                    | 2                     | 2                    | 2                      | 2                   | 2                   | 2                   |
| Load capacity, mt.tn.                    | 1.5                   | 1.5                  | 1.5                    | 3.0                 | 3.0-3.5             | 2.5                 |
| Weight, mt.tn.                           | 1.8                   | 1.8                  | 1.5                    | 3.1                 | na                  | na                  |
| Wheel base, mm.                          | 3340                  | 3340                 | 3048                   | 3810                | na                  | 3810                |
| Turning radius, m.                       | 7.5                   | 7.5                  | 7.0                    | 8.6                 | na                  | na                  |
| Cylinders                                | 4                     | 4                    | 4                      | 6                   | 4                   | 6                   |
| Cylinder diameter, mm.                   | 98.43                 | 98.43                | 100                    | 101.6               | 100                 | 95.2                |
| Piston stroke, mm.                       | 107.95                | 107.95               | 140                    | 114.3               | 140                 | 114.3               |
| Compression ratio                        | 4.2                   | 4.6                  | na                     | 4.6                 | na                  | na                  |
| Horsepower                               | 42                    | 50                   | 25-30                  | 73                  | 25-30               | 60                  |
| Revolutions per minute                   | 2600                  | 2800                 | 1500                   | 2300                | 1500                | na                  |
| Engine weight, kg.                       | 172                   | 182                  | na                     | 410                 | na                  | na                  |
| Main transmission ratio                  | 6.60                  | 6.60                 | na                     | 6.41                | na                  | 5.22                |
| Foot brake system                        | mechanical<br>4 wheel | mech.<br>4 wheel     | on trans-<br>mission   | mech.<br>4 wheel    | na                  | na                  |
| Wheel type                               | disk                  | disk                 | disk                   | disk                | na                  | na                  |
| Fuel tank capacity, lt.                  | 40                    | 40                   | na                     | 60                  | na                  | na                  |
| Radiator capacity, lt.                   | 12                    | 12                   | na                     | 23                  | na                  | na                  |
| Maximum speed, km/hr                     | 70                    | 70                   | 43                     | 60                  | na                  | na                  |
| Fuel consumption, loaded,<br>lt./100 km. | 18.5                  | 18.5                 | 22.3                   | 29                  | na                  | na                  |

APPENDIX TABLE VII CONTINUED

| Characteristic                          | Zis 150 <sup>a/</sup> | Gaz 51 <sup>a/</sup> | Zis 6 <sup>a/</sup>   | Zis 151 <sup>e/</sup> |
|-----------------------------------------|-----------------------|----------------------|-----------------------|-----------------------|
| Year first produced                     | 1946                  | 1946                 | 1933                  | 1946                  |
| Axles                                   | 2                     | 2                    | 3                     | 3                     |
| Load capacity, mt.tn.                   | 3.0-4.0               | 2.0-2.5              | 4.0                   | 2.5-4.5               |
| Weight, mt.tn.                          | 3.9                   | 2.7                  | 4.2                   | 5.46                  |
| Wheel base, mm.                         | 4000                  | 3300                 | 3900                  | na                    |
| Turning radius, m.                      | 8.0                   | 7.6                  |                       | na                    |
| Cylinders                               | 6                     | 6                    | 6                     | 6                     |
| Cylinder diameter, mm.                  | 101.6                 | 82.0                 | 101.6                 | 101.6 <sup>f/</sup>   |
| Piston stroke, mm.                      | 114.3                 | 110.0                | 114.3                 | 114.3 <sup>f/</sup>   |
| Compression ratio                       | 6.0                   | 6.2                  | 4.6                   | 6.0 <sup>f/</sup>     |
| Horsepower                              | 82                    | 70                   | 73                    | 90                    |
| Revolutions per minute                  | 2400                  | 2800                 | 2300                  | 2600                  |
| Engine weight, kg.                      | 550                   | 315                  | 410                   | 550 <sup>f/</sup>     |
| Main transmission ratio                 | 7.63                  | 6.67                 | 7.40                  | 6.67                  |
| Foot brake system                       | air, 4<br>wheel       | hydraulic<br>4 wheel | mechanical<br>4 wheel | air, 4<br>wheel       |
| Wheel type                              | disk                  | disk                 | disk                  | disk                  |
| Fuel tank capacity, lt.                 | 150                   | 105                  | 60                    | na                    |
| Radiator capacity, lt.                  | 23                    | 16.0                 | 23                    | na                    |
| Maximum speed, km./hr.                  | 65                    | 70                   | 55                    | 65                    |
| Fuel consumption loaded,<br>lt./100 km. | 30.0                  | 26.5                 | 40                    | 45                    |

## APPENDIX TABLE VII CONTINUED

- a/ Mashinostroeniya. Entsiklopediya-Spravochnik, Gosurdarstvennoe Nauchno-Tekhnicheskoe Izdatel'stvo Mashinostroitel'noi Literaturi, Moscow, 1948, vol. 11, p. 264-272. The characteristics listed above constitute a summary of the description in this source.
- b/ No adequate description of this truck was found in Soviet sources. However, according to Shimkin (op.cit.) it is a copy of the Fiat 15. Accordingly, the description given in Fiat Lorries and Tractors, Fiat, S.A., Milan, 1920, p. 9, of the Fiat 15 was used. The date of first production refers to first production in the Soviet Union, and is taken from Avtotraktoroe Delo, No. 11, 1933, p. 356.
- c/ No complete description of this truck was found in Soviet sources.. The year of first production, the number of axles and the load capacity are given in Avtotraktoroe Delo, No. 11, 1933, p. 355. The same source states that no engines were produced at the Yaroslav plant, where the Ya.Z. was made, but that the Ya.Z. was powered by the Amo F-15 engine. Accordingly, the description of that engine is included here; the source is that given in footnote b/ above.
- d/ Specifications for this truck are not available from Soviet sources. Shimkin, loc.cit., states that it was a copy of the Autocar SA-2. Accordingly, the specifications given in the table are taken from the catalog Autocar Line of Motor Trucks and Tractors, 1929, p. 3 and 12. They refer to a truck called the Autocar SA, which is presumably the vehicle referred to by Shimkin. The load-carrying capacity of 2.5 tons is the nominal Soviet rating for the Amo 3, in distinction to the rating of the Autocar Co. of 1.5 tons. The Soviet rating is offered here to insure comparability with the other load ratings, inasmuch as Soviet practice appears rather uniformly to rate load capacities higher than does non-Soviet usage. Shimkin also states that the Zis 5 was a direct outgrowth of the Amo series, the most important modifications occurring in the power of the motor; this suggests that a greater similarity between the two trucks probably exists than could be strictly inferred from the rather meager description of the Amo 3 available in the source cited.
- e/ Bol'shaya Sovetskaya Entsiklopediya (The Great Soviet Encyclopedia), 2nd Edition, vol. 1, Moscow, 1949, p. 256.
- f/ These features are not specified in the source cited. They are inferred from the description of the Zis 150 and the fact that the Zis 150 and the Zis 151 are powered by the same engine. See Koborov, op.cit., p. 16.

## APPENDIX TABLE VIII

TECHNICAL CHARACTERISTICS OF SOVIET PASSENGER AUTOMOBILES<sup>a/</sup>

| Characteristic                      | KIM-10 | Moskvich | Pobeda | Gaz-A | Gaz M-1 | Gaz 11-73 | Zis 101 | Zis 110 |
|-------------------------------------|--------|----------|--------|-------|---------|-----------|---------|---------|
| Year first produced                 | 1940   | 1946     | 1946   | 1932  | 1936    | 1940      | 1936    | 1946    |
| Passengers                          | 4      | 4        | 5      | 5     | 5       | 5         | 6       | 7       |
| Wheel base, mm.                     | 2385   | 2340     | 2700   | 2620  | 2845    | 2845      | 3605    | 3760    |
| Net weight, kg.                     | 840    | 845      | 1350   | 1080  | 1370    | 1455      | 2550    | 2425    |
| Width of rear wheels,<br>mm.        | 1145   | 1170     | 1360   | 1420  | 1440    | 1440      | 1550    | 1600    |
| Cylinders                           | 4      | 4        | 4      | 4     | 4       | 6         | 8       | 8       |
| Horsepower                          |        |          |        |       |         |           |         |         |
| Engine weight, kg.                  | 92     | 120      | 195    | 172   | 182     | 255       | 470     | 400     |
| Fuel consumption,<br>liters/100 km. | 8      | 8        | 10     | 11    | 13      | 15        | 20      | 23      |
| Main transmission<br>ratio          | 5.50   | 5.14     | 4.70   | 3.78  | 4.44    | 4.44      | 4.36    | 4.36    |
| Maximum speed, km/hr.               | 90     | 90       | 110    | 90    | 100     | 110       | 120     | 140     |

<sup>a/</sup> Mashinostroeniya, Entsiklopediya-Spravochnik, Gosudarstvennoe Nauchno-Tekhnicheskoe Izdatel'stvo Mashinostroitel'noi Literaturi, Moscow, 1948, vol. 11, p. 260-1. The above table is a summary only of the technical descriptions in this source.

APPENDIX TABLE IX

Technical Characteristics of Soviet Tractors<sup>a/</sup>

| Characteristic              | International <sup>a/</sup> | Universal <sup>a,b/</sup> | NATI <sup>a/</sup>         | Stalinets<br>S-60 <sup>a/</sup> | Stalinets<br>S-65 <sup>a/</sup> | Stalinets<br>S-80 <sup>a/</sup> |
|-----------------------------|-----------------------------|---------------------------|----------------------------|---------------------------------|---------------------------------|---------------------------------|
| Engine type                 | 4 cycle,<br>carburetor      | 4 cycle,<br>carburetor    | 4 cycle<br>carbu-<br>retor | 4 cycle<br>carburetor           | 4 cycle<br>diesel               | 4 cycle<br>diesel               |
| Fuel                        | kerosene                    | kerosene                  | kerosene                   | ligroin                         | diesel<br>oil                   | diesel<br>oil                   |
| Maximum belt<br>horsepower  | 32                          | 22                        | 52                         | 72                              | 75                              | 93                              |
| Revolutions per<br>minute   | 1050                        | 1200                      | 1250                       | 650                             | 850                             | 1000                            |
| Engine weight, kg.          | 760                         | 450                       | 720                        | 1300                            | 2000                            | 2000                            |
| Number of cylinders         | 4                           | 4                         | 4                          | 4                               | 4                               | 4                               |
| Cylinder diameter, mm.      | 114                         | 95                        | 125                        | 165                             | 145                             | 145                             |
| Piston stroke, mm.          | 152                         | 127                       | 152                        | 216                             | 205                             | 205                             |
| Piston displacement,<br>lt. | 6.4                         | 3.57                      | 7.46                       | 18.45                           | 13.53                           | 13.53                           |
| Compression ratio           | 4.15                        | 4.1                       | 4.0                        | 3.96                            | 4.1                             | 15.5                            |
| Overall length, mm.         | 3485                        | 3320                      | 3698                       | 4090                            | 4090                            | 4228                            |
| Overall width, mm.          | 1685                        | U-1 1860<br>U-2 1650      | 1861                       | 2395                            | 2415                            | 2456                            |
| Height at radiator, mm.     | 1625                        | 1550                      | 1575                       | 2030                            | 2150                            | 2767                            |
| Working weight, kg.         | 3000                        | 2050                      | 5100                       | 10,000                          | 11,000                          | 11,400                          |
| Forward speed, km./hr.      | 3.5<br>4.5<br>7.4           | 3.4<br>4.8<br>7.2         | 3.8<br>4.5<br>5.3<br>8.0   | 3.0<br>4.2<br>5.9               | 3.6<br>4.8<br>6.9               | 2.2<br>3.6<br>5.1<br>7.4, 9.6   |
| Fuel tank capacity<br>lt.   | 70                          | 80                        | 170                        | 390                             | 300                             | 230                             |

APPENDIX TABLE IX CONTINUED

| Characteristic           | Fordson<br>Putilovets <sup>c/</sup> | International<br>Farmall, 15/30 <sup>d/</sup> | Kommunar "50" <sup>h/</sup> |
|--------------------------|-------------------------------------|-----------------------------------------------|-----------------------------|
| Engine type              | 4-cycle<br>carburetor               | 4-cycle<br>carburetor                         | 4-cycle<br>carburetor       |
| Fuel                     | kerosene                            | kerosene                                      | kerosene                    |
| Maximum belt horsepower  | 19                                  | 30 <sup>e/</sup>                              | 50 <sup>e/</sup>            |
| Revolutions per minute   | 1000                                | 1000                                          | 850                         |
| Engine weight, kg.       | 299                                 | na                                            | na                          |
| Cylinders                | 4                                   |                                               |                             |
| Cylinder diameter, mm.   | 101.6                               | 114.3                                         | 150                         |
| Piston stroke, mm.       | 127.0                               | 152.4                                         | 180                         |
| Piston displacement, lt. | na                                  | na                                            | na                          |
| Compression ratio        | na                                  | na                                            | 3.8                         |
| Overall length, mm.      | 2591                                | 3379                                          | 4350                        |
| Overall width, mm.       | 1575                                | 1651                                          | 2060                        |
| Height at radiator, mm.  | 1391 <sup>f/</sup>                  | 1549 <sup>f/</sup>                            | 2460                        |
| Working weight, kg.      | 1365 <sup>g/</sup>                  | 2744 <sup>g/</sup>                            | 8500                        |
| Forward speeds, km./hr.  | 2.2; 4.4; 11.0                      | 3.2; 4.8; 6.4                                 | 1.8; 4.75; 7.0              |
| Fuel tank capacity, lt.  | 79                                  | 70                                            | 320                         |

a/ Mashinostroeniya, Entsiklopediya-Spravochnik, Gosudarstvennoe Nauchno-Tekhnicheskoe Izdatel'stvo Mashinostroitel'noi Literaturi, Moscow, 1948, vol. 11, pp. 307-311. The above table is a summary only of the technical descriptions in this source.

b/ There are actually two models of this row-crop tractor, the U-1 and the U-2. The only difference between them is found in the lateral spacing of the wheels.

## APPENDIX TABLE IX CONTINUED

- c/ Cooperative Tractor Catalog 1923, Kansas City, 1923, p. 11, 53 and 107.
- d/ Ibid, p. 55, 156-7.
- e/ This is the nominal belt horsepower. "Maximum" would be slightly higher for this tractor.
- f/ This dimension is designated only as "height" in the source, and may not refer to "height at the radiator," the customary Russian specification.
- g/ This figure is calculated from the dry weight of the machine as given in the source by adding 300 pounds for fuels and lubricants.
- h/ Tekhnicheskaya Entsiklopediya, tom 23, (Technical Encyclopedia, vol. 23), RSFSR, 1934, p. 822. This is not actually the tractor priced. "Kommunar" seems to have been a generic appellation for a group of tracklayers produced at the Kharkov Locomotive Works in the late '20's and early '30's. As these were not serially produced, changes of design were introduced with greater freedom than has been the case with other tractors of the period. Specifically, the tractor priced was identified in the source as the "International" -- believed to be a sub-class of "Kommunar" -- and it weighed 11,700 kgs. This suggests that the overall dimensions given above are not correct. It is known that the rated belt and drawbar horsepowers of the two machines were the same (SS 35, p. 55, which rates both at 28 d.h.p. and 50 b.h.p.). This suggests in turn that the engines, and probably speeds and fuel tank capacities were also the same, and, more generally, that the two machines are closely comparable for our purposes.

## APPENDIX E

ESTIMATED PRICES OF THE UNIVERSAL FOR 1935 AND 1937

As stated in the text, estimated prices for the tractor Universal for years 1935 and 1937 were used in the absence of Soviet price quotations. The following discussion explains, firstly, the method by which each estimate was constructed, and, secondly, the reason it was deemed necessary to attempt such estimates.

Estimates1935:

This price was estimated from information relating to planned investments in tractors by agricultural organizations in 1935 in current rubles and planned deliveries to the same organizations of tractors of different kinds. The pertinent information is set forth in Appendix Table X.



