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PART IV

The Construction of National Income Tables and International Comparisons of National Incomes

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Between World Wars I and II national income statistics gradually emerged as the most comprehensive and important barometer of economic conditions. More recently, national income has gained as a determinant of international economic policies.[1] For national income statistics to be adequate as a factual background for shaping international economic policies, it is imperative that those of different countries be put on a comparable basis and that the problems involved in international comparisons be clearly recognized and, if possible, practical solutions worked out.

International comparisons of national income will be greatly facilitated if the statistics of different nations are presented in some unified form. Section I suggests a possible system. The chief feature is that the data basic to the construction of national income tables constitute an intrinsic part of the 'standard' system so that the consistency of the various concepts of national income included in the tables can be proven by simple arithmetic. How the characteristics of different economies might affect the contents of the items in the 'standard tables' is discussed in Section II, and illustrated by the Chinese economy. Section III deals with some of the problems involved in comparing productivity, economic welfare, 'purchasing power', and economic structure on the basis of national income data. Many others, such as those connected with depreciation and capital gains and losses, are not discussed. All national income statistics necessitate arbitrary specifications and classifications of economic data, many of which are inherently incapable of being specified and classified; and in any international comparison many qualitatively incompatible items are set against one another. Any solution must, therefore, be more or less arbitrary.[2]

[1] The Council of the United Nations Relief and Rehabilitation Administration requires each member government (whose home territory has not been occupied by the enemy) to make a contribution approximately equal to 1 percent of its national income for the year ending June 30, 1943. The plans tentatively worked out by the technical experts of the Treasury and other departments of the United States Government include national income as one of the factors determining a member's subscription to the capital of the International Stabilization Fund and the United Nations Bank for Reconstruction and Development.

[2] See the discussion of attempts to avoid this arbitrariness by means of indifference analysis (Sec. III, 1B and 2).

I National Income Statistics and Their Basic Data
A System of Presentation

The first condition for international comparability of national income statistics is a common system of presentation. This 'standard' system should cover as many concepts of national income as possible. One concept is really no more 'fundamental' than another; each has its own functions. The 'standard' tables should be so constructed that the interrelations among the various concepts are clearly shown and that one can use any part of the tables for certain purposes.

Such a 'standard' set of tables has recently been devised by J. E. Meade and Richard Stone.[3] Probably the first attempt in the direction of international unification of national income statistics, it deserves serious attention. An attempt at unification can be facilitated by looking at the problems from as many viewpoints as possible. After commenting on the Meade-Stone approach, we try to construct a different system of tables.

1 *Comments on the Meade-Stone Approach*[4]

The major shortcoming of the Meade-Stone system is that not all basic data requisite for the construction of national income tables are given. It is entirely possible to present the basic data in a systematic manner as a coherent part of the 'standard' tables. Indeed, such a systematic presentation is indispensable to prove the mutual consistency of the various concepts of national income included. Rather indirect methods of ensuring the balance of the various concepts of national income at factor cost are given in Section VIII of the Meade-Stone article, e.g., every transaction is traced through the economy. The inclusion of the basic data in the 'standard' tables will bring out the interrelations among the various concepts and make it possible to prove their mutual consistency by simple arithmetic.

In the Meade-Stone tables national income statistics are presented in four ways.[5] Several other ways may serve certain purposes better. International comparisons would be facilitated if more concepts and forms of presentation were included.

[3] The Construction of Tables of National Income, Expenditure, Savings and Investment, *Economic Journal*, June-September 1941, pp. 216-33.

[4] The main analysis of this paper can be understood if this section is omitted.

[5] Their Table A gives net national income, output, and expenditure, all con-

The following comments, none of which is new, on the treatment of certain items in the Meade-Stone tables indicate differences in judgment and opinion rather than criticisms of the logic of the Meade-Stone system. They are suggested by the treatments accorded by other writers.

1) The Meade-Stone system treats all services rendered by government to business enterprises without a specific charge as part of net final product, instead of as cost items essential for production and deductible from the sales value of private business. On the other hand, government trading products sold to business enterprises are deducted as cost items.[6] When national income is defined in terms of monetary income receipts, this procedure is quite acceptable. It clearly involves double-counting of free government services when national income is defined as the net value of goods and services produced.[7]

2) That the different treatments accorded indirect taxes and government trading profits on the one hand, and subsidy and government trading losses on the other, may lead to different national income totals (at factor cost) for two countries producing exactly the same products and services is clearly recognized by the authors themselves.[8] Government trading profits

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verted to the factor-cost basis (*op. cit.*, p. 231). Table B gives the fourth form: personal income, consumption, and savings.

[6] Government expenditures for producing free services rendered business are included in Table A, Col. III, item 16, of the Meade-Stone article. Government expenditures for trading products sold to business, on the other hand, are not (see the table on p. 223 of the Meade-Stone article).

[7] This defect is illustrated by two hypothetical cases:

a) Imagine two nations producing exactly the same products and services, identical in quantity, quality, and composition except that, for a specific government service rendered private business (same quantity and quality in both countries), government B exacts a charge but government A does it gratis. According to the Meade-Stone method, the net national income of country B would be smaller, which is unreasonable since the net products and services in the two countries are really identical.

b) Again imagine two countries producing identical products and services, with one exception: owing to differences in local situations, A has to spend more than B on police forces to maintain order so that business can be carried on. According to the Meade-Stone method, country A has the higher national income (and when national income is defined as *net* products and services produced, higher productivity!) for the strange reason that it has to spend more on police forces in order to produce the same *net* products and services as B.

The above assumption of identical products and services in the two countries is made to bring out the point. The Meade-Stone method will always inflate A's national income relative to B's whether the net outputs in the two countries are identical or not.

[8] *Op. cit.*, pp. 224-5.

and losses, except those on government trading exports, which are not singled out by the authors, should be treated in exactly the same manner as indirect taxes and government subsidies. Profits on government trading exports have nothing in common with indirect taxes. They should be treated as an item of genuine 'collective income'.

3) Interest on government debt is treated entirely as a transfer payment by the authors.[9] Whether imputed interest on government capital should be included in national income is not discussed. While it is controversial whether to include in net national income the actual government interest payments or an amount of imputed interest, this interest item certainly should not be omitted altogether. If it is, the net value added by government is understated relative to that added by business enterprises; and, for international comparisons, the national income of a country possessing a larger government capital would be too low.

4) While the authors define net national income as the "value of the income produced by, and accruing to, the various factors of production",[10] their tables include only income actually received by a production factor from abroad, and exclude income accruing abroad to this factor. Consistency requires that these two items be treated in the same way; whether the production factor is conceived as the property located abroad or its resident owner makes no difference. Otherwise, a mere modification in the dividend policy of either domestic enterprises partly owned by non-residents or foreign enterprises partly owned by residents would alter the national income figures of all nations affected. This is proper when net national income is conceived as monetary income receipts, but clearly unacceptable when it is defined, as the authors do, as the "value of the income produced by, and accruing to, the various factors of production".

The authors explain that "in column I item 1 and 2 include . . . the net income received from abroad by the government and by the owners of foreign investment".[11] Domestic business enterprises may be, indeed usually are, the principal owners of foreign investment. Since their net income from abroad has already been included in the income paid out and retained by

[9] *Ibid.*, p. 220. [10] *Ibid.*, p. 216. [11] *Ibid.*, p. 217.

these enterprises, it should not be entered in column I,[12] where only net income received from abroad by the government and individuals should appear.

5) Because Meade and Stone concern themselves largely with the concept of net national income produced, they omit international transfer payments, i.e., payments for which no economic service is rendered, such as immigrant remittances home, international charity payments, indemnities, and reparations. International transfer payments may again be of importance after the war. For certain purposes of international comparison, the appropriate concept of national income must take them into consideration.

2 *A System of Presenting National Income and Basic Tables*

Broadly speaking, there are four concepts of net national income: the net value of final products produced; the value of total net output of different sectors of the economy; the income received by, and accruing to, production factors for economic services rendered; and the flow of net monetary receipts and expenditures. Each concept, in turn, can be presented in several forms.

Tables A-G provide all the national income data required for the various purposes of international comparison discussed in this paper. The items are from the tables containing basic data on business, government, individuals', and international accounts in Appendix I.

A) *The Basic Tables (see App. 1)*

The basic data are, of course, the accounting items usually found in a profit and loss statement and a balance sheet.[13] All national income estimates must rely upon these data. Many items are usually not available; sometimes an entire table is missing. The art and science of estimating national income consists merely in the proper ways of adjusting and using available items and of replacing the missing items. The methods

[12] To say that it is included in col. I in this indirect sense is similar to saying that the sales value of business is included in col. I.

[13] Many accounting concepts are not directly applicable to national income estimates. For example, see Solomon Fabricant, On the Treatment of Corporate Savings in the Measurement of National Income, *Studies in Income and Wealth*, Vol. One. As it is impossible to discuss here all the required adjustments, proper adjustments are assumed to have been made.

of replacing missing items do not concern us here. However, a systematic arrangement of the basic data will certainly facilitate the process.