## APPENDIX TABLE X

Planned Investments in Tractors by Soviet Agriculture, 1935

|                                                                                                  | People's Commissariat<br>of Agriculture <sup>a/</sup> | People's Commissariat<br>of State Farms <sup>b/</sup> |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| Planned investment in tractors<br>in planned prices of 1935,<br>millions of rubles <sup>c/</sup> | 425.05 <sup>d/</sup>                                  | 69.40 <sup>e/</sup>                                   |
| Planned deliveries of tractors: <sup>f/</sup>                                                    |                                                       |                                                       |
| Stalinets S-60                                                                                   | 9,500                                                 | 2,800                                                 |
| International 15/30                                                                              | 54,500                                                | 4,000                                                 |
| Universal 10/20                                                                                  | 11,300                                                | 200                                                   |

a/ I.e., Narkomzemledeliya.

b/ I.e., Narkomosovkhozov.

c/ This item does not include repairs (remont), which are shown separately. It would presumably also exclude spare parts, as these fall under the Soviet definition of investment expenditures only in connection with general overhauling (kapital'nyi remont) which is surely included in the more general term remont. (cf. Slovar'-spravochnik po sotsial'no-ekonomicheskoi statistike, (Dictionary-handbook of social and economic statistics), Moscow, 1948, pp. 250-1, as cited in N. Kaplan, Capital Investments in the Soviet Union, 1924-1951, RM-735, Santa Monica, 1951., p. 103.)

d/ 35 Plan, p. 481.

e/ Ibid, p. 482.

f/ Ibid, p. 599.

The process of estimation was as follows:

- (1) The value of the planned deliveries of Stalinets S--60's and Internationals was computed at the known 1935 factory prices for each commissariat.
- (2) This sum was subtracted from the planned investment in rubles for each commissariat.
- (3) The difference in each case must have consisted of the value at 1935 factory prices of the planned deliveries of Universals plus the cost of distributing all of the tractors.
- (4) On the assumption that distribution costs to both commissariats were the same (as a percent of the final cost to purchaser), the foregoing manipulation results in two unknowns and two equations. These were solved simultaneously to obtain the factory price of the Universal (3169 rubles) and the cost of distribution (6.15% of final cost).

The weak link in this chain of reasoning is the assumption that distribution costs are the same for both organizations. I know of no reason to suppose one set of distribution costs to be higher than the other, but it is not very likely that they would be identical. In the event that the Commissariat of Agriculture paid one percent more for distribution than the Commissariat of State Farms, the distribution costs would have been 7.2% and 6.2% respectively, and the price of the Universal would have been 2770 rubles. If the Commissariat of State Farms paid one percent more for distribution than the Commissariat of Agriculture, distribution costs would have been 6% and 5% respectively, and the Universal would have cost 3600 rubles. These alternative assumptions, which reflect a possible spread in distribution costs alone of

15-20%, probably encompass the range of error of the estimate. This would imply a possible error in the price relative as calculated of 15% either way.

1937:

This price was simply assumed to be two-thirds the price of the International in the same year. The grounds for this assumption are as follows:

(1) The Universal weighs two-thirds as much as the International (See Appendix D). Inasmuch as basic materials and semi-fabricates made up uniformly around 60% of the production costs of tractors varying greatly in size in this period (see Appendix F), weight probably offers a guide, on first approximation at least, to production costs as a whole.<sup>49/</sup> In this connection it should be added that the turnover tax on tractors was ~~insignifi-~~ cant at this time, while the production of tractors by the Central Administration of the Automobile and Tractor Industry, producer of the International (but not the Universal), was highly profitable. Thus any error arising from estimating the price of the Universal on the basis of comparative production costs would most likely be on the side of setting it too high.

Weight may be added to this argument by the observation that the two tractors priced in the 1937 handbook, the International and the Stalinets S-60, cost 1362 rubles and 1500 rubles per metric ton respectively.

---

<sup>49/</sup> These remarks refer to production costs after the period of "mastery" has been completed. The Universal had been in mass production for three years by 1937, at Kirovskii factory in Leningrad. This is the Soviet plant with the most experience in producing tractors, having commenced production of the Putilovets in 1923. Its tractor shop was retrooled during 1933 for mass-production of the Universal.

(2) The prices of the American counterparts of these two machines, from which the Soviet versions were copied, were \$1250 for the International and \$800 for the Universal in 1939.<sup>50/</sup> This fact would tend to confirm the estimated ratio of production costs referred to above.

(3) The drawbar horsepower of the Universal is two-thirds that of the International.<sup>51/</sup>

(4) Information on Soviet exports for 1937 indicates that the export price of the Universal, while lower than its estimated domestic price, was about 62% of the export price of the International. The source used<sup>52/</sup> gave total exports of tractors by kind in tons and in rubles. These were computed into unit prices on the basis of the known weights of the machines, as given in Appendix D.

---

<sup>50/</sup> A. Gerschenkron, op.cit., p. 168.

<sup>51/</sup> Korobov, op.cit., p. 9.

<sup>52/</sup> American-Russian Chamber of Commerce, Trade Information Service, Bulletin, No. 596, April 1938. Prices for tractors (except industrial tractors, which, being rubber-tired, are exceptionally high priced in the Soviet Union) ranged from 991 rubles a ton to 1113 rubles a ton. This is consistent with American prices for tractors, which also tend to be fairly constant for different makes and models when taken by weight.

The items given in the source, which is in English, under tractor exports, were: "ordinary tractors", "plowing tractors", "pulling tractors", and "other tractors". "Plowing" is the customary translation in this source of the Russian word "propashnik", which in Soviet usage of the time always referred to the Universal. "Pulling" is clearly a translation of the Russian term "tyagach", more precisely translated as "traction engine" or "industrial tractor". "Ordinary" was taken here to refer to the International, but inasmuch as "ordinary" and "other" tractors differed in price per ton by only 1%, this choice is not crucial. As only three tractor models -- the Universal, the International and the Stalinets S-60 -- can have been exported in meaningful quantities in this year, it is not believed that the problem of identification here is serious. The prices were: for "plowing tractors", 991 rubles a ton; for "ordinary" 1101 rubles per ton; and for "other", 1113 rubles per ton. 1

Rationale1935 estimate:

The alternative to estimating this price would have been to represent all wheeled tractor prices by the price of the International. This price moved upward between 1935 and 1937. The data used in estimating the 1935 and 1937 prices of the Universal seem strongly to suggest that its price, on the contrary, moved in the opposite direction. A possible explanation for this phenomenon presents itself at once: the International was well established in production in 1935 and all the economies of "mastery" had already been achieved, whereas the Universal was first produced only in 1934. Examples of the economies to be gained through increased experience in the construction of a particular tractor model at a particular factory are given in Appendix F. The effect these economies may have on prices is appropriately illustrated by the price of the Stalinets S-60, which declined some 16% from 1935 to 1937, while other machinery -- and raw material -- prices tended upward. The Stalinets S-60 was first produced in 1933. It is interesting to note that the price decline as estimated for the Universal was of about the same magnitude as that observed for the Stalinets S-60.

The effect on the finished indexes of including this estimated price are limited, of course, to the year 1935. Further, the constant weight indexes for weight years 1928, 1932 and 1941 are totally unaffected, as the Universal was not produced in any of those years and hence omitted from the corresponding indexes. The effect on the index using given-year weights is small, since

---

52/ (continued)

It is interesting to note that the American price of the Universal around the same time -- actually, 1939 -- was over 1400 per metric ton; that is, it was over double the Soviet export price. The International was long since out of production in the United States by 1937.

Universals accounted for only 6% of the value of all tractor production in that year; omission of the item would reduce the index number for that year by a little over 1%. Production of Universals in 1937 was larger, with the result that the 1935 index number weighted by 1937 value weights would stand about 3% lower if this item were simply omitted, and about 6% lower if the price relative for Internationals were weighted for all wheeled tractor production.

1937 estimate:

This estimate is of considerably more importance for the various indexes than is the estimate for 1935, because the price levels of all wheeled tractors in the postwar period were calculated on it as base. The alternative would have been to use the price relative for tracklaying tractors to represent the price level of all tractors in these years. This was rejected on the basis of the following argument: the price level for tracklayers rose from 1945 to 1949 from 2.4 to 2.9 times the 1937 level.<sup>53/</sup> The postwar price of the Universal, on the other hand, was about five times the 1937 price of the International. Thus unless it is believed that the 1937 price of the Universal was some 75% higher than that of the International, the use of the tracklayer price relative alone would clearly understate the extent of the postwar price increases. As indicated above, there is reason to believe the 1937 price of the Universal was below rather than above the 1937 price of the International.

The effect of including this estimate is nil only in the case of the index

---

<sup>53/</sup> See Text Table V.

using 1941 planned value weights, as only tracklayers were to be produced in this year. The effect on the indexes using 1928, 1932 and 1937 value weights is roughly to double them for the postwar years.<sup>54/</sup> The effect on the index using given year weights is to increase it for 1945 by about 50% and for 1949 by about 13%.

Summary:

Although the assumptions on which the above estimates are based are often tenuous, the omission of such estimates would have involved, however tacitly, assumptions even more dubious.

---

<sup>54/</sup> The precise effect for each index and each year can be seen very clearly in Tables V and VI by comparing the index number for any postwar year with the price relative for tracklayers for the same year.

---

## APPENDIX F

PRODUCTION COSTS OF SOVIET TRACTORS

As stated in Section VI, the 1935 production costs of two Soviet tractors, the International and the Stalinetts S-60, were determined on the basis of information in an article, "Production Costs of Tractors," by S. Ya. Sarikyan, in Avtotraktornoe Delo, No. 5, 1936. This source gives the cost per unit in rubles of materials and semi-fabricated items used producing tractors and also the percentage of total production costs accountable to these inputs.<sup>55/</sup> Total production costs per unit are not given in this source, but have been deduced from the above information.

The cost figures given in the source cited refer to average cost per unit of output for the following Soviet tractor plants: the Kharkov Tractor Factory, the Stalingrad Tractor Factory, and the Chelyabinsk Tractor Factory. It is known that the factory at Chelyabinsk produced only the Stalinetts S-60 in 1935, from which it is safe to conclude that the cost figures as computed refer specifically to this model of tractor. It may be true as well that the Stalingrad and Kharkov plants produced only the International, although there is some ambiguity on this point. The Kharkov plant, and possibly the Stalingrad plant also, may have produced tracklaying Kommunars in some of the years in question.<sup>56/</sup> This would not seriously impede the interpretation of these

---

<sup>55/</sup> Loc. cit., p. 137.

<sup>56/</sup> As stated earlier, the Kommunar was produced at the Kharkov Locomotive Works (referred to in Soviet sources as "KhPZ.") P. Belyanchikov, Russkie Traktory (Russian Tractors), Moscow, 1925, p. 37; Tekhnicheskaya Entsiklopediya, tom 23, (Technical Encyclopedia), RSFSR, 1934, p. 822. However, these sources make specific reference only to the 50 and 70 belt horsepower models. It is thus possible that the 90 b.h.p. model, which entered production in 1931, was produced at the Stalingrad or Kharkov Tractor Factory. A reference to the cost of a Kommunar produced at "KhTZ" (the Kharkov Tractor Factory) in 1931 and 1932 is made by Sh. Turetskii in "K analizu kachestvennykh pokazetelei narodnogo khozyaistva SSSR" (toward the analysis of qualitative indicators of the national



cost figures, as production of Kommunars from all producers amounted in the years after 1930 only to 0.5-2% of the output of Internationals.<sup>57/</sup>

In any case, reservations are always in order in using derivative materials of this kind based on Soviet statements.

The figures used in the Soviet computations of costs are given below in Appendix Table XI.

APPENDIX TABLE XI

PRODUCTION COST PER UNIT OF SOVIET TRACTORS IN 1935<sup>a/</sup>

| Item                                                  | <u>Factory</u>    |                |                    |
|-------------------------------------------------------|-------------------|----------------|--------------------|
|                                                       | <u>Stalingrad</u> | <u>Kharkov</u> | <u>Chelyabinsk</u> |
| Basic materials (rubles)                              | 834.96            | 849.65         | 3528.75            |
| Purchased items (rubles)                              | 1002.67           | 993.68         | 3503.34            |
| Materials and semi-fabricates<br>(as % of total cost) | 58.4              | 60.4           | 56.5               |

<sup>a/</sup> Op.cit., p. 137, Tables 3 and 4. It is clear from other information in this article that "basic materials" and "purchased items" taken together are the same as "materials and semi-fabricates."

56/ (continued)

economy of the USSR) in P.Kh. No. 7, 1934, p. 103. The computations referred to in the text indicate that production costs per tractor in 1935 were 95 rubles less at Kharkov than at Stalingrad. Sarikiyan (op. cit., p. 137) states, however, that the International cost 200 rubles less in 1935 in Kharkov than in Stalingrad. Perhaps this discrepancy is explainable by the inclusion of Kommunars in the per unit figures for Kharkov, in which case the figure given in Appendix Table VIII for Kharkov in 1935 is 105 rubles too high.

57/ Appendix Table 1.

A brief history of production costs of tractors is also given by Sari-kiyan; this account takes the form of production costs for specific tractor models by year, expressed as percentages of the costs of the first year of production.<sup>58/</sup> Working backward from the ruble figures for 1935, it was possible to translate these percentages into absolute figures. It is stated in the source that the figures presented are taken from accounting data. Apparently, then, the relationships expressed are in current rubles. The yearly ruble costs, as computed from this information, are presented below in Appendix Table XII.

APPENDIX TABLE XII

PRODUCTION COSTS OF SOVIET TRACTORS, 1930-1935<sup>a/</sup>

| Tractor                  | (Rubles)    |             |             |             |             |             |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                          | <u>1930</u> | <u>1931</u> | <u>1932</u> | <u>1933</u> | <u>1934</u> | <u>1935</u> |
| Stalingrad International | 7055        | 4100        | 3691        | 3359        | 3232        | 3147        |
| Kharkov International    | --          | 5509        | 4848        | 3553        | 3195        | 3052        |
| Stalinets S-60           | --          | --          | --          | 32412       | 17373       | 12446       |

<sup>a/</sup> These figures were computed by working backward from the computed costs for 1935 on the basis of percentage changes in the unit cost of the specific models identified in the table. If it is true, as surmised above, that the 1935 figure for the Kharkov International is some 100 rubles too high, the figures for the other years should be reduced by 3.4% as well.

Some test of the accuracy of these cost figures is possible by comparing them with similar figures from other sources.

Turetsky<sup>59/</sup> gives the cost of the Stalingrad International as 4076 rubles in 1931, and 3225 rubles in 1932. Another source gives the cost of the

---

<sup>58/</sup> Sarikiyan, op.cit., p. 136.

<sup>59/</sup> Loc.cit.

Stalingrad International in 1932 as 3473 rubles and that of the Kharkov International as 4659 rubles.<sup>60/</sup> In general, Sarikiyan's study, being far the most detailed and the latest to appear, suggests itself as the most reliable of these sources.

---

<sup>60/</sup> Za Industrializatsiyu (For Industrialization), September 2, 1933, p. 4. This source also gives figures for two months in 1933. The data are stated in the source to have been adjusted to eliminate the effects of the increased costs of replacing imported semi-fabricates with domestic ones. It is not clear if such an adjustment has been applied to the 1932 figures as well as the 1933 ones, but this seems likely inasmuch as the large-scale importation of tractor parts ceased in 1932. In this case, the cost quoted is below the current cost to the producing enterprise.

## APPENDIX G

PRICES USED IN SOVIET INVESTMENT DATA

In Appendixes E, H, and I of this memorandum, use is made of Soviet investment data for the years 1932 through 1935 as a basis for determining current price levels in these years. Although these data are almost always specified in Soviet sources to be expressed in current prices, some verification of this seems in order. Also, it is advisable to inquire into the correspondence between the prices used to value investments and the handbook prices used to compute the price indexes of the present study.

In Appendix E, Appendix Table X, data from a Soviet source are given on deliveries of tractors to the People's Commissariat of State Farms in 1935 and also the sum in rubles invested in tractors by that commissariat in the same year. Nineteen-thirty-five handbook price quotations for two of the three tractor models delivered, the International and the Stalinets S-60, are available (text Table I), while deliveries to the commissariat of the third tractor model, the Universal, for which no 1935 price quotation is available, were quite small. The value, at 1935 quoted prices, of the Internationals and S-60's delivered is 64.5 million rubles, or about 93% of the 69.5 million rubles invested in tractors. The remaining 7% is plausibly accounted for by the cost of the Universals and the distribution costs of all the tractors delivered. This seems strongly to suggest that the quoted 1935 prices were indeed the prices used to value investments by the People's Commissariat of State Farms in 1935.

In Appendix I, fn. 5, data from a Soviet source are given setting forth deliveries of automotive vehicles to kolkhozy in 1935 and also the sum in rubles invested in automotive vehicles by kolkhozy in the same year. Nineteen-thirty-

five handbook price quotations for two of the three models of vehicle delivered, the Gaz AA truck, and the Zis 5 truck, are available (text Table II), while deliveries of the third vehicle, the Gaz A passenger car, were small. The value, at 1935 quoted prices, of the Gaz AA's and Zis 5's delivered is 62.4 million rubles, or about 94% of the 66.3 million rubles invested in automotive vehicles by kolkhozy in 1935. The remaining 6% is plausibly accounted for by the cost of the Gaz A's and the costs of distribution for all the vehicles delivered. This would seem also to confirm that the quoted 1935 prices are the prices in which the value of investments was reckoned.

While it does not necessarily follow that the procedures employed in Soviet accounting in 1935 were also employed in 1932, 1933 and 1934, there is no reason, at least, to doubt that Soviet investment data stated to be valued "at current prices" is anything other than what it is claimed to be. This inference is reinforced by the fact that the officially announced pricing policy of the period was for the government established wholesale price of each item of machinery to be obligatory for all buyers and sellers.

A further question is raised by the preceding argument, however. Are distribution costs actually included in total investment figures? This question is answered affirmatively by an authoritative Soviet source.<sup>61/</sup> Furthermore, inasmuch as the original sources of such investment data are probably the organs responsible for financing the investments, the cost of the machines gross of distribution charges would seem to be at once the most interesting and most natural form of expression. It is significant that the breakdowns

---

<sup>61/</sup> Slovar'-Spravochnik po sotsial'no-ekonomicheskoi statistike (Dictionary-handbook of social economic statistics), Moscow, 1948, p. 373.

of investment expenditures by commissariat contain no separate item for distribution costs. The sources cited in most instances were official yearly plans; the use of figures net of distribution charges would leave unanswered the question of how the investing organizations had paid these charges and what the magnitude of the charges were. (In the case of machinery, these charges are not paid by the producer.) There seems, therefore, no reason to believe that distribution charges are omitted from the cost of investments in these data.

In establishing price levels for the years 1932-1934 from investment data, I have used estimates of the share of total investments in machinery devoted to distribution costs in the year 1935. Inasmuch as the magnitude of distribution costs relative to total investments in machinery are small, and inasmuch as these costs have been estimated as residuals after allowances for other known costs, it is pertinent to point out that the margin of error in the estimated distribution costs for 1935 is probably large. This is the case because the whole statistical error in each case accrues to the residual item, taken as the distribution cost. Nevertheless, just because the whole magnitude involved -- statistical error plus distribution cost -- is small, it is not believed that the reliability of the results obtained is seriously undermined. As calculated for 1935, the residual was positive and of a magnitude which would a priori be reasonable for distribution costs. The use of percentages, calculated explicitly for 1935, in handling data of 1932-1934, is also felt to be defensible, for the same reasons as have just been cited -- i.e., that the resulting error is small and that the magnitude employed is reasonable a priori.

## APPENDIX H

PRICE LEVELS OF SOVIET TRACTORS IN THE INTERVALS BETWEEN THE BENCHMARK YEARS

It has been possible to estimate price levels for Soviet tractors for all of the years intermediate to the benchmark years on the basis of scattered information relating to agricultural investment programs, industry-wide price changes and isolated price quotations. The results of these attempts are summarized in Appendix Table XIII, which gives estimated and quoted prices of tractors, and in Appendix Table XIV, which sets forth estimated price levels in terms of the various weighting systems employed in the text of this memorandum. While it has been possible to obtain such an estimate for every intermediate year, it has not always been possible to state the price level in terms of all the weighting systems employed in the text.

The derivation of the estimates presented in the two tables and the sources of price quotations for years other than the benchmark years follow by year.

The estimates are based on incomplete information, in consequence of which they vary in reliability. Some appraisal of the reliability of each index number is offered below with the explanation of the derivation. The estimates for the years 1932-1934 are based on investment data. The relationship of such data to current wholesale prices in the Soviet Union has been discussed already in Appendix G.

## APPENDIX TABLE XIII

ESTIMATED PRICES AND PRICE RELATIVES OF SOVIET TRACTORS, 1928-1949<sup>a/</sup>

| <u>Item</u>                            | <u>1928</u> | <u>1929</u> | <u>1930</u> | <u>1931</u>     | <u>1932</u>     | <u>1933</u> | <u>1934</u> |
|----------------------------------------|-------------|-------------|-------------|-----------------|-----------------|-------------|-------------|
| <u>Prices In Rubles</u>                |             |             |             |                 |                 |             |             |
| Wheeled Tractors:                      |             |             |             |                 |                 |             |             |
| Fordson-Putilovets 10/20 <sup>b/</sup> | (3450)      | 3450        | 3450        | 2760            | na              | na          | —           |
| International 15/30 <sup>b/</sup>      | —           | —           | na          | na              | na              | na          | na          |
| Universal 10/20 <sup>b/</sup>          | —           | —           | —           | —               | —               | —           | 4927        |
| Tracklaying Tractors:                  |             |             |             |                 |                 |             |             |
| Kommunar 50 bhp <sup>b/</sup>          | (19080)     | 17100       | 17100       | 13680           | —               | —           | —           |
| NATI 52 bhp <sup>a</sup>               | —           | —           | —           | —               | —               | —           | —           |
| Stalinets S-60, 72 bhp <sup>c/</sup>   | —           | —           | —           | — <sup>d/</sup> | — <sup>d/</sup> | na          | na          |
| Stalinets S-65, 75 bhp <sup>c/</sup>   | —           | —           | —           | —               | —               | —           | —           |
| Stalinets S-80, 93 bhp <sup>c/</sup>   | —           | —           | —           | —               | —               | —           | —           |
| Kirovets D-35, 35 bhp <sup>b/</sup>    | —           | —           | —           | —               | —               | —           | —           |
| <u>Price Relatives (1937=100)</u>      |             |             |             |                 |                 |             |             |

## Wheeled Tractors:

|                    |         |       |       |       |    |    |       |
|--------------------|---------|-------|-------|-------|----|----|-------|
| International      | (171.4) | 171.4 | 171.4 | 137.1 | na | na | na    |
| Fordson-Putilovets | (171.4) | 171.4 | 171.4 | 137.1 | na | na | na    |
| Universal          | —       | —     | —     | —     | —  | —  | 183.6 |

## Tracklaying Tractors:

|                |         |       |       |       |    |    |    |
|----------------|---------|-------|-------|-------|----|----|----|
| Kommunar 50    | (240.4) | 215.4 | 215.4 | 172.4 | na | na | na |
| NATI           | —       | —     | —     | —     | —  | —  | —  |
| Stalinets S-60 | —       | —     | —     | —     | —  | —  | —  |
| Stalinets S-80 | —       | —     | —     | —     | —  | —  | —  |
| Kirovaets D-35 | —       | —     | —     | —     | —  | —  | —  |



## APPENDIX TABLE XIII (continued)

ESTIMATED PRICES AND PRICE RELATIVES OF SOVIET TRACTORS, 1928-1949 <sup>a/</sup>

| <u>Item</u>                       | <u>1935</u> | <u>1936</u> | <u>1937</u> | <u>1938</u> | <u>1939</u> | <u>1940</u> | <u>1941</u> | <u>1942</u> |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>Price in Rubles</u>            |             |             |             |             |             |             |             |             |
| Wheeled Tractors:                 |             |             |             |             |             |             |             |             |
| Fordson-Putilovets                | —           | —           | —           | —           | —           | —           | —           | —           |
| International                     | (3525)      | 3900        | (4025)      | —           | —           | —           | (3825)      | —           |
| Universal                         | (3169)      | 2805        | (2683)      | —           | —           | —           | —           | —           |
| Tracklaying Tractors:             |             |             |             |             |             |             |             |             |
| Kommunar 50                       | —           | —           | —           | —           | —           | —           | —           | —           |
| NATI                              | —           | —           | na          | na          | na          | na          | (9000)      | 9000        |
| Stalinets S-60                    | (18000)     | 15750       | (15000)     | —           | —           | —           | (14000)     | —           |
| Stalinets S-65                    | —           | —           | na          | na          | na          | na          | (19000)     | 19000       |
| Stalinets S-80                    | —           | —           | —           | —           | —           | —           | —           | —           |
| Kirovets D-35                     | —           | —           | —           | —           | —           | —           | —           | —           |
| <u>Price Relatives (1937=100)</u> |             |             |             |             |             |             |             |             |
| Wheeled Tractors:                 |             |             |             |             |             |             |             |             |
| Int'l, Ford'n-Pu'ts               | (87.6)      | 96.9        | (100.0)     | —           | —           | —           | (95.0)      | —           |
| Universal                         | (118.1)     | 104.5       | (100.0)     | —           | —           | —           | —           | —           |
| Tracklaying Tractors:             |             |             |             |             |             |             |             |             |
| Kommunar, NATI etc.               | (120.0)     | 105.0       | (100.0)     | 100.0       | 100.0       | 100.0       | (93.3)      | 93.3        |
| Stalinets S-80 etc.               | —           | —           | —           | —           | —           | —           | —           | —           |

## APPENDIX TABLE XIII (continued)

ESTIMATED PRICES AND PRICE RELATIVES OF SOVIET TRACTORS, 1928-1949 <sup>a/</sup>

| <u>Item</u>                       | <u>1943</u> | <u>1944</u> | <u>1945</u> | <u>1946</u> | <u>1947</u> | <u>1948</u> | <u>1949</u>           |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------------------|
| <u>Price in Rubles</u>            |             |             |             |             |             |             |                       |
| Wheeled Tractors:                 |             |             |             |             |             |             |                       |
| Fordson-Putilovets                | —           | —           | —           | —           | —           | —           | —                     |
| International                     | —           | —           | (20000)     | —           | —           | na          | —                     |
| Universal                         | —           | 8367        | ((20000))   | 20000       | 20000       | 20000       | (20000)               |
| Tracklaying Tractors:             |             |             |             |             |             |             |                       |
| Kommunar 50                       | —           | —           | —           | —           | —           | —           | —                     |
| NATI                              | 9000        | 16593       | (22000)     | 22000       | 22000       | 22000       | (29000)               |
| Stalinets S-60                    | —           | —           | —           | —           | —           | —           | —                     |
| Stalinets S-65                    | 19000       | —           | na          | —           | —           | —           | —                     |
| Stalinets S-80                    | —           | —           | —           | 66000       | 66000       | 66000       | (66000)               |
| Kirovets D-35                     | —           | —           | —           | —           | —           | 40000       | (40000)               |
| <u>Price Relatives (1937=100)</u> |             |             |             |             |             |             |                       |
| Wheeled Tractors:                 |             |             |             |             |             |             |                       |
| Int'l, Ford'n-Pu'ts               | —           | —           | —           | —           | —           | —           | —                     |
| Universal                         | —           | (311.8)     | (745.4)     | 745.4       | 745.4       | 745.4       | (730.8) <sup>a/</sup> |
| Tracklaying Tractors:             |             |             |             |             |             |             |                       |
| Kommunar, NATI etc.               | 93.3        | 172.1       | (228.1)     | 228.1       | 228.1       | 228.1       | (294.8) <sup>a/</sup> |
| Stalinets S-80 etc.               | —           | —           | —           | 300.7       | 300.7       | 300.7       | (294.8) <sup>a/</sup> |

<sup>a/</sup> The derivations of the estimated prices and price relatives are given in the text of this appendix by years. The figures in parentheses are from the text of this memorandum and are explained there. They are repeated here for purposes of comparison with the estimates. The sign "—" indicates that the tractor was not produced in that year. The sign "na" indicates that available data were insufficient for the estimation of a price or price relative.

-90a-

b/ These are nominal horse-power ratings. In the case of the Fordson-Putilovets, the power actually developed appears to have been considerably less. (See Section IV, fn. 3.) In the case of the International, Universal, Kirovets, and possibly the Kommunar, actual maximum horse-power is somewhat in excess of the nominal rating.

c/ These are maximum developed belt horse-power ratings, which, apparently are substantially in excess of the nominal ratings for the machines.

d/ As indicated in Appendix Table I, a few of these machines were produced in 1931 and 1932. These, however, were experimental models and not offered for sale. Accordingly, they have no market price and may be treated, for present purposes, as costs of developing the machine finally marketed in 1933.

e/ These price relatives have been adjusted downward from the levels indicated by the quoted prices to allow for the change in the terms of quotation that occurred in this year. See Section II.

## APPENDIX TABLE XIV

ESTIMATED PRICE LEVELS OF SOVIET TRACTORS, 1928-1949<sup>a/</sup>  
(1937=100)

| <u>Index</u>             | <u>1928</u> | <u>1929</u> | <u>1930</u> | <u>1931</u> | <u>1932</u> | <u>1933</u> |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Constant Weight Indexes: |             |             |             |             |             |             |
| Weight-Year 1928         | (199)       | 189         | 189         | 151         | na          | na          |
| Weight-Year 1932         | (175)       | 174         | 174         | 139         | na          | na          |
| Weight-Year 1937         | (218)       | 201         | 201         | 161         | na          | na          |
| Weight-Year 1941         | (240)       | 215         | 215         | 172         | na          | na          |
| Given-Year Weight Index  | (199)       | 182         | 178         | 130         | 96          | 97          |
| <u>Index</u>             | <u>1934</u> | <u>1935</u> | <u>1936</u> | <u>1937</u> | <u>1938</u> | <u>1939</u> |
| Constant Weight Indexes: |             |             |             |             |             |             |
| Weight-Year 1928         | na          | (101)       | 100         | (100)       | 100         | 100         |
| Weight-Year 1932         | na          | (89)        | 97          | (100)       | 100         | 100         |
| Weight-Year 1937         | na          | (113)       | 103         | (100)       | 100         | 100         |
| Weight-Year 1941         | na          | (120)       | 105         | (100)       | 100         | 100         |
| Given-Year Weight Index  | 95          | (93)        | 102         | (100)       | 100         | 100         |
| <u>Index</u>             | <u>1940</u> | <u>1941</u> | <u>1942</u> | <u>1943</u> | <u>1944</u> | <u>1945</u> |
| Constant Weight Indexes: |             |             |             |             |             |             |
| Weight-Year 1928         | 100         | (94)        | 94          | 94          | 259         | (537)       |
| Weight-Year 1932         | 100         | (95)        | 95          | 95          | 305         | (718)       |
| Weight-Year 1937         | 100         | (94)        | 94          | 94          | 217         | (396)       |
| Weight-Year 1941         | 100         | (93)        | 93          | 93          | 172         | (228)       |
| Given-Year Weight Index  | 100         | (93)        | 93          | 93          | (172)       | (266)       |

## APPENDIX TABLE XIV (continued)

ESTIMATED PRICE LEVELS OF SOVIET TRACTORS, 1928-1949 <sup>a/</sup>

| <u>Index</u>             | <u>1946</u> | <u>1947</u> | <u>1948</u> | <u>1949</u> |
|--------------------------|-------------|-------------|-------------|-------------|
| Constant Weight Indexes: |             |             |             |             |
| Weight-Year 1928         | 553         | 553         | 553         | 555         |
| Weight-Year 1932         | 721         | 721         | 721         | 708         |
| Weight-Year 1937         | 433         | 433         | 433         | 437         |
| Weight-Year 1941         | 287         | 287         | 287         | 295         |
| Given-Year Weight Index  | 266         | 274         | (276)       | (318)       |

<sup>a/</sup> The derivations of these estimates are set forth in the text of this appendix by years. The figures in parentheses are results obtained for the benchmark years, as explained in the text of the memorandum. They are repeated here for purposes of comparison with the estimates. The sign "na" indicates that the price index number could not be computed from the available data.

Index numbers for the constant weight indexes were computed from the price relatives shown in Appendix Table XIII, using the systems of constant weights set forth in text Table III, Section VI, and the constant weight index number formulae of Section V. Given-year weight index numbers were computed from reciprocals of the price relatives of Appendix Table XIII, using expression (7) of Section V. The given-year weights used in each instance are given below by year with the discussion of the other elements of the price level calculation. These weights were computed from the production data of Appendix Table I and the prices of Appendix Table XIII.

Price of Fordson-Putilovets: 1929

Information set forth below i.e. under "1930" indicates that the price of the Fordson-Putilovets was the same in 1930 as in 1928. It has been assumed, therefore, that this price also prevailed in 1929. This is confirmed by data relating to achieved and planned investment in agriculture in K.Ts. 1929-30.

In this source achieved investment in tractors for 1927/8 and 1928/9 and planned investment for 1929/30 are stated in current prices<sup>1</sup> and in prices of 1926/7<sup>2</sup>. Both sets of figures are identical, indicating that tractor prices

did not change between 1926/7 and 1928/9, and that no change was planned for 1929/30.

Price of Kommunar 50:

The price of a 50 b.h.p. tracklaying tractor produced at the Kharkov Locomotive Works is known for the period from October 1, 1929, until January 1, 1930. This may not be the same 50 b.h.p. tracklayer priced in 1928, but for reasons set forth in Appendix D, Appendix Table IX fn. , it was decided to treat them as fully comparable for present purposes. Information from OLT indicates that the average 1928/9 price of a 50 b.h.p. tracklayer was substantially less than the 1928 price quoted<sup>3/</sup>. It is therefore assumed that the price of October 1, 1929, was effective throughout 1929.

Price Index Numbers:

The various price index numbers were calculated from the estimated prices. They are believed to be substantially reliable.