The payment and receipt items in Tables I-VI are identified by consecutive numbers and letters, which are repeated in Tables A-G to indicate the sources of the data.

The central feature of the Basic Tables is that the payment and receipt sides are always equal because the residual items — 9 of Table I, C of Table III, 26 of Table IV, and 27 of Table V — are included. This basic feature makes it possible to prove, by the simple arithmetic process given in Appendix II, that the end figures in National Income Tables A-G are either identical with or can be adjusted to equal one another. This proof is apparently the best way to ensure the mutual consistency of the National Income Tables.

Table I contains the basic data requisite to calculate the contribution of business to national income. As it is a consolidated payment and receipt statement for business enterprises as a whole, all inter-business purchases and sales of course cancel. These inter-business transactions are very important for an understanding of the economic structure of an economy. Therefore, a table for each major industry, such as agriculture, mining, manufacture, transportation, distribution, and services, should be drawn up also and inter-industrial purchases and sales included. Such tables are, indeed, indispensable for the construction of Table C.[14]

Most of the items in Table I are taken from the usual profit and loss statements (or income statements). Certain capital transactions, e.g., purchases of machinery and equipment from other enterprises, must be gotten from balance sheets. Most of the items are self-explanatory; certain detailed features are described in the notes to Table I. 'Net domestic capital formation' includes net increases in plant, equipment, and inventory. Transactions in kind should be incorporated in the relevant items; e.g., income payments in kind should be added to both items 2 and a.

[14] See Table C, note a. The construction of Table C will to a large extent answer W. W. Leontief's criticism of current national income statistics (*The Structure of American Economy, 1919-1929*, Harvard University Press, 1941, pp. 19-20).

The left side of Table II gives government trading and service expenditures by type of payment, such as salaries, wages, purchases, and imputed items.[15] The same expenditures are rearranged on the right side of the table according to the purposes for which they are spent. This implies the allocation, by some arbitrary cost accounting method, of government expenditures to the various categories of trading, service, and capital accounts.

Many authorities have objected to such an allocation of government expenditures. It is said that government net capital formation and trading expenditure can perhaps be separated if a more business-like accounting system is established as Mr. Copeland suggests, but other government services "have such a broad reference to the needs of society at large that it is difficult to say that they serve business or that they serve individuals as members of the community".[16] My arguments in defense of allocation are that (1) while it might be conceptually difficult to differentiate, for each individual item of government services, between the consumption portion and the portion furthering business output, no one would deny that some government services are more in the nature of final consumption, and others, more intermediate; (2) an approximate value differentiation[17]

[15] The controversy centering about the imputation of interest and rent on government capital is well-known. The author agrees entirely with M. A. Copeland's opinion that:

"property income derived from government should, for purposes of estimating the social net value product, be put on an imputed basis . . . Although this proposal necessarily represents a rough procedure in the present stage of our information, none the less it is less arbitrary than . . . existing American practice . . . It is admitted that data for estimating the value of government tangible assets are poor and that difficult valuation problems are involved. But the possibility of making accurate estimates of a theoretically untenable item is not an argument for substituting it for a tenable item that can be estimated only roughly. The imputed interest item here proposed is largely independent of the eccentricities of government fiscal and financial policy and of any particular division of functions between national and local governments. Moreover, it probably more closely approximates what a full balance sheet and income statement type of government accounting would show than does . . . the item used in the National Bureau and Commerce Department estimates . . ." (Concepts of National Income, *Studies in Income and Wealth,* Vol. One, p. 28).

When national income is conceived in terms of monetary flows, actual government interest payments should of course be used (see Table G, note c).

[16] Simon Kuznets' discussion of Gerhard Colm, Public Revenue and Public Expenditure in National Income, *Studies in Income and Wealth,* Vol. One, p. 234.

[17] That is, instead of splitting the physical contents of any specific service.

to approach the relative emphases given final and intermediate services is better than complete disregard of such different emphases; (3) the allocation of government services is no more arbitrary than that of some accounting items upon which all current national income estimates depend; and (4) an attempt has been made to differentiate these services—with reasonably good results,[18] though better ones will doubtless ensue as information, experience, and government accounting systems improve.

Government tax revenues, sales receipts, and other income items are balanced against government service expenditures and other payments in Table III. Since government deficits are also included, the receipts and payments sides are naturally equal. Tables II and III cover only items entering into the calculation of national income. The actual government deficit may be different from item C of Table III because of government purchases of existing capital assets, the difference between actual payments and imputed items, etc.[19]

Except individuals' incomes received from, and accruing, abroad and their transfer payments with foreign countries, all the items in Table IV giving payments and receipts in individuals' accounts are from the preceding basic tables. The two sides of the account are balanced by the insertion of item 26, individual savings. For the sake of simplicity, all transactions of imports and exports and income paid, and accruing, abroad are assumed to be carried out by business and government and are incorporated into Tables I, II, and III, as are also expenses incurred in these transactions. If so desired, such transactions executed directly by individuals can easily be inserted in Table IV.

Table V is the usual international balance of payments.

Relations between various saving, borrowing, and capital items in Table VI can readily be derived from the preceding basic tables.

Systematic presentation of the basic data will prevent many mistakes, double counting, and confusion in drawing up

[18] R. W. Nelson and Donald Jackson, Allocation of Benefits from Government Expenditure, *Studies in Income and Wealth,* Vol. Two, pp. 315 ff.

[19] See Table G, note c.

national income tables, and will assure the mutual consistency of the tables. If notes are appended to the basic tables indicating how the substitutes for missing items were obtained and explaining the precise meaning of each item, a great deal of misunderstanding and controversy can be avoided.

B) *The National Income Tables*

In Tables A-G seven forms of presenting the four broad concepts of national income mentioned at the beginning of this Section are given by combining the relevant items in Tables I-VI in different ways. As used here, the term 'nation' refers to the group of individuals residing within the boundaries of a given political entity. The tables can, however, be converted to conform to the purely 'political' and 'territorial' concepts of the term.[20]

1) CONTENTS OF TABLES A AND B

Tables A and B give net national final products from two angles.[21] In Table A net final products are classified by the sectors of the economy that produce them in their final form. For the business sector, there are only four: sales to resident individuals for consumption; exports; services of property abroad owned by domestic enterprises (income received from, and accruing, abroad); and net domestic capital formation in the form of net increases in plant, equipment, and inventory. The portion of the value of final products attributable to imports and services of property owned by non-residents (income payments, and income accruing, to non-residents) is not the product of the 'nation' and, therefore, is deducted from the final values.

[20] See Simon Kuznets, *National Income and Its Composition, 1919-1938* (National Bureau of Economic Research, 1941), I, 50-4.

[21] The 'final products' concept is defined by the U. S. Department of Commerce as follows: "A second method of measuring national income, the so-called 'final products approach,' leads directly to estimates of national output by summing the values of all finished commodities and services produced during a given period. These finished commodities include both the products sold to consumers and those retained by business enterprises for use in further production. Thus the flow of goods and services to consumers plus the net flow to capital purposes (net capital formation) equals the net national product." (Milton Gilbert and R. B. Bangs, Preliminary Estimates of Gross National Product, 1929-41, *Survey of Current Business,* May 1942, p. 9).

As will be seen presently, this definition is less than complete, because the net flow to capital purposes' cannot be said to cover international transfer payments (for which no economic services have been rendered), which must also come from the net product of the nation.

Preferably, final products produced by business should be given separately for each major industry such as agriculture, mining, manufacture, transportation, distribution, and services.[22] For certain industries the value of final products produced would appear rather small because most of their sales are inter-business or to government and do not appear under final products as such. The relative importance of these industries in the economy can be better seen from Tables C and E than from Tables A and B.

Under the government sector another category appears: current services rendered individuals without a specific charge. These services are valued at cost.[23] Government trading products sold to business and current government services rendered business without a specific charge are instruments furthering the production of business but are not a part of society's final products.[24] Therefore, they do not appear in Tables A and B.

All business activities of persons who are independent entrepreneurs, or employees of business, government, and of private individuals are classified under business. The only other form in which an individual can produce final products is through the services of his property located abroad (income received from, and accruing, abroad).[25]

In Table B net final products are classified by the uses to which they are put. Most of the items have already appeared in A. However, Table B brings into the picture two more important items. The final products of society may be used to furnish the substance of net lending to foreign countries and of transfer payments for which no economic services are rendered by the recipients, in addition to being used for consumption, for domestic capital accumulation, and for net income accruing abroad.[26]

[22] I.e., items a, b, e + f, g, 7, and 3 + 4 should appear separately for each industry.

[23] The 'cost' approach of evaluating government services is followed in this paper. The 'sales' or 'tax' approach, proposed by Kuznets, has its own merits. The choice of any of these approaches is governed more by opinion and taste than by logic.

[24] See Sec. I 1 and I 2A.

[25] The services of owners' residences and other durable consumer goods are another item in this category if they are considered part of net national product.

[26] Income accruing abroad minus income accruing to non-residents.