Value weights for the given-year weighted index were as follows; wheeled tractors, 10.5 million rubles; crawlers, 4.1 million rubles.<sup>4/</sup>

---

<sup>1/</sup> p. 446

<sup>2/</sup> p. 454

<sup>3/</sup> p. 150. It is here stated that 220 tracklayers produced at the Kharkov Works during 1928/9 had a value of 4 million rubles. As over two-thirds of these were 70 b.h.p. machines (see SS35, p. 55) it is not possible that the 1928 price of 19,080 rubles for a 50 b.h.p. machine still applied. Assuming that the 1929/30 price of 17,100 rubles for the 50 b.h.p. model was effective, the price of the larger machine would have been only 18,338 rubles.

<sup>4/</sup> Value weights for wheeled tractors were obtained by multiplying production of the Fordson-Putilovets in 1928/9 by the 1929 price; those for tracklayers, by multiplying 1928/9 production of all tracklayers by the 1928/9 price of the Kommunar 50.

1930Price of Fordson-Putilovets:

The value of tractor production in 1930 in Leningrad Oblast—where the only tractor produced was the Fordson-Putilovets—was estimated from the following statements in SPE<sup>5/</sup>: 1) that "all tractor production" <sup>6/</sup> in 1931 was planned to be 2.5 times the actual output of 1930, or 144.2 million rubles; 2) and that production of spare parts for tractors was planned for 1931 to be four times actual 1930 output, or 80 million rubles. From this it was deduced that "all tractor production" in 1930 was 57.68 million rubles, of which 20 millions were spare parts. The same source <sup>7/</sup> states that 1930 output of the Krasnyi Putilovets factory was 10,800 tractors. This implies a price of 3,479 rubles per tractor. It was assumed that this departed from the 1928 price of 3,450 rubles only because of the approximative nature of the statistical presentation in the source.

Price of Kommunar 50:

A price for a 50 b.h.p. tractor produced at the Kharkov Locomotive Works is quoted in Metall (Metal), no. 1, 1931, p. 1928. The source states that the price is to be effective as of October 1, 1930, but also that no change in the price of this item was occurring. Until 1931 it was the custom to set prices for the products of this factory every October 1; it was assumed, therefore, that the price quoted had taken effect at latest by October 1, 1929.

---

<sup>5/</sup> p. 64.

<sup>6/</sup> I.e. "obshchii ob'em vsego traktornogo proizvodstva" which clearly would include spare parts. The juxtaposition of the statements in the context also leaves no doubt that the larger figure includes spare parts. From the context, it might also include semi-fabricates produced by subcontractors. This interpretation, however, would lead to the conclusion that a price reduction was planned for 1931 of greater magnitude than the 20% known actually to have been planned at the time of SPE's preparation; see below under "1931".

<sup>7/</sup> p. 63.

Price Index Numbers:

The various price index numbers were calculated from the estimated prices. They are believed to be as reliable as the index numbers for the benchmark years.

Value weights used in computing the given-year weighted index number were: for wheeled tractors, 29.6 million rubles; for tracklayers, 7.0 million rubles. They were calculated by a procedure analagous to that employed for 1929.

1931

Price of Fordson-Putilovets:

It is stated in Metall (Metal), no. 2-3, 1931, p. 190, that prices of tractors and tractor parts were to be reduced 20% on January 1, 1931. This percentage was applied directly to the 1930 price of the Fordson-Putilovets. This interpretation of the decree is confirmed by the statements in SPE cited above. These set the 1931 planned value of tractor output of Krasnyi Putilovets 64.2 million rubles, which was to represent physical output of 22,000 machines <sup>8/</sup>, or 2918 rubles per machine. This is 16% less than the 1930 price. However, the total output figure includes 500 of a new type of tractor, which may have been priced substantially above the Fordson-Putilovets.

Price of Kommunar 50:

This price was derived from the 1930 price by applying the percentage decrease cited above.

Price Index Numbers:

The various price index numbers were calculated from the estimated prices, using the price relative for the Fordson-Putilovets to represent all wheeled tractors and the price relative for the Kommunar 50 to represent all crawlers. For the constant weight indexes, the weighting systems of text Table III, Section VI were used; the weights used for the given-year weighted index are given in fn. 9, below. Numerically, these two models accounted for about 50%

---

<sup>8/</sup> SPE, p. 63.

of production in 1931; in terms of value, their share would be substantially less. The other tractors were in first production in 1931, and accordingly, they may have been priced high. This would seem to cast a considerable doubt on the reliability of the index number as calculated <sup>9/</sup>.

One important mitigating consideration should be mentioned, however. There is evidence <sup>10/</sup> that the "1926/7 price" of the International, at least

---

<sup>9/</sup> The value of production of the various tractors produced in 1931 may be estimated on the assumption that 5300 rubles was the price of the International, and that the various models of tracklayers were priced in relation to the known price of the Kommunar 50 according to their relative power in b.h.p. The result is:

|                    |                     |
|--------------------|---------------------|
| International      | 98.1 million rubles |
| Fordson-Putilovets | 52.4 million rubles |
| Kommunar 50        | 2.8 million rubles  |
| Other tracklayers  | 9.9 million rubles  |

Use is made here of the prices of Appendix Table XIII and the output data of Appendix Table I. These values are also the value weights used in computing the given-year weighted index number. They probably underestimate the value of "other tracklayers", as most of these were new in 1931 and may have been high priced.

<sup>10/</sup> ATD, No. 4, 1932, p. 122, states that marketable production of the Kharkov tractor factory in the fourth quarter of 1931 was 5,177,700 rubles in 1926/7 prices. The same source states that 970 Internationals were produced in the plant, all during the fourth quarter, and that production of spare parts was only 8% of the amount planned — i.e. that it was negligible. Dividing the value of production by the number of machines produced, the 1926/7 price of 5300 rubles is obtained.



as produced at the Kharkov Tractor Factory <sup>11/</sup>, was 5,300 rubles. If this was the price at which the machine was first produced, the use of such current prices as "unchanging 1926/7 prices" is believed to be a Soviet practice—then the price relative of the International in 1931 was 131.7, which is not too different from 137.1 the relative for the Fordson-Putilovets. The International, Fordson-Putilovets, and Kommunar 50 together accounted for around 95% of all tractor production in 1931, whether in terms of number or value.

The preceding argument, even if correct, is relevant mainly to the index number using given-year weights. The other index numbers give much greater weight to the price level of tracklaying tractors. In this regard the representativeness of the price relative for the Kommunar 50 must be appraised. This relative is probably too low because it was calculated from the blanket decrease applied to 1930 prices. Actually, only 231 of the 618 crawlers produced in 1931 were models produced in 1930. The other 387 were models first produced in 1931 and may well have been priced high. For this reason, all the other index numbers computed, and particularly the one using 1941 weights, must be considered to understate the true price level in 1931, although it would be difficult to estimate the degree of this understatement.

---

<sup>11/</sup> The Kharkov works started production of the International in 1931, which was also the first year of operation for the plant itself. (See Appendix K.) "Unchanging 1926/7 prices" until 1936 were set for the output of specific plants, with the result that the same item, if produced by different enterprises, would be evaluated by different 1926/7 prices. A. Savinskii, Kurs Promyshlennoi Statistiki (A Course in Industrial Statistics), Moscow, 1949, p. 86). At the same time it was government policy to set uniform current prices for specific items, wherever produced. This policy, apparently, has been easier to announce than to enforce. (cf. for example, Maizenberg, op. cit., p. 207, who writes in 1950 that a system of unified prices for all producers of like items had still not been achieved.) But it should not have been too hard to apply in the case of such an important item as tractors, especially where only two producers were concerned. The implication is that if 5,300 rubles was the 1931 price of the International as produced at Kharkov, it was the 1931 price of the machine produced at Stalingrad as well.

1932Price Index Number:

Available information was not sufficient to permit the estimation of prices for specific machines. An index number using given year weights and based on 1937 was computed from data relating to the value of 1932 output in terms of horse-power units. These data are as follows: 1) 1,057 thousand drawbar horse-power of tractors were planned for delivery to agriculture in 1933;<sup>12/</sup> 2) the value of these tractors, calculated from the 1932 value per unit drawbar horse-power, plus the value of the planned delivery of spare tractor parts in 1933 was 375 million rubles;<sup>13/</sup> 3) the planned production of spare tractor parts for 1933 was 92.1 million rubles;<sup>14/</sup> 4) the planned production of tractors for 1933 was 1,205 thousand drawbar horse-power.<sup>15/</sup>

From the foregoing, it is seen that 87.7% of the tractors to be produced were intended for agriculture. Accordingly, it was assumed that 87.7% of the spare tractor parts were intended for agriculture—which is to say that the value of the planned delivery of spare tractor parts to agriculture in 1933 was 80.8 million rubles.

The value per unit d.h.p. of the 1933 planned deliveries at 1932 prices was found by 1) dividing the total planned investment by a factor of 1.0615 to allow for distribution costs;<sup>12/</sup> (See fn. 12, Appendix E.) 2) subtracting the value of the spare parts planned for delivery to agriculture; and 3) dividing by 1,057,000, the total planned delivery in d.h.p. The result was a 1932 price of 258 rubles per d.h.p.

---

<sup>12/</sup> FYP 2, p. 710.

<sup>13/</sup> *ibid*, p. 711.

<sup>14/</sup> ARI, Jan. 1933, p. 12.

<sup>15/</sup> FYP 2, p. 694.

Total tractor production in 1932 was 755 thousand drawbar horse-power,<sup>16/</sup> having, therefore, a value of 195 million rubles at 1932 prices, according to the above computation. The tractor output of 1932 was valued at 1937 prices and found to have a total value of 204 million rubles.<sup>17/</sup> The quotient of these sums is the given-year weighted index number for 1932.

In offering this index number, the following reservations should be presented:

1) The value of investment figure is stated in the source to have been calculated on the basis of the value (stoimost') per drawbar horse-power in 1932. This Russian term may be rendered variously in English by "value" or "cost." The precise Russian word for production cost, sebestoimost', is appropriately employed in the present context.<sup>18/</sup> In the event that mine is not the correct interpretation, however, the index number as computed is too low, probably by 20-30%.<sup>19/</sup>

---

<sup>16/</sup> SS 35, p. 55.

<sup>17/</sup> Not all the tractors produced in 1932 could be priced in 1937, inasmuch as two of the four 1932 models were discontinued before that year. The Fordson-Putilovets were assumed to have a value half that of the International in 1937, for reasons set forth in Section IV, fn. 3. Kommunar 90's were assumed to have a value half again that of the Stalinets S-60, but this is probably not a crucial assumption, since less than 1% of the tractors produced in 1932 were of this model.

<sup>18/</sup> Machinery prices were quoted uniformly on an at-the-factory (franko-zavod) basis in the Soviet Union at this time. Accordingly, the cost of tractors to the organization financing investment in tractors differed from their officially regulated price by the costs of distribution. My feeling is that this accounts for the use in this instance of the term stoimost' -- "cost" in place of the term tsena -- "price" -- or tsennost' -- which would suggest value at quoted (official) price. The easiest way to estimate the cost of investing in tractors at 1932 prices would be to take the amount expended in financing the actual investment in tractors in 1932 and divide it by the quantity of tractors received. In this instance, apparently, it was chosen to measure the quantity of tractors in units of drawbar horse-power, probably because of major changes in the models of tractors planned for production in 1933. The result is a cost per unit, gross of distribution charges, which, however, could not be described as the price.

<sup>19/</sup> Actual production costs for the two tractors for which we have data do not contradict the hypothesis that the reference in the source was to production costs. Turetskii, loc.cit., states that the cost of a Kommunar 90 was 17,302 rubles or about 247 rubles per d.h.p. Costs at Stalingrad for the International, as given in Appendix F, were about 240 rubles per d.h.p., while at Kharkov they were over 310.

2) I have assumed that the authors of FYP 2, in referring to the "value per unit horse-power" in 1932 meant the average value per unit horse-power of all tractors produced in that year. It may be, however, that reference was to a single model only. If this is the case, the model can only be the International, which dominated tractor output in both 1932 and 1933. In this case we are left with a price relative for Internationals--specifically, 96.1--rather than a price index number. This is not too serious, because Internationals accounted for over 90% of all tractors produced in 1932, and, in fact, a comparison of this relative with the given-year weighted index number as presented in Appendix Table X shows no significant difference.

In the light of these serious qualifications, the index number computed may be considered reliable only within the range of the possible error indicated, i.e. the true index may be higher by up to 30%.

### 1933

#### Price Index Number:

In this instance, again, it was possible to estimate a given-year weighted price index number based on 1937, even though prices of specific tractor models could not be determined.

The information used in constructing the estimate consisted of value figures in 1933 prices relating to agricultural investment in tractors in that year, and data revealing the numbers of various tractor models actually delivered. This information is set forth in Appendix Table XV.

## APPENDIX TABLE XV

INVESTMENTS IN TRACTORS BY SOVIET AGRICULTURE, 1933

|                                                                    | <u>People's Commis-</u><br><u>sariat of Agri-</u><br><u>culture</u> | <u>People's Commis-</u><br><u>sariat of State</u><br><u>Farms</u> |
|--------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
| Actual investment in tractors,<br>1933 (mill.rubles) <sup>a/</sup> | 168.0                                                               | 75.0                                                              |
| Actual deliveries of tractors,<br>1933: <sup>b/</sup>              |                                                                     |                                                                   |
| International 15/30                                                | 51,564                                                              | 13,014                                                            |
| Stalinets S-60                                                     | 300                                                                 | 527                                                               |

a/ OOK, p. 118. This source is an appendix to the first volume of the draft of the second five year plan. The figures cited in Appendix Table XI are given with figures showing planned investment in tractors (net of repairs and parts) by agricultural organization by years for the period of the second five year plan. It is stated in the preface to Volume I, which presumably applies to the appendix as well, by V. V. Kuibyshev, then Commissar of that the investment figures for 1933 were taken from achieved totals of sums expended on financing investments during the year. Like the rest of the draft figures, of course, these are expressed in prices of 1933. Thus, although labeled "planned investment" the figures for 1933 given above relate to actual investments. The volumes of the draft, however, went to press early in 1934, indicating that the totals presented must have been preliminary ones.

b/ SS 36, p. 248. Incidentally, the actual deliveries to these two organizations amounted to 1,008,400 d.h.p., whereas the deliveries planned in the draft of the second five year plan (PVP, p. 468) were to have been 995,000 d.h.p., or 1.3% less.

Total production in 1933 of the two tractor types delivered to agriculture was 71,567 Internationals and 1,652 Stalinets S-60's.<sup>20/</sup> Their value at 1933

prices must have been 304 million rubles<sup>21/</sup>, while at 1937 prices it was 313 millions.<sup>22/</sup> The quotient of these two sums is the desired index number.<sup>23/</sup>

In appraising the reliability of this index number, it should be remembered that the two sources from which the data in Appendix Table XV are taken were published two years apart. In particular, the value data are preliminary, whereas the delivery data are final. Although the intention of the authors in both cases was to offer the same coverage, some error no doubt exists.

---

<sup>21/</sup> The value at 1933 prices was calculated as follows: the value of investment for the Commissariat of Agriculture was multiplied by .697, that of the Commissariat of State Farms, by 2.738, which two products were summed. These coefficients were chosen to bring the regimen of deliveries to agriculture into conformity with the production for the year. Thus if deliveries to each commissariat are uniformly multiplied by the appropriate coefficient, as given above, the sum for the two commissariats of each model of tractor would be equal to the total number of that model produced in 1933. Similarly, the value of deliveries-times-coefficient for each commissariat is obtained by multiplying the value of investment by the coefficient. The sum of values so obtained for the two commissariats is thus equivalent to the value of 1933 production at 1933 prices, plus a proportional charge equal to the proportion of total investment funds going to distribution costs. Accordingly, the sum was divided by a factor of 1.0615 to allow for distribution costs; this factor is taken from Appendix E, where actual distribution costs for 1935 were estimated.

<sup>22/</sup> i.e. the quantities produced times the 1937 prices of text Table I.

<sup>23/</sup> It would be mathematically possible to establish index numbers for other weighting systems by the methods set forth in fn. 21. However, the other weighting systems employed in this memorandum give a very much greater weight to tracklaying tractors than do given-year weights for 1933. Because of the small proportion of crawlers to wheeled tractors in 1933, small random errors in the investment and delivery figures for wheeled tractors would result in very large errors in the estimated price level of crawlers. This produces no great error in the given-year weighted index number, but the error would be substantially magnified by other weighting systems. The same argument suggests the inadvisability of attempting to deduce specific prices for the two tractor models by simultaneous equations, although, again this is mathematically possible.