Since final products consist of a bundle of goods and services, their net value must be in terms of their market prices. The concept of national income at factor cost can be adopted more logically and conveniently in Tables D, E, and F, which express national income in terms of the services of production factors (instead of goods and consumption services produced by the factors).

The adjustments required to convert net final product at market prices to net national income at factor cost are given in Tables A and B. Government trading profits on sales to resident individuals and domestic enterprises, similar in nature to indirect taxes, are deducted together with the latter from net national final product at market prices to obtain net national income at factor cost. Similarly, government trading losses are treated in the same way as government subsidies. Because the elements of risk-bearing are largely lacking in government enterprises and all factors facilitating the production of government trading products are already paid for, it seems improper to consider government profits on domestic sales as remuneration to a production factor. Furthermore, it is difficult to conceive that the nation as a whole makes a profit on itself. On the other hand, profits on government trading exports are a genuine item of collective income received by the nation from other nations and are, therefore, not deducted. For proof that net national product and income are equal after the necessary adjustments have been made, see Appendix II.

2) CONTENTS OF TABLE C

Table C gives net national product as the sum of the net values added by different sectors of the economy. The net value added by an organization is defined as the value of its output, net of depreciation, minus the value of purchases from other organizations. Since it is in terms of the value of products produced and of intermediate products purchased from other organizations, it must be at their market prices. It can, of course, be converted to national income at factor cost.

Government services rendered business without a specific charge are deducted at cost. The reason, explained in the comments on the Meade-Stone article, is consistent with omitting this item from Tables A and B.

The net value added by business should be given by major industrial divisions such as agriculture, mining, manufacturing, transportation, distribution, and services. Inter-industrial purchases and sales should be shown for each industry,[27] these items canceling in the net value added by business as a whole.

The value added by individuals qua individuals, in contrast to their activity in connection with domestic enterprises, covered under (i), is simply their income received from, and accruing, abroad (see note 25).

3) CONTENTS OF TABLES D, E, AND F

Tables D, E, and F present forms of net national income, i.e., the net value of the economic services rendered by members of society and their property in their individual and collective capacities, classified in three ways: by its recipients (Table D), by the sectors of the economy that utilize their services (Table E), and by the sources of financing its components (Table F).

Individuals' net income (Table D, item i) should be classified also by type (e.g., salaries, wages, interest, net rents, and dividends) and by size.

The net services used through business (Table E, item i) and the sources of financing business net product (Table F, item i) should be classified by major industrial divisions, and item ii of Table E divided into those used to produce free government services and those which go into trading products sold.

Most of the items in these three tables are self-explanatory. The following may need some clarification. Direct business taxes and business transfer payments abroad are paid directly out of business income[28] and are added to business savings to yield the net income received by business (Table D, item ii). For the same reason, they are added also to income payments to resident individuals and business savings to give the value of services rendered business (Table E, item i). Similarly, individuals' net income (Table D, item i) is also gross of direct personal taxes and their transfer payments.

The appearance of government income received from abroad twice in Table F may seem odd, but can easily be explained.

[27] See Table C, note a.

[28] See the definition of direct business taxes in Appendix I, Table I, note f. There is no question about transfer payments.

Government income received from abroad is a part of net national income. Flowing into the nation as the services of government-owned property abroad are being rendered, it does not need to be 'financed', but since government uses its proceeds to finance other net income paid out, it is included a second time. This is not the only item to appear twice. Business income received from abroad is included first as such, then in business savings. The sale proceeds that become a part of business savings are also counted twice.[29] The correctness of this double-inclusion is confirmed by the equivalence of Table F, after adjustments, and Table E (see App. II).

4) CONTENTS OF TABLE G

Table G presents national income in terms of flows of monetary receipts and expenditures. International and intra-national transfer payments, for which no economic services are rendered, are introduced because they are a part of such flows. They are naturally not included in national income when defined as the value of net products and services produced, or net value added, or the net value of the services of production factors.

The net flow of monetary receipts and expenditure can be traced from any sector of the economy. Table G starts with those of individuals. The sum of items D, E, F, G, and 20 gives the income and transfer receipts of individuals. After savings, taxes, and transfer payments abroad are deducted, the final figure of item i represents what is available to them for current expenditures. However, if a part of the receipts consists of income in kind, this amount also must be deducted.[30] Business current expenditures are already included in items i and iii; the rest of business receipts is available for capital purposes (item ii). Government receipts and expenditures are given in item iii.

[29] For a discussion of a similar case of double-inclusion, see Kuznets' discussion of Means' article, *Studies in Income and Wealth,* Vol. Two, p. 298.
[30] See Table G, note a.

NATIONAL INCOME TABLES (A-G)[a]

TABLE A

Net National Final Products at Market Prices

SOURCES (in Basic Tables App. I)	ITEM
	i) Produced by Business[b]
a	Sales to Resident Individuals
b	Exports
e + f	Services of Property Owned Abroad (income received from, and accruing, abroad)
g	Net Domestic Capital Formation
	Minus
7	Business Imports
3 + 4	Business Income Payments, and Income Accruing, to Non-residents
	ii) Produced by Government
	Trading Products
q	sales to resident individuals
w	exports
k	Current Services to Resident Individuals
z + A	Services of Property Owned Abroad (income received from, and accruing, abroad)
m	Net Domestic Capital Formation
	Minus
14	Government Imports
11 + 12	Government Income Payments, and Income Accruing, to Non-residents
	iii) Produced by Individuals[c]
F + G	Services of Property Owned Abroad (income received from, and accruing, abroad)
	Items (i + ii + iii) = Net National Final Products at Market Prices
	Adjustments from Net National Final Products at Market Prices to Net National Income at Factor Cost (Tables D, E, and F)
	Net National Final Product at Market Prices
	Plus
l	Government Services to Business
17	Government Subsidy
	Minus
n	Indirect Taxes
s + v	Government Trading Profits (from sales to resident individuals and domestic business)
	= Net National Income at Factor Cost

[a] All the items in these tables are taken from the basic tables in Appendix I, as identified by the numbers and letters. Their meaning is discussed in the notes to the basic tables and the text. That the National Income Tables are consistent with one another is proved in Appendix II.

[b] All the items in this group—(i) Produced by Business—should be given separately for each major industry, such as agriculture, mining, manufacturing, transportation, distribution, and service.

[c] All other business activities of individuals are included under i, the business sector

TABLE B

Uses of Net National Final Products at Market Prices

SOURCES (in Basic Tables App. I)	ITEM
	i) For Consumption[a]
a	Business Products (sold to resident individuals)[b]
q	Government Trading Products (sold to resident individuals)
k	Government Services to Resident Individuals
	ii) For Net Domestic Capital Formation[c]
g	Business
m	Government
18	Monetary Gold Import
f + A + G − 4 − 12	iii) For Net Income Accruing Abroad (income accruing abroad minus income accruing to non-residents)
27	iv) For International Lending
5 + 19 + 24	v) For Transfer Payments Abroad
	Items (i + ii + iii + iv + v) =
	Net National Final Products at Market Prices
	Adjustments from Net National Final Products at Market Prices to Net National Income at Factor Cost (Tables D, E, and F) are the same as those in Table A

[a] This item should be classified by income groups. An item of services of owners' residences and other durable consumer goods should be added under this item if they are considered a part of net national product.

[b] This item should be classified by major industrial divisions, such as agriculture, mining, manufacturing, transportation, distribution, and services.

[c] If new residences (and some other durable consumer goods) of individuals are considered capital formation, their value should be deducted from item i and inserted under ii as a separate item.

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of the economy. An item of services of owners' residences and other durable consumer goods should be added under this item if these are considered a part of net national product.

TABLE C

Net National Value Added at Market Prices

SOURCES (in Basic Tables App. I)	ITEM
	i) Added by Business[a]
a + b + c	Total Sales
e + f	Services of Property Owned Abroad (income received from, and accruing, abroad)
g	Net Domestic Capital Formation
	Minus
6	Business Purchases of Government Trading Products
7	Government Services to Business
1	Business Imports
3 + 4	Business Income Payments, and Income Accruing, to Non-residents
	ii) Added by Government
16	Government Trading and Service Expenditure
s + v + y	Government Trading Profits
z + A	Services of Property Owned Abroad (income received from, and accruing, abroad)
	Minus
13	Government Purchases from Domestic Business
14	Government Imports
11 + 12	Government Income Payments, and Income Accruing, to Non-residents
	iii) Added by Individuals[b]
F + G	Services of Property Owned Abroad (income received from, and accruing, abroad)
	Items (i + ii + iii) = Net National Value Added at Market Prices
	Adjustments from Net National Value Added at Market Prices to Net National Income at Factor Cost are the same as those in Table A

[a] The net value added by business should be classified by major industrial divisions, such as agriculture, mining, manufacturing, transportation, distribution, and services. *Inter-industrial purchases and sales should be shown for each industry, these items being canceled out against themselves in the net value added by business as a whole.*

[b] All other business activities of individuals are included under i, the business sector of the economy. An item of services of owners' residences and other durable consumer goods should be added under this item if these are considered a part of net national product.

TABLE D

Net National Income (Distributive Shares) at Factor Cost

SOURCES (in Basic Tables App. I)	ITEM
	i) Received by Resident Individuals[a]
D	From Business
E	From Government
F + G	Received from, and Accruing, Abroad
	ii) Received by Business (income accruing to individual owners)
9	Business Savings
8	Direct Business Taxes[b]
5	Business Transfer Payments Abroad[c]
	iii) Received by Government (collective income of individuals)
B	Imputed Interest and Rent
y	Government Trading Export Profits[d]
z + A	Government Income Received from, and Accruing, Abroad
	Items (i + ii + iii) =
	Net National Income at Factor Cost

Adjustments from Net National Income at Factor Cost to Net National Final Products (or Net National Value Added) at Market Prices are the Reverse of the Adjustments in Tables A, B, and C

[a] Net income received by individuals should be classified by type (e.g., salaries, wages, interest, net rents, and dividends) and also by size. Services of owners' residences and other durable consumer goods should be added under this item if these are considered a part of net national income.

[b & c] As direct business taxes and business transfer payments abroad are paid out of business income, they are added to business savings to yield business income for economic services rendered.

[d] Government trading profits from sales to resident individuals and to domestic business are treated in the same way as indirect taxes. Government trading export profits, however, are a genuine source of the collective income of the nation.

TABLE E

Uses (Employment) of Net National Services of Production Factors at Factor Cost

SOURCES (in Basic Tables App. I)	ITEM
2 + 5 + 8 + 9	i) Through Business[a]
	Services of:
	Labor
	Land
	Domestic Capital and Property Owned Abroad
	Entrepreneurship
	ii) Through Government[b]
10	Services of Labor
15	Services of Land and Domestic Capital
y	Collective Services (government trading export profits)
z + A	Services of Property Owned Abroad
	iii) Through Individuals[c]
F + G	Services of Property Owned Abroad
	Items (i + ii + iii) = Net National Services of Production Factors at Factor Cost
	Adjustments from Net National Services at Factor Cost to Net National Final Product (or Net National Value Added) at Market Prices are the Reverse of the Adjustments in Tables A, B, and C

[a] The utilization of net services of production factors through business should be classified separately for each major industry, such as agriculture, mining, manufacturing, transportation, distribution, and services.

Direct business taxes and business transfer payments abroad are paid out of the value of services utilized through business and are therefore included.

[b] This item should be classified separately for government free services and for government trading products.

[c] An item of services of owners' residences and other durable consumer goods should be added under this item if these are considered a part of net national services.

TABLE F

Sources of Financing Net National Income at Factor Cost

SOURCES (in Basic Tables App. I)	ITEM
	i) Sources of Financing Business Net Products[a]
a + b + c	Revenue from Sales
d	Government Subsidy
e	Income Received from Abroad
9	Business Savings
I	Business Borrowings[b]
	Minus
1	Indirect Taxes
6	Purchases of Government Trading Products
7	Imports
3	Income Payments to Non-residents
	ii) Sources of Financing Government Net Products
n	Indirect Taxes
o	Direct Business Taxes
p	Direct Personal Taxes
q + t + w	Trading Revenue from Sales
y	Trading Exports Profits
z + A	Income Received from, and Accruing, Abroad
z	Income Received from Abroad[c]
B	Imputed Interest and Rent
C	Government Deficit
	Minus
17	Government Subsidy
13	Purchases from Domestic Business
14	Imports
11	Income Payments to Non-residents
18	Monetary Gold Import
19	Transfer Payments Abroad
20	Transfer Payments to Resident Individuals
	iii) Sources of Financing Individual Net Products[d]
F + G	Income Received from, and Accruing, Abroad
	Items (i + ii + iii) =
	Total Financing of Net National Income at Factor Cost
	Adjustments from Sources of Net Financing at Factor Cost to Net National Final Products at Market Prices are the same as those in Tables D and E

[a] The sources of financing should be given separately for the major industrial divisions, such as agriculture, mining, manufacturing, transportation, distribution and services. Inter-industrial sales and purchases should be shown for each industry, these items being canceled out against themselves in the statement for business as a whole.

[b] Including reduction of cash, banking deposit and security holdings, in addition to actual borrowings. See Appendix I, Table VI, note b.

[c] For the reason for the double-inclusion of this item, see Sec. I 2B(3).

[d] An item of services of owners' residences and other durable consumer goods should be added under this item if these are considered a part of the net national income.

TABLE G

Net National Monetary Receipts and Expenditures

SOURCES (in Basic Tables App. I)	ITEM
	i) Available to Individuals for Current Expenditures[a]
D + E + F + G	Distributive Shares Received by Individuals
20	Transfer Payments from Government
	Minus
26	Personal Savings
25	Direct Personal Taxes
24	Individual Transfer Payments Abroad
	ii) Available to Business for Capital Expenditures
9	Business Savings
I	Business Borrowings[b]
	Minus
f - 4	Net Business Income Accruing Abroad (income accruing abroad minus income accruing to non-residents)
	iii) Available to Government for Service and Capital Expenditures[c]
n + o + p	Tax Revenue
s + v + y	Trading Profits
z	Income Received from Abroad
12	Income Accruing to Non-residents
C	Government Deficit
	Minus
17	Government Subsidy
19	Government Transfer Payments Abroad
20	Government Transfer Payments to Resident Individuals
	Items (i + ii + iii) = Net National Monetary Expenditures
	Adjustments from Net National Monetary Receipts and Expenditure to Net National Final Products at Market Prices
	Net National Monetary Expenditure
	Plus
5 + 19 + 24	Transfer Payments Abroad
f + A + G - 4 - 12	Net Income Accruing Abroad (income accruing abroad minus income accruing to non-residents)
27	International Lending
B	Imputed Government Interest and Rent
	Minus
1	Government Services to Business
	= Net National Final Products at Market Prices

[a] Individuals' income in kind must be deducted from this item to obtain actual net monetary expenditures.

[b] Including reduction of cash, deposit, and security holdings, in addition to actual borrowings; see Appendix I, Table VI, note b.

[c] This item includes only items entering the national income calculation. The actual expenditure of government may differ from this sum on account of purchases of existing capital assets from private sectors of the economy, differences between imputed interest and actual interest payments, etc. Adjustments should be made to obtain the actual monetary expenditure of the government.

II Bearing of the Characteristics of the Chinese Economy Upon International Comparisons of National Income Statistics

In Section I a sample set of national income tables is presented to indicate a way of unifying the national income statistics of different countries, covering several concepts of national income useful for many purposes. International comparability further requires that corresponding items in the national income tables of different countries should cover the same substance. This simple principle raises intricate problems when the national income of countries with substantially different characteristics and institutions are compared; e.g., China and any western nation. As no satisfactory estimate of the Chinese national income is available at present, we have to sketch certain unique characteristics of the Chinese economy in order to examine what their probable bearing would be upon a comparison of Chinese national income with that of a western nation.

1 *Family Services Rendered Gratis*

In the national income estimates of western countries it is customary to omit the value of services rendered gratis to one's self and one's family, though their bearing on the market system is often recognized.[31] Certainly the scope of family services is much wider in China than in any western country. Much of the service (cooking, weaving and spinning, tailoring, laundering, haircutting, formal teaching of children, even the construction of their own dwellings) rendered gratis in China is purchased in the United States or United Kingdom. If the Chinese estimate were put on exactly the same basis as the United States or United Kingdom, i.e., excluding all family services rendered gratis, it would be grossly understated.

Two methods of adjustment are possible. First, the imputed value of such services, on the basis of local market prices for similar services, may be added to the relevant items in the national income tables of all countries. Second, the estimates for one country (e.g., the United States) may be taken as 'standard', and an imputed value of the portion of the gratis services in

[31] See Kuznets, *National Income and Its Composition, 1919-1938* (National Bureau of Economic Research, 1941), II, 431-2.

another country (e.g., China) that would be purchased in the market in the former country be added to the relevant items in the national income tables of the latter. For instance, if 95 percent of the tailoring services in the United States are purchased in the market while the corresponding proportion in China is only 10 percent, then 85 percent of the Chinese tailoring services would be given an imputed value and be added to the purchased value of tailoring service in the Chinese national income.

2 *Peculiarities of Chinese Agriculture*

The Chinese economy is preponderantly agricultural. The rural population has been estimated by various authorities to be 75-85 percent of the total. As is usual in the agricultural sector of any economy, much of farm production and consumption does not go through the market. But in China the percentage is much larger than in any western nation. An illustration is given below.

Gross Agricultural Income, United States and China[a]
(annual average, 1921-25)

	UNITED STATES[b]		CHINA[c]	
	(million $)	%	(million yuan)	%
Cash income	9,505	79.8	13,291	59.3
Income in kind (other than rental value)	1,630	13.7	8,420	37.6
Imputed rent of operators' houses	769	6.5	686	3.1
Gross income	11,904	100.0	22,397	100.0

[a] Adjustments necessary for incorporating these data into national income calculation have not all been made. These figures are merely for rough illustration.
[b] *Statistical Abstract of the United States, 1941*, p. 706.
[c] Calculated on the basis of data given in J. L. Buck, *Chinese Farm Economy*, 1930. Detailed assumptions involved in arriving at these figures by the present writers are omitted.