1934Price Index Number:

As in the case of 1933, it was possible, from data relating to agricultural investment in tractors, to estimate for 1934 a given-year weighted price index number based on 1937, even though prices of specific tractor models could not be determined.

The information used in constructing the estimate is set forth in Appendix Table XVI.

APPENDIX TABLE XVI

INVESTMENTS IN TRACTORS BY SOVIET AGRICULTURE, 1934

|                                                             | <u>People's Commis-</u><br><u>sariat of Agri-</u><br><u>culture</u> | <u>People's Commis-</u><br><u>sariat of State</u><br><u>Farms</u> |
|-------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
| Actual investment in tractors<br>1934, prel. (mill. rubles) | 337.00 <sup>a/</sup>                                                | 75.00 <sup>b/</sup>                                               |
| Actual deliveries of tractors<br>1934, final: <sup>c/</sup> |                                                                     |                                                                   |
| International 15/30                                         | 61,926                                                              | 10,169                                                            |
| Stalinets S-60                                              | 5,057                                                               | 2,326                                                             |
| Universal 10/20                                             | 2,631                                                               | --                                                                |

a/ 35 Plan, p. 481. The figure is net of repairs and parts.

b/ ibid, p. 482. The figure is net of repairs and parts.

c/ SS 36, p. 248. The sign "--" indicates a zero delivery.

The process of estimation was as follows:

1) The total sums invested were divided by a factor of 1.0615 to allow for distribution costs.<sup>24/</sup> This gives the value at factory prices of the tractors delivered to each commissariat.

2) The value at factory prices of the Universals delivered to the Commissariat of Agriculture was estimated and deducted from the value at

---

<sup>24/</sup> See Appendix E, for the derivation of this figure.

factory prices of all tractors delivered to this Commissariat, as calculated in the preceding paragraph. This estimate is based on the 1935 price of the Universal,<sup>25/</sup> and the information that the 1935 price was reduced from the 1934 price so as to result in a "saving" of 21.1 million rubles on planned production of Universals in 1935.<sup>26/</sup> Planned production of Universals in 1935 was 12,000.<sup>27/</sup> Together these pieces of information add up to a 1934 price for the Universal of 4,927 rubles.

3) The value at 1934 factory prices of the 80,680 Internationals and 10,100 Stalinet S-60's produced in 1934 was determined from the above,<sup>28/</sup> and to this was added the value at the factory of the 3,167 Universals produced.<sup>29/</sup> The value at 1934 prices of 1934 production of these three

---

<sup>25/</sup> See Appendix F.

<sup>26/</sup> Nashe Stroitel'stvo (Our Construction), no. 8, 1935, p. 36. The "saving" referred to in this context is calculated in Soviet usage by deducting the value of production at the new price from its value at the old price. Despite the odd phrasing of this statement, it is part of an official price-fixing decree of STO (The Council of Labor and Defense), no. 204 of March 16, 1935. The new price took effect January 1, 1935.

<sup>27/</sup> 35 Plan, p. 599.

<sup>28/</sup> The value at 1934 prices was found by multiplying the investment, net of distribution costs and the value of Universals, of the Commissariat of Agriculture by a factor of .917, that of the Commissariat of State farms by a factor of 2,348. These two coefficients, if applied uniformly to actual deliveries to the two commissariats, would convert the sum of the deliveries for each model into the total volume of production for the year. The procedure is analagous to that explained in fn. 21, above.

<sup>29/</sup> This was calculated by multiplying the production of Universals by the estimated factory price of 4,927 rubles. This operation, it should be noted, balances to a large extent the deduction made for Universals from the investment figure for the Commissariat of Agriculture. Thus the net effect of estimating the 1934 price of the Universal changes the total value of production estimate by 5 million rubles, or about 1%. For this reason, it is not believed that any serious error in the index number can have resulted from this phase of the estimation.



models was found to be 461 million rubles; at 1937 prices, it would be 485 million rubles.<sup>30/</sup> The quotient of these two sums is the desired price index number, as shown in Appendix Table X.

Unless there are large errors in the Soviet sources from which the data used here are drawn, the index number as estimated should be substantially reliable.<sup>31/</sup> This is the case because the tractors delivered to agriculture in 1934 and paid for by the investment sums cited in Appendix Table XII accounted for almost 90% of all the tractors produced in the Soviet Union in that year. The index number, then, must reflect the average price at which the machines were actually sold.

### 1936

#### Tractor Prices

Tractor prices, as stated in the text, were changed on April 1, 1936. No other change in tractor prices is known to have occurred between January 1, 1935, and April 1, 1936, whereas it is definitely known that the prices of April 1, 1936, were effective into 1937. (See Section II.) The tractor prices of Appendix Table XIII, then, are average prices for the year 1936, calculated from 1935 and 1937 prices, as given in text Table I. The average was computed by giving 1935 prices a weight of .25 and 1937 prices a weight of .75, in accord with the length of time each was in effect during 1936.

#### Price Index Numbers:

The price index numbers were computed from the prices as given in Appendix Table IX, according to the various weighting systems used.

---

<sup>30/</sup> This figure is obtained by multiplying 1934 output by the 1937 prices of text Table I.

<sup>31/</sup> It is true, of course, that the value figures are preliminary and the delivery figures final. However, preliminary total delivery figures for 1934, undifferentiated by Commissariat, (35 Plan, p. 599), differ from the final figures used here by less than 1%.

Weights used in computing the given-year weighted index number were, in millions of rubles: for Internationals, 253.0; for Universals, 51.9; and for Stalinets S-60's, 457.7.

1938-1940

Price Index Numbers:

None of the tractors for which price quotations in 1937 were available were produced in this period, whereas the prices known for 1941 took effect only in that year. In general, this was a period in which Soviet prices remained stable at their 1937 levels. The two principle tractors produced in the Soviet Union during these years, the Stalinets S-65 and the NATI, were first produced in 1937, and it has been assumed for present purposes that the prices established for them in that year were maintained until the general price revision of 1941.

1942-1943

Tractor Prices:

No changes in tractor prices are known to have occurred between January 1, 1941, and mid-1944. The prices of 1941 are therefore assumed to have been maintained in these years.

Price Index Numbers:

Price index numbers were computed from the prices as given in Appendix Table XIII. As it is known that only tracklayers were produced in these years (see Section III, fn. 5 and 6), the price relative for tracklayers only was taken as the given-year weighted index number in both years.

1944

Tractor Prices:

New prices for the NATI and the Universal were established during 1944 (see Appendix B). The prices and price relative given in

Appendix Table XIII are averages, weighted for the duration in effect, of the two prices for each tractor, which prevailed in 1944.

Price Index Numbers:

The price index numbers were computed from the prices as given in Appendix Table XIII. As it is believed that production of Universals was negligible in 1944, the given-year weighted index number is based on the price relative for the NATI only.

1946-1948

Tractor Prices:

No changes are known to have occurred in tractor prices between 1945 and the general price revision of January 1, 1949. It is thus assumed that the prices set in 1944 were maintained in effect through these years.

However, one important tractor came into first production in 1946, the Stalinets S-80; another was first produced in 1948, the Kirovets D-35. It has been assumed that the 1949 prices of these models prevailed before 1949 as well. The basis for this assumption is set forth in fn. c, to Appendix Table V, Appendix C. Price relatives for these models have been linked to the 1949 price relative of the NATI in order to provide price relatives for the years before 1949.<sup>32/</sup>

Price Index Numbers:

For the constant weight indexes of weight years 1928, 1932 and 1941, an unweighted average of the price relative of the NATI and the price

---

<sup>32/</sup> In accord with the reasoning offered in relation to linking in price relatives for gas-generating trucks (Section IV), it is considered that the first year in which production of a new item is fairly well established is most appropriate for starting such a link.

relative of the Stalinets S-80 was used for the years 1946-1948 as the price relative for all crawlers. This was done because neither machine was produced in 1928 and 1932, while the proportions in which the two were produced in 1941 are not known.<sup>33/</sup> For the constant weight index for weight year 1937, the two relatives are averaged, weighted by their value of production in 1937.<sup>34/</sup>

Production regimen data are lacking for the postwar years. For this reason, the given-year weighted index numbers were computed on the assumptions that: 1) the regimen of 1946 was substantially the same as the estimated regimen of 1945 (as shown in Appendix C); and 2) the regimens of 1947 and 1948 were substantially the same as the regimen of planned deliveries to agriculture for 1947 (also as shown in Appendix C). To this one exception is made: the Kirovets D-35 is omitted from the weights computed for 1947, as it is known that this machine was not actually produced until 1948. The weights are shown in Appendix Table V, Appendix C.

---

<sup>33/</sup> As explained in Section IV, it was necessary to resort to linkage in obtaining a continuous series of price relatives for tracklaying tractors from 1928 through 1949, because of changes of regimen. Relatives based on prices of the NATI and Stalinets S-80 were employed, of course, only in index numbers for the years in which they were produced.

<sup>34/</sup> In fact, the Stalinets S-80 was not produced in 1937. However, the Stalinets S-65, a very similar machine, was made in 1937; accordingly, for weighting purposes, production of the S-65 in 1937 was taken to represent production of the S-80. Neither the NATI nor the Stalinets S-65 was priced in 1937 in the sources available. Value weights were estimated, therefore, using the synthetic 1937 prices as described in Section V--i.e. the 1941 prices, divided by the 1941 price relative for tracklayers.

## APPENDIX I

PRICE LEVELS OF SOVIET TRUCKS AND AUTOMOBILES IN THE  
INTERVALS BETWEEN THE BENCHMARK YEARS.

It has been possible to estimate price levels for Soviet trucks and automobiles for all of the years intermediate to the benchmark years except 1931 and 1932 on the basis of scattered information relating to agricultural investment programs and industry-wide price changes. The results of these calculations are summarized in Appendix Table XVII, which gives estimated prices and price relatives for trucks and automobiles, and in Appendix Table XVIII, which sets forth estimated price levels in terms of the various weighting systems employed in the text of the memorandum. It has not been possible to make such a determination in terms of all of the weighting systems for all of the years in which estimates were made because of limitations in the data available.

The derivation of the estimates presented in the two tables and the sources of price quotations for years other than the benchmark years follow by year.

The estimates are based on incomplete information, in consequence of which they vary in reliability. Some appraisal of the reliability of each index number is offered below with the explanation of the derivation. The estimates for the years 1933 and 1934 are based on investment data. The relationship of such data to current wholesale prices in the Soviet Union has already been discussed in Appendix G.

Index numbers for the constant weight indexes were computed from price relatives shown in Appendix Table XVII, using the systems of constant weights set forth in text Table IV, Section VI, and the constant weight index number formulae of Section V. Given-year weight index numbers were computed from reciprocals of the price relatives of Appendix Table XVII, using expression (7) of Section V. The given-year weights used in each instance are given below by year with the discussion of the other elements of the price level calculation. These weights were computed from the production data of Appendix Table I and the prices of Appendix Table XVII.

## APPENDIX TABLE XVII

ESTIMATED PRICES AND PRICE RELATIVES OF TRUCKS AND AUTOMOBILES, USSR, 1928-1949<sup>a/</sup>

| <u>Item</u>                       | <u>1928</u>                       | <u>1929</u> | <u>1930</u> | <u>1933</u> | <u>1934</u> | <u>1935</u> | <u>1936</u> |
|-----------------------------------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>Trucks</u>                     | <u>Prices in Rubles</u>           |             |             |             |             |             |             |
| Amo F 15, 1.5 ton                 | (12316)                           | (12300)     | 10677       | --          | --          | --          | --          |
| Gaz-AA, 1.5 ton                   | --                                | --          | --          | na          | na          | (4800)      | 5522        |
| Gaz-MM, 1.5 ton                   | --                                | --          | --          | --          | --          | --          | --          |
| Ya.Z., 3.0 ton                    | (18000)                           | (17500)     | 15191       | --          | --          | --          | --          |
| Zis 5, 3.0 ton                    | --                                | --          | --          | na          | na          | (10000)     | 10000       |
| Zis 6, 4.0 ton                    | --                                | --          | --          | na          | na          | na          | na          |
| Zis 21, 3.0 ton<br>gas-generator  | --                                | --          | --          | --          | --          | --          | --          |
| Gaz-42, 1.5 ton,<br>gas-generator | --                                | --          | --          | --          | --          | --          | --          |
| Fire engine, pump,<br>Gaz AA      | --                                | --          | --          | --          | --          | --          | --          |
| <u>Light Automobiles</u>          |                                   |             |             |             |             |             |             |
| Gaz M-1                           | --                                | --          | --          | --          | --          | --          | --          |
| Gaz M20, "Pobeda"                 | --                                | --          | --          | --          | --          | --          | --          |
|                                   | <u>Price Relatives (1937=100)</u> |             |             |             |             |             |             |
| 1.5 ton trucks, reg.              | 213.7                             | 213.4       | 181.0       | na          | na          | (83.3)      | 95.8        |
| 1.5 ton trucks, gas-gen.          | --                                | --          | --          | --          | --          | --          | --          |
| 3.0 ton trucks, reg.              | 213.7                             | 207.8       | 176.2       | na          | na          | (100.0)     | (100.0)     |
| 3.0 ton trucks, gas-gen.          | --                                | --          | --          | --          | --          | --          | --          |
| 4.0 ton trucks                    | --                                | --          | --          | na          | na          | na          | na          |
| Fire Engines                      | --                                | na          | na          | na          | na          | na          | na          |
| Light automobiles                 | --                                | na          | na          | na          | na          | na          | na          |

<sup>a/</sup> The derivation of the estimated prices is given in the text of this appendix by years. Various adjustments for comparability discussed in the text of the memorandum have been applied to the price relative presented here as well. Figures in parentheses are for the benchmark years and are from the text of the memorandum; they are repeated here to facilitate comparisons between years. The sign "--" indicates that the item was not produced. The sign "na" indicates that available data were insufficient for the estimation of a price or price relative.

APPENDIX TABLE XVII (Cont. 2)

| <u>Item</u>                       | <u>1937</u>                       | <u>1938</u> | <u>1939</u> | <u>1940</u> | <u>1941</u> | <u>1942</u> | <u>1943</u> |
|-----------------------------------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>Trucks</u>                     | <u>Prices in Rubles</u>           |             |             |             |             |             |             |
| Amo F 15, 1.5 ton                 | --                                | --          | --          | --          | --          | --          | --          |
| Gaz AA, 1.5 ton                   | (5763)                            | 5763        | 5763        | 5763        | (6000)      | 6000        | 6000        |
| Gaz MM, 1.5 ton                   | --                                | na          | na          | na          | na          | na          | na          |
| Ya.Z., 3.0 ton                    | --                                | --          | --          | --          | --          | --          | --          |
| Zis 5, 3.0 ton                    | (10000)                           | 10000       | 10000       | 10000       | (10000)     | 10000       | 10000       |
| Zis 6, 4.0 ton                    | (12500)                           | 12500       | 12500       | 12500       | (15800)     | 15800       | 15800       |
| Zis 21, 3.0 ton<br>gas-generator  | na                                | na          | na          | na          | (13500)     | 13500       | 13500       |
| Gaz 42, 1.5 ton,<br>gas-generator | na                                | na          | na          | na          | (8200)      | 8200        | 8200        |
| Fire engine, pump,<br>Gaz AA      | (8963)                            | 8963        | 8963        | 8963        | (15500)     | 15500       | 15500       |
| <u>Light Automobiles</u>          | <u>Price Relatives (1937=100)</u> |             |             |             |             |             |             |
| Gaz M-1                           | (8500)                            | 8500        | 9000        | 9500        | (9500)      | 9500        | 9500        |
| Gaz M-20, "Pobeda"                | --                                | --          | --          | --          | --          | --          | --          |
| 1.5 ton trucks, reg.              | (100.0)                           | 100.0       | 100.0       | 100.0       | (104.1)     | 104.1       | 104.1       |
| 1.5 ton trucks, gas-gen.          | na                                | na          | na          | na          | (121.5)     | 121.5       | 121.5       |
| 3.0 ton trucks, reg.              | (100.0)                           | 100.0       | 100.0       | 100.0       | (100.0)     | 100.0       | 100.0       |
| 3.0 ton trucks, gas-gen.          | na                                | na          | na          | na          | (125.0)     | 125.0       | 125.0       |
| 4.0 ton trucks                    | (100.0)                           | 100.0       | 100.0       | 100.0       | (126.4)     | 126.4       | 126.4       |
| Fire Engines                      | (100.0)                           | 100.0       | 100.0       | 100.0       | (172.9)     | 172.9       | 172.9       |
| Light Automobiles                 | (100.0)                           | 100.0       | 105.9       | 111.8       | (111.8)     | 111.8       | 111.8       |



APPENDIX TABLE XVII (Cont. 3)

| <u>Item</u>                       | <u>1944</u> | <u>1945</u> | <u>1946</u> | <u>1947</u> | <u>1948</u> | <u>1949</u> |
|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>Trucks</u>                     |             |             |             |             |             |             |
| Amo F 15, 1.5 ton                 | --          | --          | --          | --          | --          | --          |
| Gaz AA, 1.5 ton                   | 6000        | (6667)      | 7000        | 7000        | 7000        | na          |
| Gaz MM, 1.5 ton                   | na          | na          | na          | na          | na          | (16500)     |
| Ya.Z., 3.0 ton                    | --          | --          | --          | --          | --          | --          |
| Zis 5, 3.0 ton                    | 11458       | (12500)     | 12500       | 12500       | 12500       | (24000)     |
| Zis 6, 4.0 ton                    | 15800       | na          | na          | na          | na          | na          |
| Zis 21, 3.0 ton,<br>gas-generator | 13500       | (13500)     | 13500       | 13500       | 13500       | na          |
| Gaz 42, 1.5 ton,<br>gas-generator | 8200        | (8200)      | 8200        | 8200        | 8200        | na          |
| Fire engine, pump,<br>Gaz AA      | 15500       | (23200)     | 23200       | 23200       | 23200       | (32500)     |
| <u>Light Automobiles</u>          |             |             |             |             |             |             |
| Gaz M-1                           | 9500        | (9500)      | --          | --          | --          | --          |
| Gaz M-20, "Pobeda"                | --          | --          | 33000       | 33000       | 33000       | (33000)     |
| 1.5 ton trucks, reg.              | 104.1       | (115.7)     | 121.5       | 121.5       | 121.5       | (252.6)     |
| 1.5 ton trucks, gas-gen.          | 121.5       | (121.5)     | 121.5       | 121.5       | 121.5       | (252.6)     |
| 3.0 ton trucks, reg.              | 114.6       | (125.0)     | 125.0       | 125.0       | 125.0       | (245.9)     |
| 3.0 ton trucks, gas-gen.          | 125.0       | (125.0)     | 125.0       | 125.0       | 125.0       | (245.9)     |
| 4.0 ton trucks                    | 126.4       | na          | na          | na          | na          | (314.5)     |
| Fire engines                      | 172.9       | (258.8)     | 258.8       | 258.8       | 258.8       | (355.5)     |
| Light automobiles                 | 111.8       | (111.8)     | 342.5       | 388.2       | 388.2       | (342.5)     |

## APPENDIX TABLE XVIII

ESTIMATED PRICE INDEXES OF TRUCKS AND AUTOMOBILES, USSR, 1928-1949<sup>a/</sup>

(1937=100)

| <u>Index</u>             | <u>1928</u> | <u>1929</u> | <u>1930</u> | <u>1933</u> | <u>1934</u> | <u>1935</u> | <u>1936</u> |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Constant Weight Indexes: |             |             |             |             |             |             |             |
| Weight-Year 1928         | (214)       | (204)       | 180         | na          | na          | (87)        | 97          |
| Weight-Year 1932         | (213)       | (202)       | 177         | na          | na          | (96)        | 99          |
| Weight-Year 1937         | (213)       | (203)       | 179         | na          | na          | (91)        | 98          |
| Weight-Year 1941         | (213)       | (203)       | 179         | na          | na          | (91)        | 98          |
| Given-Year Weight Index  | (213)       | (203)       | 179         | 131         | 107         | (92)        | 98          |
| <u>Index</u>             | <u>1937</u> | <u>1938</u> | <u>1939</u> | <u>1940</u> | <u>1941</u> | <u>1942</u> | <u>1943</u> |
| Constant Weight Indexes: |             |             |             |             |             |             |             |
| Weight-Year 1928         | (100)       | 100         | 100         | 100         | (103)       | 103         | 103         |
| Weight-Year 1932         | (100)       | 100         | 100         | 100         | (103)       | 103         | 103         |
| Weight-Year 1937         | (100)       | 100         | 101         | 101         | (105)       | 105         | 105         |
| Weight-Year 1941         | (100)       | 100         | 100         | 101         | (111)       | 111         | 111         |
| Given-Year Weight Index  | (100)       | 100         | 101         | 102         | (111)       | 111         | 111         |
| <u>Index</u>             | <u>1944</u> | <u>1945</u> | <u>1946</u> | <u>1947</u> | <u>1948</u> | <u>1949</u> |             |
| Constant Weight Indexes: |             |             |             |             |             |             |             |
| Weight-Year 1928         | 106         | (113)       | 122         | 122         | 122         | (251)       |             |
| Weight-Year 1932         | 114         | (125)       | 127         | 127         | 127         | (250)       |             |
| Weight-Year 1937         | 110         | (118)       | 149         | 149         | 149         | (263)       |             |
| Weight-Year 1941         | 115         | (119)       | 140         | 140         | 140         | (259)       |             |
| Given-Year Weight Index  | 115         | (119)       | 133         | 132         | 136         | (260)       |             |

<sup>a/</sup> The derivations of these estimates are set forth in the text of this appendix by years. The figures in parentheses are results obtained for the benchmark years, as explained in the text of the memorandum. They are repeated here for purposes of comparison with the estimates. The sign "na" indicates that the price index number could not be computed from the available data.

1930Price Quotations:

An official price decrees published in Metall (Metal)<sup>1/</sup> prescribed a price decrease for the products of Avtotrest, the sole producer of automotive products in the Soviet Union at this time. The new prices decreed were to become effective on October 1, 1929, and were to result in an average price decrease for the trust of not less than 15.2%, individual price changes being left to the discretion of the trust administration. This decree was promulgated on December 15, 1929. In the event that the trust administration did not comply with its provisions, it was specified, the 15.2% price decrease would automatically apply uniformly to all items. The prices shown for 1930 in Appendix Table XVII were calculated from the price quotations for 1929 of text Table II by uniformly applying the 15.2% decrease. It is assumed, in the absence of other information, that the new prices prevailed throughout 1930. The price relatives shown incorporate the corrections for comparability described in Section IV of the text.

Price Index Numbers:

The various price index numbers were calculated from the estimated prices of Appendix Table XVII. The constant weight index numbers were derived in accord with the appropriate weighting systems, as described in the text. The given-year weights were computed by valuing production of 1929/30, as shown in Appendix Table II, at the estimated prices of 1930. These weights are: for 1.5 ton trucks, 22.3 million rubles; for 3.0 ton trucks, 6.3 million rubles.

---

<sup>1/</sup> No.2, 1930, p. 124.

Two ambiguities detract from the reliability of the estimated price levels. 1) It is not known how the price decrease was distributed over the range of products offered by Avtotrest. It is believed that these were limited to trucks, passenger cars and spare parts, of which 1.5 and 3.0 ton trucks made up the preponderance in value terms. But even so, it is clear that the variously weighted index numbers would be substantially affected just by the distribution of the decrease between the two dominant truck models. The exception of course, is the given-year weighted index number, which, presumably, would show no appreciable distortion on this score.

2) Of the 4,217 truck and automobile models produced in the calendar year 1930, 888 were models in first production.<sup>2/</sup> This number did not undergo any price reduction as a result of the decree mentioned above. These models, being new, may have been overpriced, although there is no specific evidence on the matter. If this is the case, the various index numbers understate the true price level in 1930. As the new models amount to some 21% of total production in 1930, it is not felt that the magnitude of this possible understatement is likely to be greater than 10%.<sup>3/</sup>

### 1933

#### Price Index Number:

It was possible for this year to estimate a given-year weighted price index number based on 1937, even though prices of specific automotive vehicles could not be determined.

---

<sup>2/</sup> Production in calendar years by model is given in ATD, no. 11, 1933, p.356. Similar data by Soviet fiscal years--i.e. 1928/9, and 1929/30, in the present instance--are not available. It is not likely that the number of new models in first production in 1930 would appear differently in the light of such data, however, as it is not believed that production of any new models was inaugurated during the last quarter of 1929.

<sup>3/</sup> This is on the assumption that the relative price level of these new models would not be any more than 50% greater than the price level of the older models. This assumption is a very rough guess. At the same time, it is altogether possible that the new models were not overpriced at all.

The information used in constructing the estimate consisted of value figures in 1933 prices relating to agricultural investment in trucks and automobiles in that year and data giving the numbers of the various machines actually delivered. This information is set forth in Appendix Table XIX.

## APPENDIX TABLE XIX

INVESTMENTS IN TRUCKS AND AUTOMOBILES BY SOVIET AGRICULTURE, 1933

Obtained by multiplying deliveries to each Commissariat and State Farms, Appendix Table XIX by the appropriate coefficients and summing.

The value of the machines of the calculated 1933 regimen was determined by multiplying the appropriate coefficients to the gross investment by the appropriate coefficients and summing.

Realized Investment in trucks and automobiles, 1933, millions of rubles

97.00 68.00

Actual deliveries of trucks and automobiles, 1933:

|                        | People's Commissariat of Agriculture | People's Commissariat of State Farms |
|------------------------|--------------------------------------|--------------------------------------|
| 1.5 ton trucks         | 4,904                                | 1,560                                |
| 2.5 and 3.0 ton trucks | 3,557                                | 2,963                                |
| Other trucks           | 137                                  | 282                                  |
| Light automobiles      | 2,929                                | 1,295                                |

a/ OOK, p. 118. These are preliminary figures. They are net of repairs and spare parts. See fn. "a" to Appendix Table XI for further considerations relevant to their interpretation.

b/ SS 36, p. 253. These are final figures.

The agricultural delivery regimen of 1933 was made to conform to the total production regimen of 1933 by uniformly applying a coefficient of

1.8063 to deliveries to the Commissariat of Agriculture and a coefficient of

4.8839 to deliveries to the Commissariat of State Farms. The correspondence

achieved between the two regimens by this procedure is indicated in Appendix Table XX.

The data on truck deliveries are from SS 36, p. 253. The 1933 prices of light cars was estimated by applying the 1937 base-year weighted price index to the 1933 price of the Vaz A. This price is 6,066 rubles, as given in SS 37, p. 22. It is not believed that any great error can have occurred here because of the small number of light cars involved.

4/ The rationale of this use of coefficients is discussed in Appendix H, fn. 21. It was assumed that the difference between the gross investment and the value of the vehicles at factory price represents the costs of distribution. There were some found in the gross investment.

to obtain an index number based on 1937, it was also necessary to value the calculated 1933 regimen at 1937 prices. The 1937 prices by means of which this was done are described in the next paragraph.

The only "light" automobiles produced in 1933 were Gaz A passenger cars and Gaz A pick-up trucks. These were identically priced in 1937 at 4,965 rubles.<sup>6/</sup> Similarly, the only 1.5 ton truck produced in 1933 was Gaz AA, whose 1937 price was 5763 rubles. Of the 20,896 trucks of 2.5 and 3.0 ton capacities produced in 1933, however, 20,005 were Amo 3's, a model no longer made after that year; the remainder were Zis 5's, whose 1937 price was 10,000 rubles. The Amo 3 and Zis 5--originally called the Amo 4--are similar vehicles, apparently; the chief difference is the advance in motor horse-power from 60 for the Amo 3 to 73 for the Zis 5.<sup>7/</sup> It was felt that 10% would reasonably reflect this differential; accordingly, 9,000 rubles was taken as the 1937 price of the Amo 3. The remaining trucks produced in 1933 were almost exclusively Ya.G. 3's, a 5.0 ton model. This truck was also discontinued before 1937, being replaced by the 5.0 ton Ya.G 4. Insufficient information is available to permit a critical comparison of these two models. Consequently, the 1937 price of the Ya.G. 4, 15,275 rubles, was used to compute the value at 1937 prices of the category "other trucks" in the approximated regimen.<sup>8/</sup> It is not felt that the resulting error here can be great because of the small number of trucks in this category.

---

<sup>6/</sup> All the 1937 price quotations in the succeeding discussion are from SMS 37, p. 220.

<sup>7/</sup> See Appendix D for a more complete comparison of the two trucks.

<sup>8/</sup> The output regimen by model for 1933 is taken from ATD, no. 11, 1933, p. 356.

In general, it is believed that the procedures adopted meet the problems of comparability.

Using the prices of the preceding paragraph, the value at 1937 price of the calculated 1933 regimen was found to be 366 million rubles. The quotient of the value at 1933 prices--481 million rubles--and the value at 1937 prices is the desired price index number.

In spite of the length and complexity of the argument by which the given-year weighted index number was obtained, it is believed to be fairly reliable, on the following grounds: 1) The information presented above, fn. 4, indicates that in 1935, at least, the prices paid by agricultural organizations were in fact the quoted factory prices of the machines received. No reason is known for believing that this was less true in 1933. 2) The large scale importation of automotive products was discontinued in 1932.<sup>2/</sup> 3) The number of vehicles involved in the agricultural investment program, 17,618, is sufficiently large in relation to the total number of machines produced, 49,724, to reduce the influence of certain factors which seem likely to have been operative, but could not be taken into account in constructing the estimate. For example, the number of vehicles supplied to agriculture in 1933 was equal to about 50% of all production for the five preceding years; this suggests that the role of used machines, if in fact any were included, was not important.

At the same time, the following reservations should be expressed:

1) The delivery figures are final ones, whereas the investment figures are preliminary. I know of no reason a priori to expect any particular bias

---

<sup>2/</sup> Sc, p. 434.

as a result of this, but differences between preliminary and final figures in this period run as high as 10%. This would seem to be about the maximum random error to be expected from this source. 2) The allowance for distribution costs is based on information pertaining to 1935, and may be off by one or two percent. This again is a random error. 3) Errors in the adjustment for comparability in the case of the Amo 3 may have resulted in some random error; its maximum possible magnitude is believed to be about 3%.

### 1934

#### Price Index Number:

In this year, as in 1933, it was possible to estimate a given-year weight price index number, even though prices of specific automotive vehicles could not be determined.

The procedures employed and the information used in constructing the estimate are analagous to those used in the case of 1933. The basic data are given in Appendix Table XXI.

#### APPENDIX TABLE XXI

#### INVESTMENTS IN TRUCKS AND AUTOMOBILES BY SOVIET AGRICULTURE, 1934

|                                                              | People's Commis-<br>sariat of Agricul-<br>ture | People's Commis-<br>sariat of State<br>Farms |
|--------------------------------------------------------------|------------------------------------------------|----------------------------------------------|
| Investment in trucks and automobiles,<br>1934, mill.rubles   | 81.00 <sup>a/</sup>                            | 35.00 <sup>b/</sup>                          |
| Deliveries of trucks and automobiles,<br>1934. <sup>c/</sup> |                                                |                                              |
| 1.5 ton trucks                                               | 6,659                                          | 1,527                                        |
| 3.0 ton trucks                                               | 1,631                                          | 1,209                                        |
| Other trucks                                                 | 30                                             | 445                                          |
| Light automobiles                                            | 2,528                                          | 1,152                                        |

a/ 35 Plan, p. 481. These are preliminary figures, net of repairs and spare parts.

b/ 35 Plan, p. 482. These also are preliminary figures, net of repairs and spare parts.

c/ SS 36, p. 253. These are final figures.



The agricultural delivery regimen of 1934 was made to conform to the total production regimen of 1934 by uniformly applying a coefficient of 1.4898 to deliveries to the Commissariat of Agriculture and a coefficient of 14.4479 to deliveries to the Commissariat of State Farms. Because of a fundamental difference that existed between the two delivery regimens and the total production regimen, it was impossible to obtain complete conformity in the approximation to the actual production regimen. The two regimens are compared in Appendix Table XXII.

APPENDIX TABLE XXII

ACTUAL AND APPROXIMATED OUTPUT REGIMENS OF TRUCKS AND AUTOMOBILES, USSR, 1934

|                   | <u>Actual Production<sup>a/</sup></u> | <u>Calculated<br/>Regimen<sup>b/</sup></u> |
|-------------------|---------------------------------------|--------------------------------------------|
| 1.5 ton trucks    | 32,186                                | 31,982                                     |
| 3.0 ton trucks    | 19,935                                | 19,935                                     |
| Other trucks      | 3,150                                 | 1,090                                      |
| Light automobiles | 17,110                                | 20,410                                     |

a/ Appendix Table II.

b/ Obtained by multiplying deliveries to each Commissariat as shown in Appendix Table XXI, by the appropriate coefficient, as given in the text, and summing.

It is not believed that discrepancies in the weights used could produce errors in the final index number of more than 3%.

The value of the calculated 1934 regimen in 1934 prices was estimated by applying the coefficients to the sums invested by the two Commissariats, summing, and dividing the total by 1.0546 to allow for distribution costs.<sup>10/</sup> This value was found to be 539 million rubles. The value of the calculated 1934 output regimen at 1937 prices was also taken. The 1937 prices by means of which this was done are described in the next paragraph.

---

<sup>10/</sup> See fn. 5 of this Appendix for the derivation of the allowance for distribution costs.