Imputed on the basis of farm realization prices of similar products, agricultural income in kind, i.e., farm products consumed at the source, including the rental value of operators' houses, constitutes about 40 percent of total agricultural gross income in China, but only about 20 percent in the United States.

Should not agricultural income in kind be imputed on the basis of market prices in a near-by city, so that the same product would have the same value regardless where consumed? Prices for agricultural products in a near-by city may be different from farm realization prices because of: (a) transportation and selling costs and (b) certain institutional factors such as a possibly favorable position of the city merchant with respect to his status

both as buyer and seller.[32] As transportation and selling costs are not incurred in connection with agricultural income in kind, they are of course not to be added to the imputed value of the latter. An agricultural commodity is really not the same when it reaches urban consumers, for additional services have been incorporated in it through transportation and selling. But whether price differentials arising on account of factors in group (b) should be disregarded is a question. They do not reflect actual services added but exist merely because of certain institutional peculiarities. In fact, their influence is not restricted to the differentials between prices of agricultural products in the country and in a near-by city; they may make for different prices of the same product, agricultural and industrial alike, in different cities after differences in actual transportation and selling costs have been adjusted for. In other words, they affect nearly every item in the national income tables. There does not seem to be any method of isolating values from their influence. In Section III 1, where the method of comparing national income estimates with respect to their physical magnitudes is discussed, certain arbitrary methods are suggested to take care of the effects of these factors (see especially note 41).

The mere fact that a larger proportion of agricultural income is in kind in China than in the United States offers no special difficulty. However, the cash income figures of Chinese farmers usually contain elements of transportation and selling costs. For instance, it is customary for a Chinese farmer to walk many miles to the city, carrying his product on his back, and sell to an urban merchant. If an American farmer drives a truck of produce to the city, he deducts the cost of his gasoline and depreciation, if not his labor, from his cash income (or the Department of Commerce and the National Bureau deduct them for him). Or, if an American city merchant sends a truck to collect the produce from the farmer, the farmer's cash income does not include the transportation costs, which appear instead under 'trade'. The Chinese figures must be adjusted to put them on a comparable basis with American figures. An imputed value of the labor service and other costs involved must be given separately in the

[32] A partly monoposonic buyer of agricultural products in the country and a partly monopolistic seller in the city.

Chinese statistics and be incorporated in the farmer's net income or the gross income of 'transportation' and 'trade' in the same proportion as in the American statistics. Or the American figures may be adjusted to a basis comparable with the Chinese. Otherwise, a comparison between the proportions of American national income components (e.g., agriculture vs. trade or transportation) and of corresponding Chinese components would be misleading. Also, the value of the income in kind received by the Chinese farmer should be so imputed as to exclude the transportation and selling elements in farm realization prices.

Similar adjustments may have to be made for agricultural transactions in kind other than gross income, such as family farm labor,[33] rental payments in kind to landlords, and farm consumption in kind.[34]

The imputed rental value of land owned by operators themselves should be given separately under agricultural net income. Comparison of certain aspects of the economic structure of different nations may require such a separate listing (Sec. III 4).

Recently the Chinese government has been collecting land taxes in kind. As they are more in the nature of income or excess profits taxes than indirect taxes, an imputed value should be incorporated in the national tables under direct taxes.

The important role played by transactions in kind in China will cause the Chinese national income Table G (net national monetary receipts and expenditure)[35] and the same table for a western nation, in both of which transactions in kind are deducted from national income to reveal the net monetary flows, to differ markedly.

3 *Payments in Kind and Other Imputed Items in Non-agricultural Sectors of the Chinese Economy*

Payments in kind are more important in China also in connection with commerce, industry, and domestic employment. Shop and factory employees and domestic servants often receive their wages partly in cash and partly in kind. The value of the portion received in kind must be imputed on the basis of local prices.

[33] This item in China has been estimated to be at least as large as the sum of all cash expenditures by the farmer.

[34] Which, to a large extent, coincides with gross income in kind.

[35] See Table G, note a.

Sometimes almost the entire remuneration of apprentices is in kind—in the form of room, board, clothing, and medical care. In view of the relatively large number of apprentices, an imputed wage over and above the payments in kind must also be added on the basis of cash wages paid similar unskilled labor.

Self-finance is very common among Chinese small proprietorships and partnerships, and an imputed interest item should be given separately under their net income. Borrowing for consumption is also common among low income groups in China. Instalment payment schemes in the United States make it difficult to judge where borrowing for such purposes is more common. It would seem proper not to include interest payments on consumption loans in the national income tables dealing with real production and utilization of resources (D and E). It would, however, affect the tables dealing with monetary flows and consumption by income classes (G and B).

4 *Governmental Economic Enterprises*

The Chinese people have decided to industrialize their economy, including agriculture, as rapidly as possible after the war. In order to promote new industry and prevent economic inequality, the Chinese government will undertake on its own initiative and responsibility many economic ventures, covering wider ground than those entered into by most western governments. Most public utilities, transportation agencies, the so-called 'heavy' industries, and other fields that may be monopolistic in nature will be developed by the government, at least in the beginning.

The national income and basic tables in Section I and Appendix I, it is hoped, have adequately taken this factor into consideration. Government trading profits on domestic sales appear as a part of net national income at market prices in Tables A-C, but are deducted in a manner similar to indirect taxes to yield net national income at factor costs in Tables D-E. Government trading profits on exports are considered a genuine source of collective income in all tables. As noted in Section I 2B (1), government trading losses are treated like government subsidies.

5 *Foreign Investment in China*

It is the avowed policy of the Chinese government to welcome and encourage foreign investment in China after the war and

to give it fair and non-discriminatory treatment under Chinese laws and regulations. The flow of foreign capital to China, it is hoped, will help to raise national output and income, which will in turn contribute to world prosperity.

The construction of the national income tables makes clear that national income is estimated on a 'residence' basis. Imports of all kinds, including capital equipment sent to China to substantiate foreign investments, are not considered part of current Chinese national income. In case of a net capital import, item 27 in Table B will become negative, reflecting the fact that a part of domestic capital formation and consumption is due to borrowing from abroad. Income remitted, and accruing, to investors residing abroad is also deducted. On the other hand, income received by, and accruing to, Chinese resident participants in foreign or joint Chinese-foreign enterprises is of course included in Chinese national income. Should a 'nationality' basis be preferred, the national income tables in Section I can easily be modified.

R. R. Nathan gives two bases for calculating the income of a region having transactions with other regions: (a) "The net value of product *derived by* residents of a state from their labor and from the services of their property, wherever located", and (b) "the net value of product *derived from* the resources of labor and wealth employed in a state".[36] The concept adopted in this paper is his concept (a). However, all the relevant items are given separately in the tables in Section I so that the figures can easily be converted to conform to his concept (b), which serves many useful purposes. These have been so eloquently set forth by Mr. Kuznets that we cannot do better than quote him at length:[37]

"It would seem, offhand, that since evaluative uses are grounded largely in the interests of a given group of people they call for state allocation of income *derived by* to the exclusion of allocations *derived from*. But this

[36] Some Problems Involved in Allocating Incomes by States, *Studies in Income and Wealth,* (National Bureau of Economic Research, 1939) Vol. Three, p. 411.

[37] Mr. Kuznets' comment on Mr. Nathan's article, *ibid.,* pp. 432-3. All his references to 'state' can be changed to 'nation', and his reference to 'the South' to 'a debtor nation' or 'a colonial economy', without changing the meaning of his analysis. If both the 'derived by' and 'derived from' approaches are used for a country relying on foreign capital and entrepreneurship, the influence of foreign economic interests will be evident when the two final figures are compared.

inference overlooks the possibility that consciousness of kind may extend to the productive resources to which a given group applies its labor; that inhabitants of a given state may have a sense of proprietary interest in the total output in whose production they participate; and that their judgment of the performance of the economic system in its bearing upon them may be largely dependent upon a comparison of their share with the total they assisted in producing. This is especially the case when a group living in a given state contributes only one of the productive factors, the others being contributed by residents of other states. To refer again to the possible feeling of the South as an exploited region, its residents must obviously base their judgment not only upon what income they receive but upon a comparison of that income with income originating in the productive activity in which they participate. If we assume that all residents of the South are in receipt of service incomes only, whereas property income and business savings accrue to residents outside, the important questions that must be answered are: Is income produced in the South relatively smaller than in other parts of the country? Is the distribution of income as between service income payments on the one hand and property income and business savings on the other substantially different from that in other parts of the country?"

Foreign investment in China and in other nations can be treated in the same way, and the general discussion of international comparisons of national incomes with respect to international transactions in Section III seems to cover China's case.

6 *Other Characteristic Chinese Institutions*

Institutions such as Buddhist and Taoist temples, clan halls, and natives' guilds in China have no counterparts in western nations. Whether their receipts should be treated as transfer payments or as income is an open question. They might be treated like those of Christian churches in western nations.