The vehicles produced in 1934 were, for the most part, also produced in 1937. Thus the only 1.5 ton truck in 1934 was the Gaz AA; the only 3.0 ton truck was the Zis 5; and the only light automobiles were the Gaz A passenger car and the Gaz A pick-up truck. The 1937 prices of these vehicles were: for the Gaz AA, 5,763 rubles; for the Zis 5, 10,000 rubles; and for the Gaz A passenger car and Gaz A pick-up truck, 4,965 rubles.<sup>11/</sup> Of the remaining trucks produced, five-sixths were 5.0 ton trucks and the rest 4.0 ton trucks.<sup>12/</sup> The 5.0 ton truck was undoubtedly the YaG. 3 or the Ya.G.4, but precisely which of these it was is not known. In any case, the 1937 price of the Ya.G. 4 is all that is available; this price is 15,275 rubles, and was used to value all the trucks in the category "other trucks".<sup>13/</sup> This category was small in the approximated regimen; it is not believed, therefore, that any large error has resulted here.

Using the prices of the preceding paragraph, the value at 1937 prices of the calculated 1934 regimen was found to be 502 million rubles. The quotient of the value at 1933 prices--539 million rubles--and the value at 1937 prices is the desired price index number.

#### 1936

##### Price Quotations:

Truck prices, as stated in the text, were changed on April 1, 1936. No other change in truck prices between January 1, 1935, and April 1, 1936, is known to have occurred, whereas it is definitely known that the prices of April 1, 1936, were effective into 1937.<sup>14/</sup> The truck prices presented in

---

<sup>11/</sup> SMS 37, P. 220.

<sup>12/</sup> Appendix Table II.

<sup>13/</sup> SMS 37, p. 220.

<sup>14/</sup> See Section II.

Appendix Table XVII for 1936, then, are average prices for the year, calculated from 1935 and 1937 prices, as given in text Table II. The average was computed by giving 1935 prices a weight of 0.25 and 1937 prices a weight of 0.75, in accord with the length of time each was in effect during 1936.

Prices for passenger cars were available for 1937, but not for 1935. For this reason, no average prices for 1936 could be computed, and the item was omitted from the index number calculations for 1936.

Price Index Numbers:

The constant weight price index numbers for 1936 were calculated from the prices given in Appendix Table XVII, according to the various weighting systems set forth in Section VI. The given year weights were computed from production for 1936, as shown in Appendix Table II, and the prices of Appendix Table XVII. They are: for 1.5 ton trucks, 456 million rubles; for 3.0 ton trucks, 455 million rubles.

1938-1940

Price Quotations:

The vehicles produced in 1937 continued to be produced during these years. No changes in the prices of trucks are known to have occurred until the general price revision of January 1, 1941. Truck prices, accordingly, are assumed to have remained at their 1937 level through 1940. On the other hand, a price for the passenger car Gaz M-1 prevailed in 1940, which was 1,000 rubles higher than the 1937 price.<sup>15/</sup> Exactly when the price change occurred is unknown, but it has been assumed here that the new price became

---

<sup>15/</sup> See text Table II and Appendix B.

effective July 1, 1939.<sup>16/</sup> The estimated price of the Gaz M-1 for 1939 is thus the simple average of the 1937 and 1940 prices.

Price Index Numbers:

Constant weight price index numbers are computed from the prices shown in Appendix Table XVII and the constant weight systems set forth in Section VI.

As stated in the text, no breakdowns by model are available for truck production in the USSR after 1937. Accordingly, the only reflection of changing regimen in the weights for years later than 1937 is for changes in the ratio of trucks to light automobiles. Given-year weights were computed within these limitations for 1938 and 1940, on the basis of the prices in Appendix Table XVII and the production data of Appendix Table II. Production data are lacking for 1939; instead, therefore, given-year weights for 1939 were approximated by using the production data for 1938 and the price data for 1939, as given in the two tables just cited. The given year value weights are set forth in Appendix Table XXIII.

APPENDIX TABLE XXIII

GIVEN-YEAR VALUE WEIGHTS FOR TRUCKS AND AUTOMOBILES, 1938-1940

| <u>Item</u>             | (millions of rubles) |             |             |
|-------------------------|----------------------|-------------|-------------|
|                         | <u>1938</u>          | <u>1939</u> | <u>1940</u> |
| Trucks and fire engines | 1335                 | 1335        | 913         |
| Automobiles             | 230                  | 243         | 200         |

---

<sup>16/</sup> It seems unlikely that the increase in price occurred in 1938, because it is known that it was planned to reduce prices of automobile spare parts in that year in order to lessen the excessive profitability of the automobile industry. See L. Vilensky, "Finansovye Voprosy Promyshlennosti" (Financial Questions of Industry), P.Kh., no. 10, 1938, p. 61. On the other hand, the new price was in effect early in 1940. Apparently, then, the increase occurred during 1939. July 1 is taken as the probable date only because it is the mid-point of the year.

1942-1943Price Quotations:

No changes in prices of automotive productions are known to have occurred between January 1, 1941, and mid-1944. The prices of 1941 are therefore assumed to have been maintained in these years.

Price Index Numbers:

Constant weight price index numbers were computed from the prices shown in Appendix Table XVII and the weighting systems of Section VI. Little is known of the production regimen of the years during the war. It seems reasonable to believe, however, that passenger car production at this time was negligible. Accordingly, for given-year weights, the weights assigned to trucks and fire engines for 1941 were used for both 1942 and 1943.

1944Price Quotations:

The price of the Zis 5 was changed on June 1, 1944, as explained in Appendix B. The 1944 price of this vehicle was taken to be the average of the two prices prevailing in the year, weighted by the time during which each was in effect. Other truck, fire engine and passenger car prices are believed not to have changed until 1945. Accordingly, the 1941 prices are assumed to have been in effect in 1944 as well.

Price Index Numbers:

Constant weight price numbers were computed from the prices shown in Appendix Table XVII and the weighting systems of Section VI. It was again assumed that passenger car production was negligible. Accordingly, for given-year weights, the weights assigned to trucks and fire engines for 1941 were used for 1944 as well.

1946-1948Price Quotations:

No changes in the prices of trucks or fire engines are known to have occurred between the general price revisions of 1944<sup>95</sup> and 1949. The truck and fire engine prices of 1945 are therefore assumed to have prevailed until the beginning of 1949.

The passenger car Gaz M-1 was replaced in 1946 by the Pobeda, or Gaz 20. No price quotation for this car is available before 1949. It is assumed that the 1949 price of this machine prevailed in the years 1946-1948 as well; this assumption is based on the reasoning of fn. "c", Appendix Table V, Appendix C.

Price Index Numbers:

Constant weight price index numbers were computed from the prices shown in Appendix Table XVII and the weighting systems of Section VI.

Given-year weights are based on the production of trucks and passenger cars in each year, as shown in Appendix Table II and the prices of Appendix Table XVII. Details as to the breakdown of truck production by model are lacking. Accordingly, the truck regimen of 1937 has been applied to the total truck figure for each year, as explained in the text, Section VI. The given-year weights so-computed are shown in Appendix Table XXIV.

## APPENDIX TABLE XXIV

GIVEN-YEAR VALUE WEIGHTS FOR TRUCKS AND AUTOMOBILES, 1946-1948

| <u>Item</u>             | (Millions of Rubles) |             |             |
|-------------------------|----------------------|-------------|-------------|
|                         | <u>1946</u>          | <u>1947</u> | <u>1948</u> |
| Trucks and Fire Engines | 1061                 | 1380        | 1974        |
| Automobiles             | 109                  | 139         | 290         |

## APPENDIX J

COMPARABILITY OF NEW AND OLD SOVIET TRUCK MODELS, 1945-1949

As stated in Section IV of this memorandum, the large-scale shift to production of new truck models that occurred between 1945 and 1949 in the Soviet Union tends to obscure 1949 price levels of trucks relative to earlier years. An attempt is made here to establish the 1949 price levels of trucks on a basis of acceptable comparability by comparisons with known price levels in 1949 and earlier years for the Zis 5, an important 3.0 ton Soviet truck.

Data supporting the contention made in Section IV that prices of other basic truck models rose relative to the price of the Zis 5 between 1937 and 1949 are presented in Appendix Table XXV.

## APPENDIX TABLE XXV

PRICES AND PRICE RELATIVES OF SOVIET TRUCKS, 1949

| (1)<br>Truck                          | (2)<br>1949<br>Price <sup>a/</sup><br>(rubles) | (3)<br>1949 Price<br>Relative<br>(1937 100) <sup>b/</sup> | (4)<br>Truck with which<br>compared to Ob-<br>tain Price Rela-<br>tive | (5)<br>1949 Price Re-<br>lative as % of<br>Zis 5 1949<br>Relative |
|---------------------------------------|------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------|
| <u>Truck</u>                          |                                                |                                                           |                                                                        |                                                                   |
| Zis 5, 3.0 ton, 76 hp.                | 24,000                                         | 235.3                                                     | Zis 5, 3.0 ton, 76 hp.                                                 | 100                                                               |
| Gaz MM, 1.5 ton, 50 hp.               | 16,500                                         | 280.7                                                     | Gaz AA, 1.5 ton, 42 hp.                                                | 119                                                               |
| Zis 21A, gas-gen., 2.5<br>ton, 47 hp. | 31,000                                         | 281.4                                                     | Zis 21, gas-gen., 2.5<br>ton, 45 hp.                                   | 119                                                               |
| Zis 150, 4.0 ton, 90 hp.              | 28,000                                         | 274.5                                                     | Zis 5, 3.0 ton, 76 hp.                                                 | 117                                                               |
| Zis 151, 4.0 ton, 90 hp.              | 46,000                                         | 361.2                                                     | Zis 6, 4.0 ton, 76 hp.                                                 | 154                                                               |
| Gaz 51, 2.5 ton, 70 hp.               | 24,000                                         | na                                                        | na                                                                     | na                                                                |

a/ SUSN 49, p. 248.

b/ All price relatives are computed by direct comparisons with the 1937 prices of the models specified in column (4), except for the Zis 21A. This price relative was established by linkage with the 1945 price relative of a related truck, the Zis 5, as explained in the text, Section IV. These price relatives, therefore, have not been adjusted for comparability, a question to be discussed momentarily in the text. However, they have been adjusted for the change in the terms of quotation from at-the-factory (franko-zavod), the basis of earlier years, to FOB (franko-vagon), the basis of 1949. Prices for the trucks in column (4) are from text Table II.

The following are considerations relevant to the comparability of the 1949 truck models, as shown in Appendix Table XXV, column (1), with their earlier counterparts, as shown in the same table, column (4).

1) Gaz MM: The only important advance reflected in the Gaz MM as opposed to its immediate predecessor, the Gaz AA, is an increase in the compression ratio of the engine from 4.2 for the Gaz AA to 4.6 for the Gaz MM.<sup>1/</sup> The chassis, weight, overall dimensions, gear set, braking system, etc. are identical

<sup>1/</sup> See Appendix D.



for both machines. Upon the introduction of this increase in power the price of the basic 1.5 truck rose by 19% relative to the price of the Zis 5, as is shown in Appendix Table XXV, column (5). It would not seem that the increased compression of the Gaz MM would make it 19% more valuable than the Gaz AA; from which it follows that the price of the 1.5 ton truck rose, in 1949, relative to the price of the 3.0 ton Zis 5. In order to obtain a price relative for 1.5 ton trucks reflective of this relative increase in price, but not reflecting the added value of the new model, the uncorrected price relative for 1949 of the Gaz MM, as shown in column (3) of Appendix Table XXV, was reduced by 10%. This is to say that the relative price of 1.5 ton trucks was considered to have advanced by 9%, the other 10% of the 19% difference in 1949 standings being laid to increased value.

2) Zis 150: This truck was intended as the immediate successor of the Zis 5,<sup>2/</sup> although both were being produced simultaneously in 1949. In this instance, not only was the compression of the engine increased, but many other features of the truck were redesigned and improved as well. For example, streamlining was introduced; air-brakes replaced the mechanical brakes of the Zis 5; the wheel base and other overall dimensions were slightly increased; and the load capacity

---

<sup>2/</sup> Korobov, op.cit., p. 16.

was increased from 3.0 to 4.0 tons.<sup>3/</sup> In general, therefore, there seems no reason to believe that the 17% additional charged for the Zis 150 over the cost of the Zis 5 reflects anything more than the additional value of the later model. Accordingly, it is felt that the price relative for 1949 for the Zis 5 reflects accurately the price standing of the Zis 150 in 1949.

3) Zis 21A: Detailed specifications of this truck have not been found. Presumably it is very similar to the Zis 21, which is the Zis 5 equipped with a gas-generator for the consumption of solid fuels. The Zis 21A, from the brief descriptions given in the price handbooks cited, appears to be slightly--about 4%--more powerful than the Zis 21. It seems most unlikely, therefore, that the Zis 21A is worth 19% more than the Zis 21, as is implied by their standing relative to the Zis 5 in and before 1949. Instead, 4%, the increase in power, is taken as reflecting the increase in value; accordingly, the price relative for the gas-generating 2.5 ton truck is taken as 270.6, which is the relative shown in Appendix Table XXV for the item, less 4%. This implies an increase in relative price vis-a-vis the Zis 5 of 15%.

4) 3.0 ton trucks: A 1949 price relative for the category "3.0 ton trucks" has been compounded from the above two calculations, inasmuch as this is the appellation most appropriate to the Zis 150 as well as to the Zis 21 and

---

<sup>3/</sup> To some extent, the increase in load capacity appears to have been the result of a change in the system of nominal ratings. Thus the Zis 5 was rated unconditionally at 3.0 tons, whereas the Zis 150 was rated as able to carry 3.0 tons on dirt roads and 4.0 tons on hardsurfaced roads. In consequence, it is referred to in price handbooks as a 4.0 ton truck. It is no doubt true of the Zis 5 as well that its capacity varies with the road surface; it is possible, though by no means certain, that under the dual rating system applied to the Zis 150, the rating of the Zis 5 would be greater.

Zis 21A. The proportions in which gas-generating and gasoline burning trucks were produced in 1949 is not known. The latest year for which such information is available is 1941, in which some 30% of all trucks were planned to be gas-generators. This has been assumed to be the proportion for 1949 as well. Accordingly, the 1949 price relatives for the Zis 5 and Zis 21A as adjusted have been averaged, given the weights of 0.7 and 0.3 respectively, to obtain a relative reflective of all "3.0 ton trucks" in 1949. This relative is 245.9.

Further support for the adoption of a relative higher than the relative of the Zis 5 to reflect the price level of this category is found in the 1949 price of the Gaz 51. This truck was first produced in 1946 and has no close counterpart among Soviet trucks of earlier years. Accordingly, it is not possible to compute a price relative for it by direct comparison with any earlier price. It properly falls in the 3.0 ton group, having a load capacity of 2.5 tons and an engine of 70 horse-power. It is, however, inferior in virtually every respect--weight, capacity, power, overall dimensions, etc.--to the Zis 5. At the same time its 1949 price was the same as that of the Zis 5, an indication that the relative price level of the group as a whole is above that of the Zis 5.

Because it was held desirable that this relative reflect the price level of such higher priced gasoline burning trucks as the Gaz 51, the single relative was taken to represent the price level of both gasoline and gas-generating trucks.

5) Zis 151: This truck is a three-axle version of the Zis 150. In this respect it is similar to the Zis 6, which is a three axle version of the Zis 5. Accordingly, it would be expected that the added value of the Zis 151 as compared with the Zis 6, would be of the same magnitude,

measured in percent, as the added value of the Zis 150 compared with the Zis 5. In the above argument, it was considered that the 17% difference between the 1949 prices of the Zis 150 and Zis 5 was adequate to reflect the difference in value between them. Accordingly, the 1949 price of the Zis 151 is reduced by 17% to render it comparable to the Zis 6 and a price relative for 1949 for 3 axle trucks of the 4.0 ton class<sup>4/</sup> is computed by a direct comparison of this adjusted price with the 1937 price of the Zis 6. The resulting relative is 314.5. This too shows an advance over the 1949 standing of the Zis 5.

---

<sup>4/</sup> Here too some ambiguity is introduced by the change in the system of capacity ratings. The Zis 151 is rated at 2.5 tons on dirt roads and 4.5 tons on hard surface. See SUSN 49, p. 248. The Zis 6 is rating without qualification at 4.0 tons.

## APPENDIX K

PRICE INDEXES PER UNIT OF DRAWBAR HORSE-POWER OF SOVIET TRACTORS, 1928-1949

In addition to measurement in terms of physical units, quantities of tractors can be measured in terms of the horse-power collectively developed by them. This is a common Soviet practice. In the case of specific tractor models, the power developed by each kind may be used as a coefficient for the rough translation of quantities of one kind of machine into quantities of another. Such translations may be of interest, for example, in fixing the cost of supplying draft power in the form of a certain tractor type as opposed to its cost in the form of some other tractor type.