The discussion in this section concerns the principles for dealing with these characteristic items. Once these principles are established, the treatment of the specific items in the basic tables (App. I) is easy. The mutual consistency required in the national income tables, after these items have been modified, can be assured by following the method suggested in Appendix II. It will lead to an unique arrangement of these items in the national income tables. No detailed discussion of the procedures is necessary in this connection.

III International Comparisons of Productivity, Economic Welfare, Purchasing Power, and Economic Structure

National income may be compared for many purposes, e.g., to show differences in productivity, economic welfare, purchasing power, and economic structure. A common pattern of presenting national income statistics of different nations, as discussed in Section I, and the few adjustments to correct the bias of comparison due to differences in market structures, as suggested in Section II, are merely steps in a series of adjustments preliminary to international comparisons of national income. They solve by no means all the problems arising from differences in institutions, customs, and the physical characteristics of different economies.

1 *Productivity*

Both specific industries and the over-all economy can be compared internationally in respect of productivity. Each requires different sets of information in the national income tables, and in addition, some data not included in the national income tables, especially on prices.

A) *International Comparisons with respect to a Given Industry*

Productivity may be measured by sales, gross income,[38] or net value added,[39] depending upon the purpose for which the comparison is made. A comparison of railway revenues in the United States and China illustrates the complexity of the problems. The relevant data are:[40]

	UNITED STATES	CHINA
Total Revenue (millions)	$3,019	148 yuan
Traffic		
Freight (million ton-miles)	270,292	4,278
Passenger (million passenger-miles)	18,069	2,520
Revenue per		
Ton-mile	$0.0099	0.0221 yuan
Passenger-mile	0.0192	0.0211 yuan

The revenue from railway services, $3,019 million and 148

[38] Sec. I, Table C, i; i.e., a + b + c + e + f + g.

[39] The end figure of Table C, i; i.e., a + b + c + e + f + g − 6 − 1 − 7 − 3 − 4.

[40] These figures are for illustration only. Many necessary detailed adjustments, especially in the Chinese data, have not been made. The United States figures, for 1934, are from the *Statistical Abstract of the United States, 1940* (Department of Commerce), pp. 434 and 436. The Chinese figures, for the fiscal year 1934-35, are calculated from data in the *Statistical Abstract of the Republic of China, 1940* (Directorate of Statistics, National Government). The total revenues are simply the sum of freight and passenger revenue. Miscellaneous revenues are omitted.

million yuan, is determined by the peculiar demand and supply conditions in the two countries. Obviously, it cannot be used to compare the gross *physical* output of railway services. First, the pecuniary valuations given these outputs by the respective economies may not have anything to do with the relative quality of the railway services, from a technical standpoint. Second, since railway services do not enter international trade in any direct fashion, the exchange rate is not a satisfactory means of converting revenues to a common currency for purposes of comparison.

The difficulties arising from differences in quality cannot be overcome except by arbitrary solutions, arbitrary in the sense that the judgment of the person making the comparison will affect the relative valuations. But subjective judgments are not necessarily devoid of scientific meaning. Again, take the railway services as an example. The relative quality of United States and Chinese railway services may be expressed by a ratio worked out by transportation experts in terms of technical standards (i.e., safety, speed, comfort, and convenience).[41] When the object of the comparison is to get a relative picture of the physical volume of goods and services produced, it is difficult to think of anything less arbitrary than the judgment of technical experts in the respective fields, except perhaps for a few items giving purely emotional or spiritual satisfaction, such as music and art. Such items would not loom large in the total national product. In any case, this procedure is less arbitrary than converting revenues in two countries to a common currency by the exchange rate.

Even after the problem of quality differences is solved in this arbitrary manner, there is still the difficulty of differences in the relative valuations given freight and passenger services in the two economies.[42] How should freight and passenger services be

[41] E.g., Chinese freight service may be valued at 80 percent of the American rate, $0.0099 per ton-mile; passenger services at 50 percent of the American rate, $0.0192 per passenger-mile.

When the ratios of the unit values of the same product in different countries have been adjusted to proportions reflecting quality differences alone, the effects of certain institutional factors on these unit values (see Sec. II 1) are also eliminated.

[42] The American relative valuation is $\frac{\text{ton-mile}}{\text{passenger-mile}} = \frac{0.0099}{0.0192}$; the Chinese ratio, $\frac{0.0221}{0.0211}$.

combined so that total railway services can be compared? If *both* freight and passenger traffic are greater in country A than in B after quality differences have been corrected for,[43] the total physical volume of railway services is larger in the former. But it is difficult to say how much larger without a system of weighting. Furthermore, when ton-miles are larger in A but B leads in passenger-miles, it is entirely impossible, without a set of weights, to say which railway system has the greater physical volume.

While the relative quality of the *same* service (e.g., freight service) in the two countries may be left to the experts, the relative weights by which *different* services should be combined cannot. Our sole recourse for differences in relative valuation is arbitrary statistical formulae. The best seems to be the following form of Fisher's 'ideal formula', modified by introducing quality ratios:

$$\sqrt{\frac{\Sigma Q_{Ch}\ cR_{US}}{\Sigma Q_{US}\ R_{US}} \cdot \frac{\Sigma Q_{Ch}\ R_{Ch}}{\Sigma Q_{US}\ \frac{R_{Ch}}{c}}}$$

The Q's stand for physical quantities (ton- and passenger-miles); the R's, the rates charged for these services in the two countries respectively. The c's represent the qualitative ratios in the form of percentages.[44]

This formula has several advantages. First, since it requires no exchange rate, conversion from one currency to the other is avoided. Second, as it satisfies the 'nation reversal test',[45] it is immaterial whether the values of the railway services are expressed in dollars or yuan.[46] Third, it gives equal consideration

[43] As they are in the case of American railway services vs. Chinese.

[44] On the bases of the data in Sec. III 1 A and the hypothetical proportions in note 41, the ratio of Chinese railway services to American is:

$$\sqrt{\frac{(4{,}278 \times 0.0099 \times 0.8) + (2{,}520 \times 0.0192 \times 0.5)}{(270{,}292 \times 0.0099) + (18{,}069 \times 0.0192)} \cdot \frac{(4{,}278 \times 0.0221) + (2{,}520 \times 0.0}{\frac{(270{,}292 \times 0.0221)}{0.8} + \frac{(18{,}069 \times 0.}{0.5}}}$$

$$= \sqrt{.00034368} = 0.0185 \text{ (or } 1.85\%)$$

[45] A term parallel to 'time reversal test', meaning that the numerical result works both from the United States (as the base country) to China and *vice versa*. One ratio is the reciprocal of the other, and their product is equal to one.

[46] In dollars the revenues of the railway industry in the two countries are: American, \$3,019 million; Chinese, 3,019 × 0.0185 = \$56 million. In yuan,

to the relative values placed upon freight and passenger services in the two economies.

In putting the net domestic capital formation portion[47] of the gross output of a given industry in different countries on a comparable basis the same difficulty, differences in quality and in relative valuation, is met and can be solved in the same way.

For a comparison of the net value added by a given industry, purchases from other industries[48] must be deducted from gross output, and certain international[49] and governmental[50] items must be added to, or deducted from, gross output. Purchases from other industries, a part of the sales of other industries, can be treated similarly to the sales of the industry concerned. International and governmental items require special consideration.

1) *Exports and imports.* If the productivity of industry A in the United States and in China are compared in dollar terms and the exports of United States industry A have a value of x dollars, then on the principle discussed in connection with the comparison of railway revenues, the value of the exports of Chinese industry A will be

$$x \sqrt{\frac{\Sigma Q_{Ch}\ cP_{US}}{\Sigma Q_{US}\ P_{US}} \cdot \frac{\Sigma Q_{US}\ P_{Ch}}{\Sigma Q_{US}\ \frac{P_{Ch}}{c}}} \text{ dollars.}$$ [51]

If a portion of the exports of United States industry A is imported by Chinese industry A, its value should simply be the corresponding American export value. Imports of Chinese industry A from other United States industries should be valued at the export values of the latter calculated similarly.[52] Comparison in terms of the yuan can similarly be made (see note 46).

2) *Services of property abroad owned by residents.*[53] If such property contributes to the production process, the method of calculation is similar to that for exports and imports. The modi-

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they become: Chinese, 148 million yuan; American, 148 × 1/0.0185 = 8,000 million yuan.

[47] Sec. I, Table C, i, g.

[48] See Sec. I, Table C, note a.

[49] Table C, i, e, f, 7, 3, and 4.

[50] Table C, i, 6 and 1.

[51] The Q's are the quantities of exports in the respective countries; the P's, the respective prices of exports. The c's represent qualitative ratios.

[52] These values are obtained by using the modified Fisher's 'ideal' formula for comparison of these American industries with their counterparts in China.

[53] Table C, i, e and f.

fied Fisher's 'ideal' formula would be applied to the services of similar physical properties in the two countries. If the property represents the portion of foreign securities (e.g., shares) owned by residents, the corresponding fraction[54] of the relevant portion (e.g., profits) in the net value added would be deducted from the national income of the foreign country. Domestic property owned by foreigners[55] should be treated similarly.

3) *Government items.* For government trading products,[56] the method of calculation is the same as for the product of private enterprise in this connection. However, government services rendered without a specific charge[57] are difficult to compare. The institutions of different countries may vary so widely that even technical experts are unable to judge what the qualitative ratios would approximate.[58] Furthermore, since government services are measured at cost and no physical units can be assigned to most of them, Fisher's 'ideal' formula cannot be applied to cross-weight them. The sole alternative is to make a percentage deduction on the basis of the relative valuations in the two countries. For instance, if the ratios of government free services to the gross income of industry A[59] are x and y percent respectively in the United States and China, then the product of these percentages and the respective gross income as calculated from the modified Fisher's 'ideal' formula will be deducted from gross income to get the net value added by industry A in each country. Since this is a percentage deduction, it is immaterial whether the comparison is in terms of the dollar or the yuan.

The net product of a specific industry can be compared also by means of data on the uses of the services of production factors (Sec. I, Table E). International differences in quality and relative valuations raise problems here too. The values of the services of production factors in different countries must be deflated on a quality basis and cross-weighted by the modified Fisher's 'ideal' formula. Since the quality of the services of factors is traceable only through the fruits of their production, it is easier to com-

[54] I.e., the percentage that shares owned by residents are of total shares of the foreign security under consideration.

[55] Table C, i, 3 and 4.

[56] Table C, i, 6.

[57] Table C, i, 1.

[58] The c's in the modified Fisher's 'ideal' formula.

[59] I.e., the ratio of item 1 to the sum of a, b, c, e, f, and g in Table C.

pare net value added by using Table C than Table E, which is useful for other purposes.[60]

A comparative picture of per capita productivity in a specific industry in different countries may be obtained by dividing net value added by employment figures. How net value added figures are put on a comparable basis is discussed above. The treatment of the employment figures raises a host of problems not dealt with here.

B) *International Comparisons with respect to the Over-all Economy*

J. R. Hicks has concluded that the possibility of applying the technique of indifference analysis to compare inter-temporal productivity of a given economy is very remote.[61] Indifference analysis is even less applicable to international comparisons because differences in the production substitution functions of different nations are likely to be greater than inter-temporal changes in the same economy.

It is therefore again necessary to follow the arbitrary method suggested above for international comparisons of productivity in respect of a specific industry. The modified Fisher's 'ideal' formula may be extended to cover the entire economy in such a way that all relevant items in Table C would be included. The summation symbols in the formula now cover all industries and their sub-items. After the ratio between the over-all productivity of the two countries is obtained from this formula, the comparison may be made in either currency. The 'nation reversal test' (see note 45) will be satisfied. Such a comparison would have taken into consideration, in the arbitrary manner discussed above, the quality differences between the same product in different countries and the differences in the relative valuations given the various products by different economies.

Two difficulties arise: First, how to deal with the items in one country that have no opposite numbers in the other, e.g., when two radically different economies are compared. Second, how to treat the government service items, which would be of radically

[60] See Sec. 4 below.

[61] The Valuation of the Social Income, *Economica*, New series, Vol. 7, 1940, pp. 105-23. Besides containing much original thinking, Hicks' article may be considered a partial summary of a series of articles on the theory of index numbers in the *Review of Economic Studies* and *Econometrica* in recent years.

different natures in different countries. The second difficulty is really a special case of the first, i.e., some government service items of one country would have no counterparts in the other. Obviously, we can suggest no real solution but again have to rely upon the arbitrary method proposed for treating government service items with respect to a specific industry (Sec. III 1A). Ratios of these peculiar items to the items covered by the modified Fisher's 'ideal' formula would be calculated on the original relative valuations given these items in each economy. The products of these ratios and the values obtained from the modified Fisher's 'ideal' formula will be added to or deducted from the latter. Since these are percentage additions or deductions, the comparison may be made in either currency.

2 *Economic Welfare*

In the article cited above, J. R. Hicks has conveniently summarized a method of applying the technique of indifference analysis to inter-temporal comparisons of 'economic welfare', defined as the satisfaction derived from goods and services currently consumed. The consumption portion of 'net final product at market prices',[62] together with prices of the classified items, give the essential information.

According to Hicks' summary, economic welfare could be compared 'objectively' in countries whose inhabitants have the same tastes and preferences, i.e., the same indifference function.[63] If the ratio of consumers' expenditure in country A to that in country B is higher than both the Laspeyre and Passche indices, economic welfare is definitely greater in A; if it is lower, economic welfare in B is greater. If it is higher than the Passche index but lower than the Laspeyre index, the result is indeterminate.[64]

The scope of a reasonable comparison on the basis of indifference analysis is narrow. Even within approximately identical indifference functions, serious objections may be raised to the

[62] Table B (in Sec. I), item i, with business products and government trading products classified by major items.

[63] 'Objective' in the sense that the judgment of the people making the comparison would not affect the result.

[64] Hicks has suggested a 'practical' way to settle this indeterminate case. 'Usually' the ratio would not be higher than the Laspeyre index but lower than the Passche index if the indifference functions of the two peoples are similar.

application of the indifference technique. First, it is very doubtful that indifference analysis can be applied to consumption expenditure alone, ignoring savings for future income and hoarding for security and speculation purposes as being irrelevant to the determination of the equilibrium of consumption expenditure. The 'price' and 'satisfaction' of saving and hoarding are also determinants of the allocation of current income to various purposes.[65] Data on consumption alone do not constitute a complete indifference function; therefore, indifference analysis cannot be applied to them in isolation. Second, it is inherent in the nature of indifference analysis that no definite ratings can be obtained by such a comparison, even if logically sound. It is possible to learn only that economic welfare is greater in country A than in B, but not how much.

For peoples having radically different indifference functions, it is obviously difficult, if not impossible, to apply the technique of indifference analysis to a comparison of their economic welfare. Thus, like productivity, economic welfare can be compared internationally only on some arbitrary bases. It is a matter of choosing the least arbitrary. The consumption portion of net national final product (Table B, i) should be presented in a way that, using also other information on the physical contents and nature of consumption goods and services, nutrition experts could compare food expenditures on a nutrition basis, housing experts living conditions on sanitation, safety, and convenience bases, etc.

If, in these experts' judgment,[66] all essential items in the consumers' expenditures of A are better and more substantial than those of B it is safe to say that in this sense economic welfare in A is definitely greater. If some of the essential items are better but some others are poorer in A than in B, the relative importance of the various items must be decided on some arbitrary basis. The modified Fisher's 'ideal' formula, proposed for productivity, may be applied. Or, perhaps, some 'standard consumption basket' might be worked out. Obviously a specific 'standard' would have to be set for each income group.

[65] In addition to the price of, and satisfaction derived from, consumption.

[66] Which is therefore subjective but has definite scientific meaning in the fields of the respective experts.

Attempts at such a comparison immediately lead to the conclusion that the consumption portion of Table B should be classified also by income groups. Comparison on the basis of a 'standard consumption basket' is probably the most trustworthy for the lowest income group whose consumption consists chiefly of daily necessities.

3 *Purchasing Power*

'Purchasing power' may be compared internationally in two senses. The more common is a comparison of the 'purchasing power' of different currencies in determining 'equilibrium' rates of exchange. When the 'purchasing power parity' theory of exchange was popular, the 'equilibrium' exchange rate was held to be governed by the relevant portion of the relative price levels in different countries. The bearing of the important components of national income on the exchange rate was not explicitly recognized, to say the least. With the development of national income statistics and the technique of 'aggregate analysis' in terms of such important components of national income as investment, savings, and consumption (and the multiplier) in recent years, the theory of international exchange has taken a more promising turn. Two recent works in this category may be cited as illustrations.

J. J. Polak and A. J. Brown have introduced the rate of exchange as a variable into a system of linear and of constant-elasticity equations respectively.[67] The mutual relation between the exchange rate and important components of the national income are discussed. With further development of national income statistics and improvement in the standardization of presentation, much statistical substance can be incorporated into the theoretical studies. These possibilities cannot be discussed in detail here. Suffice it to say that, for this purpose, the national income tables should be so constructed that the international transactions are explicitly introduced (e.g., Tables A and B in Sec. I) and that the concept of national income should be in terms of monetary flows (e.g., Table G) rather than actual economic services rendered.

[67] J. J. Polak, European Exchange Depreciation in the Early Twenties, *Econometrica,* April 1943, pp. 151-62; A. J. Brown, Trade Balances and Exchange Stability, *Oxford Economic Papers,* 6, April 1942, pp. 57-75.

'Purchasing power' may be compared also to gauge the relative 'purchasing ability' of a given income group in different countries. The international trader may want to know the marketing possibilities for his products to a certain income group in different countries. His sales would usually be such a small fraction of total international transactions that they would not affect the exchange rate. The information required for a comparison of 'purchasing power' in this sense is given in Table G, i. Mr. Nathan has discussed the problems involved in such a comparison very adequately in the article referred to in Section II (note 36).