Appendix Table XXVI sets forth a calculation intended to indicate the price per unit of drawbar horse-power for the tractors produced in the Soviet Union in the years 1928 through 1949.

The effort has been to obtain for each year the average price paid in the Soviet Union per unit of drawbar horse-power for all tractors of domestic production. Where possible, this has been done by valuing total production at current prices and dividing by total drawbar horse-power. Where the available data did not permit such an inclusive calculation, some approximation to it has been attempted. A more detailed discussion of the techniques employed is offered below.

In addition to the calculations for "all tractors", Appendix Table XXVI contains similar determinations for the three basic categories of tractor: Wheeled tractors, all of which are kerosine-burning in the Soviet Union; kerosine-burning tracklayers; and diesel-fueled tracklayers. The grouping of Soviet tractors into these three categories is shown in Appendix Table XXVII, which also gives their respective drawbar horse-power ratings.

## APPENDIX TABLE XXVI

PRICES AND PRICE INDEXES PER UNIT OF DRAWBAR HORSE-POWER OF SOVIET TRACTORS,1928-1949<sup>a/</sup>

| <u>Year</u> | <u>All Tractors</u> |                            | <u>Wheeled Tractors</u> |                            | <u>Tracklayers,<br/>Kerosine</u> |                            | <u>Tracklayers,<br/>Diesel</u> |                            |
|-------------|---------------------|----------------------------|-------------------------|----------------------------|----------------------------------|----------------------------|--------------------------------|----------------------------|
|             | <u>Rubles</u>       | <u>Index</u><br>(1937 100) | <u>Rubles</u>           | <u>Index</u><br>(1937 100) | <u>Rubles</u>                    | <u>Index</u><br>(1937 100) | <u>Rubles</u>                  | <u>Index</u><br>(1937 100) |
| 1927/8      | 514                 | 166                        | 431                     | 161                        | 581                              | 223                        | --                             | --                         |
| 1928/9      | 448                 | 145                        | 431                     | 161                        | 611                              | 199                        | --                             | --                         |
| 1929/30     | 443                 | 143                        | 431                     | 161                        | 611                              | 199                        | --                             | --                         |
| 1931        | 351                 | 114                        | 350                     | 131                        | 489                              | 160                        | --                             | --                         |
| 1932        | 258                 | 83                         | na                      | na                         | na                               | na                         | --                             | --                         |
| 1933        | 264                 | 85                         | na                      | na                         | na                               | na                         | --                             | --                         |
| 1934        | 267                 | 86                         | na                      | na                         | na                               | na                         | --                             | --                         |
| 1935        | 303                 | 98                         | 243                     | 90                         | 375                              | 123                        | --                             | --                         |
| 1936        | 299                 | 97                         | 263                     | 98                         | 328                              | 107                        | --                             | --                         |
| 1937        | 309                 | 100                        | 268                     | 100                        | 307                              | 100                        | 407                            | 100                        |
| 1938-1940   | 345                 | 111                        | --                      | --                         | 284                              | 91                         | 407                            | 100                        |
| 1941-1943   | 322                 | 104                        | --                      | --                         | 265                              | 85                         | 380                            | 93                         |
| 1944        | 488                 | 155                        | --                      | --                         | 488                              | 156                        | --                             | --                         |
| 1945        | 750                 | 242                        | 2000                    | 745                        | 647                              | 211                        | --                             | --                         |
| 1946        | 750                 | 242                        | 2000                    | 745                        | 647                              | 211                        | 1031                           | 253                        |
| 1947        | 760                 | 246                        | 2000                    | 745                        | 647                              | 211                        | 1031                           | 253                        |
| 1948        | 798                 | 258                        | 2000                    | 745                        | 647                              | 211                        | 1128                           | 277                        |
| 1949        | 929                 | 301                        | 1960                    | 731                        | 836                              | 272                        | 1106                           | 272                        |

<sup>a/</sup> The derivations of the figures presented in this table are set forth in the text of this appendix. The sign "--" indicates that the tractor type was not produced. The sign "na" indicates that the available information did not permit the computation of a price or index number.

## APPENDIX TABLE XXVII

DRAWBAR HORSE-POWER RATINGS OF SOVIET TRACTORS

| <u>Tractor</u>                   | <u>Drawbar Horse-Power</u> |
|----------------------------------|----------------------------|
| Wheeled:                         |                            |
| Fordson-Putilovets <sup>a/</sup> | 8                          |
| International <sup>b/</sup>      | 15                         |
| Universal <sup>b/</sup>          | 10                         |
| Tracklaying, kerosine:           |                            |
| Kommunar 50 <sup>c/</sup>        | 28                         |
| Kommunar 70 <sup>c/</sup>        | 45                         |
| Kommunar 90 <sup>c/</sup>        | 50                         |
| Kommunar 110 <sup>c/</sup>       | 60                         |
| Stalinets S-60 <sup>b/</sup>     | 48                         |
| NATI <sup>d/</sup>               | 34                         |
| Tracklaying, diesel:             |                            |
| Stalinets S-65 <sup>e/</sup>     | 50                         |
| Stalinets S-80 <sup>f/</sup>     | 64                         |
| Kirovets D-35 <sup>g/</sup>      | 25                         |

- a/ A. Dmitriev, loc.cit.. In this case, as in the case of all the other tractors cited, the effort is to obtain the actual power developed rather than the nominal rating.
- b/ Korobov, op.cit., p. 9.
- c/ SS 35, p. 55. These are nominal ratings, calculated from production data from the machines concerned expressed in physical units and in units of drawbar horse-power. The drawbar ratings, when compared with the belt horse-power developed by the engines of the tractors, appear to be fairly conservative. Accordingly they are believed to be acceptable in reliability.
- d/ Economic Commission for Europe, op.cit., Appendix I, p. 20.
- e/ N. Jasny, The Socialized Agriculture of the USSR, Stanford, 1949, p. 463.
- f/ Estimated by applying the ratio of drawbar to belt horse-power of the Stalinets S-65--50: 73--to the belt horse-power--93--of the Stalinets S-80. See Appendix D for belt horse-power ratings.
- g/ Kalendar-Spravochnik 1948 (Calendar-Reference Book, 1948), loc.cit.

As is apparent in Appendix Table XXVI, the price index per unit of drawbar horse-power for all tractors is similar to the given-year weight price index for tractors in physical units set forth in Appendix H, Appendix Table XIV. In general, in the prewar period, tracklayers were more expensive than wheeled tractors per unit of drawbar horse-power (Appendix Table XXVI). The result of this is to depress the price index per unit of horse-power relative to the conventional ~~given-year~~ weight price index in those years for which wheeled tractors were proportionately more abundant than in 1937--and to inflate it, relatively, in the other years. This pattern is precisely reversed in postwar years, when wheeled tractors were the more expensive per unit of drawbar horse-power.

The price index per unit of drawbar horse-power for wheeled tractors (Appendix Table XXVI) is almost identical with the set of price relatives calculated for wheeled tractors (Appendix H, Appendix Table XIII). This is because comparisons used in computing both the price relatives and the horse-power price index were made, in most years, for a single tractor model only.

In the case of tracklayers, again, the horse-power price indexes of Appendix Table XXVI are very similar to the price relatives for tracklayers of Appendix Table XIII (Appendix H). It is interesting to note, in this connection, that the relative price per unit horse-power rise for kerosine-burning tracklayers between 1937 and 1949 was identical to that for diesel-burning tracklayers. This is, presumably, some expression of Soviet pricing policies for tractors.

The derivations of the prices of Appendix Table XXVI follow. In those instances where more than one tractor in one of the subgroups, "wheeled", "kerosine-burning tracklayers", "diesel-fueled tracklayers", was included in the calculation, the price per unit of drawbar horse-power for the subgroup was



determined on the basis of the prices per physical unit of all the tractors in the subgroup; the value of production of all the tractors in the subgroup for the year, as set forth below, was taken and divided by the total drawbar horse-power of the tractors in the subgroup.

The index calculated for each price series was obtained by dividing the price for each year by the price for 1937.

Unless otherwise specified, the production figures referred to in the succeeding discussion are from Appendix Table I; the prices are from Appendix Table XIII; and the drawbar horse-power ratings of the various tractor models are from Appendix Table XXVII.

1927/8

Production of the Fordson-Putilovets and the Kommunar 50, the only two tractors produced, was valued at current prices; this sum was divided by production of the two tractors calculated in drawbar horse-power.

1928/9-1929/30

As in the preceding item. In these years, however, another tracklayer, the Kommunar 70, was produced in addition to the two tractors included in the calculation. As the price of this machine is not known, it is not clear what the effect of its inclusion would have been.

1931

Production of the Fordson-Putilovets, the Kommunar 50 and the International 15/30 was valued at current prices and divided by their total drawbar horse-power. The price used for the International 15/30 was 5,300 rubles, which is believed to have been its price in 1931. See Appendix K. The calculation thus omits certain tracklaying models known to have been produced. Considering the preponderance of wheeled tractors, the omission, at least in the case of the "all tractors" series, is not felt to be serious.

1932

The price per unit of drawbar horse-power is the same as that calculated for 1932 in Appendix H.

1933

The value of production of the main tractor models in this year was estimated in Appendix H. This sum was divided by the total drawbar horse-power of the tractors evaluated to produce the price per unit drawbar horsepower. Production of the Kommunar 90 is thus omitted from the calculation, but it is believed that the effect of this is small.

1934

As in the preceding item.

1935

Production of the International, the Universal and the Stalinets S-60 was valued at current prices and divided by their total drawbar horse-power. The calculation thus omits the Kommunar 90, but it is believed that the effect of this is small.

1936

As in the preceding item.

1937

Production of the International, the Universal and the Stalinets S-60 was valued at current prices. To this was added the estimated value of the NATI's and Stalinets S-65's produced. Prices for the latter two tractors were estimated by dividing their 1941 prices by the 1941 price relative for tracklaying tractors. The estimated prices are, for the NATI, 9,643 rubles; for the Stalinets S-65, 20,357 rubles. The total value obtained was then divided by the total output for the year in units of drawbar horse-power--1,182,000--as given in Tretii Plan, p. 206.

1938-1940

The tractor regimen for these years is not known. Only the NATI and the Stalinets S-65 are definitely known to have been produced in this period. Accordingly, the simple average of their 1937 prices per unit drawbar horse-power, as determined in the preceding item, is taken as the price for all tractors in these years.

1941-1943

The tractor regimen for these years is not known. Only the NATI and the Stalinets S-65 are definitely known to have been produced in any of the years of this period. Accordingly, the average of their 1941 prices per unit drawbar horse-power is taken as the price of all tractors for the years.

1944

The price per unit drawbar horse-power of the NATI is taken as the price for all tractors for this year.

1945-1946

Estimated production of the NATI and the Universal in 1945 was valued at current prices and divided by their total drawbar horse-power. The quotient was used as the price for both years. The reliability of the result thus obtained for 1946 is questionable on the following grounds: 1) The ratio of output of NATI's to Universals may have changed between 1945 and 1946. 2) The Stalinets S-80 entered production in 1946, although total output of it was probably small.

1947

The regimen of planned deliveries to agriculture for 1947, as set forth in Appendix C, was used to obtain the proportion of Universals, NATI's and Stalinets S-80's. The Kirovets D-35 was omitted from the calculation because it is known that it was not actually produced until 1948. The tractors included were valued at current prices, and the average price per unit of drawbar horse-power was calculated accordingly. Considerations pertinent to this use of the regimen of planned tractor deliveries to agriculture as an approximation to the actual production regimen are set forth in Appendix C.

1948

Again the 1947 plan of tractor deliveries to agriculture was used, this time with the inclusion of the Kirovets D-35. Valuation was made at prices of 1948.

1949

The regimen used is that of the preceding item. Valuation was made at prices of 1949; these were reduced by 2% to take account of the introduction

of price quotations on an FOB basis, as discussed in Section II.

## APPENDIX L

ABBREVIATIONS USED IN CITATIONS OTHER THAN FOR PRICE SOURCES

- SS 35 Tsentral'noe Upravlenie Narodno-Khozyaistvennikh Uchet, SSSR, Sotsialisticheskoe Stroitel'stvo 1935 (Socialist Construction 1935) Moscow, 1935.
- SS 36 \_\_\_\_\_, Sotsialisticheskoe Stroitel'stvo 1936 (Socialist Construction 1936), Moscow, 1936.
- SS 39 \_\_\_\_\_, Sotsialisticheskoe Stroitel'stvo 1933-1938 (Socialist Construction 1933-1938), Moscow, 1939.
- SSKh 1939 \_\_\_\_\_, Sotsialisticheskoe Sel'sko-Khozyaistvo SSSR, Statisticheskii Spravochnik (Socialist Agriculture of the USSR, a Statistical Handbook), Moscow-Leningrad, 1939.
- 35 Plan Gosudarstvennaya Planovaya Komissiya, SSSR, Narodno-Khozyaistvennyi Plan na 1935 (National Economic Plan for 1935, Moscow, 1935).
- 37 Plan \_\_\_\_\_, Narodno-Khozyaistvennyi Plan na 1937, (National Economic Plan for 1937), Moscow, 1937.
- Tretii Plan \_\_\_\_\_, Tretii Pyatiletnii Plan Razvitiya Narodnogo Khozyaistva SSSR, 1938-1942, Proekt (Third Five Year Plan for Developing the National Economy of the USSR, 1938-1942, Draft), Moscow, 1939.
- Itogi \_\_\_\_\_, Itogi Vypolneniya Vtorogo Pyatiletnego Plana Razvitiya Narodnogo Khozyaistva SSSR (Results of the Fulfillment of the Second Five Year Plan for the Development of the National Economy of the USSR), Moscow, 1939.
- OOK \_\_\_\_\_, Osnovnye Ob'ekty Kapital'nogo Stroitel'stvo vo vtorom Pyatiletii, 1933-1937, prilozhenie k Proekt Vtorogo Pyatiletnego Plana Razvitiya Narodno-Khozyaistva SSSR, tom I (Fundamental Objectives for Capital Investments in the Second Quinquennial, 1933-1937, appendixes to the Draft of the Second Five Year Plan for the Development of the National Economy of the USSR, vol. I), Moscow, 1934.
- PVP \_\_\_\_\_, Proekt Vtorogo Pyatiletnego Plana Razvitiya Narodno-Khozyaistva SSSR, tom I (Draft of the Second Five Year Plan for the Development of the National Economy of the USSR, vol. I), Moscow, 1934.
- FYP 2 \_\_\_\_\_, Vtoroi Pyatiletnii Plan Razvitiya Narodno-Khozyaistva SSSR, tom I (Second Five Year Plan for the Development of the National Economy of the USSR, vol. I), second edition, Moscow, 1934.

- KTs 1929/30 Kontrol'nye Tsifry Narodno-Khozyaistva SSSR za 1929/30 god (Control Figures for the National Economy of the USSR for the Year 1929/30), Moscow, 1930.
- OLT Vysshii Sovet Narodno-Khozyaistva, SSSR, Materialy k Pyatiletnemu Planu Promyshlennost', 1928/9-1932/3, tom II, Osnovnye Linii Tekhnicheskoi Rekonstruktsii Promyshlennosti SSSR, (Materials for the Five Year Plan in Industry, 1928/9-1932/3, vol. II, Basic Lines for the Technical Rebuilding of Industry in the USSR), Moscow, 1929.
- SPE Sbornik Pyatiletki, Ezhegodnik za 1931, III (Handbook of the Five Year Plan, a Yearbook for 1931, III), Leningrad, 1931.
- PS 1927/8 Promyshlennost' SSSR v 1927/8 godu, Ezhegodnik VSNKH SSSR (Industry of the USSR in the Year 1927/8, a Yearbook of the Supreme Soviet of the National Economy of the USSR), Moscow, 1930.
- SKS SSSR i Kapitalisticheskiye Strany; Statisticheskii Spornik Tekhniko-Ekonomicheskikh Pokazatelei Narodnogo Khozyaistva SSSR i Kapitalisticheskikh Stran za 1913-1937 gg., (The USSR and the Capitalistic Countries; a Statistical Handbook of Technico-Economic Indicators of the National Economy of the USSR and of Capitalist Countries during the years 1913-1937), Moscow, 1939.
- ARI American-Russian Chamber of Commerce, Trade Information from the USSR. (Note: the pages of these releases are not numbered. References to page numbers in the citations indicate the count from the first page of the release for the date cited.)
- P.Kh. Planovoye Khozyaistvo (Planned Economy).
- VP Voprosy Ekonomiki (Problems of Economics).
- ATD Avto-Trakternoe Delo (The Auto-Tractor Business).

jsg