4 *Economic Structure*

Most characteristics of the economic structure of an economy can be indicated by a ratio between two significant figures in the national income tables—either original values or values adjusted for differences in quality and in relative valuations by some such method as the modified Fisher's 'ideal' formula discussed above.

An international comparison of ratios of original values reveals differences in the proportions of value magnitudes as determined by the peculiar institutional set-up, taste, and preference, endowment of natural resources, current capital stock, and level of technological attainment in each country. Comparisons based on adjusted values are attempts to indicate differences in the proportions of physical magnitudes, reduced to qualitatively comparable bases and valued by arbitrary statistical methods.

Some of the significant ratios, each revealing a part of the economic structure, are suggested in the following outline. This is not, of course, an exhaustive list. The required data in the national income tables are also indicated. For each ratio two figures can be obtained on the bases just discussed.

1) *The composition of net final product.* The proportion of products of private enterprise in net national final product can be calculated by dividing item i of Table A (Section I) by the end figure of net national final product. Similar proportions may be calculated separately for each major industry.

The proportion of government products in net national final product can be calculated similarly (Table A, ii ÷ end figure). Proportions of the trading product and free service components may also be calculated.

The importance of exports and services of property owned abroad in the over-all economy and in each major industry can be calculated from items in Table A (e.g., the importance of these items in the over-all economy: [b + e + f + w + z + A] ÷ end figure).

The dependence of the over-all economy and each major industry upon imports and services of property owned by foreigners can also be calculated from Table A (e.g., the dependence of the economy on these items: [7 + 3 + 4 + 14 + 11 + 12] ÷ end figure).

2) *Relative position of different fields in the economy.* The importance of private business in the economy can be measured by dividing the net value added by private enterprise by the end figure of net national product (Table C, i ÷ end figure). The importance of each major industry may also be calculated separately. Because a major portion of the production of some industries consists of intermediate products, the net value added figure is a better indicator than the final product figure of the importance of an industry.

The importance of government production may be similarly calculated.

3) *Proportions of utilization and allocation of resources.* On the one hand, the proportions of resources utilized for consumption, domestic capital formation, international lending, international transfer, and additions to resources accruing abroad can be revealed by taking the proper ratios in Table B. On the other hand, ratios calculated from items in Table E indicate the proportions of the utilization of each major category of production factors (labor, land, capital, etc.) by various public and private sectors of the economy. The same ratios give also the proportion of income generated by each industry and organization.

The proportions by which the various categories of production factors are combined in each major field can also be calculated from Table E.

4) *Distribution of net income.* The proportions of net national income stemming from production agents can be calculated from Table D either by the type of income (e.g., wages ÷ net national income) or by its size distribution (e.g., income within the $1,000-2,000 range ÷ net national income).

5) *The financial structure.* From Table F the proportions in which the net products of the major sectors and industries are financed by current receipts, savings, and borrowings from other sectors of the economy, and government net product is financed by taxes and other sources, including imputed values, can be calculated.

The ratios at which net national purchasing power is available to individuals for current expenditure, to business for capital expenditure, and to government for service and capital expenditure, and the ratios of transfer payments (incoming and outgoing, intranational and international) to income earned can be calculated from Table G.

Appendix I

THE BASIC TABLES[a]

SOURCES OF THE DATA IN THE NATIONAL INCOME TABLES IN SECTION I

TABLE I
Basic Business Data
Consolidated Payments and Receipts of Business Enterprises[b]

	PAYMENTS		RECEIPTS
1	Indirect taxes[c]	a	Sales to resident individuals[h]
2	Income payments to resident individuals[d]	b	Exports
		c	Sales to government
3	Income payments abroad	d	Government subsidy
4	Income accruing to non-residents	e	Income received from abroad
5	Transfer payments abroad[e]	f	Income accruing abroad
6	Purchases of government trading products	g	Net domestic capital formation[i]
7	Imports		
8	Direct business taxes[f]		
9	Business savings (undistributed profits)[g]		
Total Business Payments		Total Business Receipts	

[a] For explanation of these tables see Section I. The payment (debit) and receipt (credit) items in these tables are identified by numbers and letters respectively. Identifications are for use in connection with Tables A-G in Section I.

The sum of the payment side is equal to the sum of the receipt side in all tables in this Appendix because residual items (9 of Table I, C of III, 26 of IV, and 27 of V) are included.

Naturally some items appear in more than one table in this Appendix. In order to maintain the consecutiveness of the identifications in these tables, some items may be represented by several numbers or letters.

Notes to Table 1 concluded on page 114.

Notes to Table 1 concluded:

[b] In addition to this comprehensive table, a separate table should be given for each major industry, such as agriculture, mining, manufacturing, transportation, distribution, and service. *For these separate tables, 'sales to other industries' and 'purchases from other industries' should be included in the receipt and payment sides respectively.* These items, of course, cancel in the comprehensive table.

[c] Indirect taxes are those deductible before determining business income.

[d] Salaries, wages, interest, net rents, dividends, and entrepreneurial withdrawals; *they may include payments in kind.*

[e] 'Transfer payments' are used in the sense that the payments are not made for economic services rendered by non-residents to domestic enterprises. The latter are paid for by items 3, 4, and 7. Transfer payments can, of course, be negative. Transfer payments from domestic enterprises to resident individuals (and *vice versa*) are omitted from these tables for the sake of simplicity, but can easily be inserted.

[f] Direct taxes are those not deductible before determining income. Direct business taxes should be added to business savings (item 9) to yield business savings before direct taxes.

[g] Business savings can, of course, be negative; they are net of direct taxes.

[h] Including income payments in kind to individuals.

[i] Net of depreciation allowances. The problems of depreciation and capital gains and losses are entirely ignored in this paper.

TABLE II

Basic Government Data
Trading and Service Payments and Allocation of Expenditures[a]

PAYMENTS		ALLOCATION OF EXPENDITURES	
10	Income payments to resident individuals[b]	h	Trading expenditures for sales to resident individuals
11	Income payments abroad	i	Trading expenditures for sales to domestic enterprises
12	Income accruing to non-residents	j	Trading expenditures for exports
13	Purchases from domestic enterprises	k	Expenditure for current services to resident individuals
14	Imports	l	Expenditure for current services to domestic enterprises
15	Imputed interest & rents	m	Net domestic capital formation[c]
	Government Trading and Service Expenditures		Government Trading and Service Expenditures

[a] See discussion in Sec. I 2 A.

[b] Including salaries, wages and net rent (both in cash and in kind), but *excluding* interest payments on government debt.

[c] See Table I, note i.

TABLE III

Basic Government Data
Payments and Receipts

PAYMENTS		RECEIPTS	
16	Government trading & service expenditure[a]	n	Indirect taxes[f]
17	Government subsidy	o	Direct business taxes[g]
		p	Direct personal taxes

18 Monetary gold import[b]	q Trading revenue from sales to resident individuals
19 Transfer payments abroad[c]	r Expenditures[h]
20 Transfer payments to resident individuals[d]	s Profits
21 Government savings abroad (income accruing abroad minus income accruing to non-residents)[e]	t Trading revenue from sales to domestic enterprises
	u Expenditures[i]
	v Profits
	w Trading revenue from exports
	x Expenditures[j]
	y Profits
	z Income from abroad
	A Income accruing abroad
	B Imputed interest & rent[k]
	C Government deficit[l]
Total Government Payments	Total Government Receipts

[a] Sum of each side of Table II.

[b] Including import of foreign currencies. This arrangement implies a monetary system in which gold does not circulate as active money in the domestic economy, the case in most countries at present.

[c & d] See Table I, note e. [e] This item can, of course, be negative.

[f] See Table I, note c. [g] See Table I, note f.

[h, i, j, & k] From Table II (items h, i, j, and 15).

[l] This item can, of course, be negative. The amount may be different from the actual deficits by reason of government purchases of existing assets, difference between actual payments and imputed items, etc.

TABLE IV

Basic Individual Data
Payments and Receipts

PAYMENTS	RECEIPTS
22 Consumption expenditures (business products)[a]	D Income received from domestic enterprises[e]
23 Consumption expenditures (government trading products)[b]	E Income received from government[f]
24 Transfer payments abroad[c]	F Income received from abroad[g]
25 Direct personal taxes	G Income accruing abroad[h]
26 Individual savings[d]	H Transfer income received from government[i]
Total Individual Payments	Total Individual Receipts

[a] Including consumption of income in kind. All private import and export transactions are assumed to be carried out by business (Table I, 7 and b). When individuals import directly from abroad, their transactions would be incorporated into Table I, where the expenses for such transactions would also appear. This arrangement is for the sake of simplicity. Imports and exports can be inserted in this table if so desired.

[b] Including consumption of income in kind. [c] See Table I, note e.

[d] This item can, of course, be negative. [e] Including income in kind.

[f] Including income in kind.

[g & h] These incomes are received from, and accruing in, foreign enterprises and governments. Similarly, income paid and accruing abroad are assumed to be from domestic enterprises and government, and appear in Tables I, II, and III. For the sake of simplicity, when individuals have income payments to make abroad, the payments are considered business transactions.

[i] Transfer payments to and from domestic enterprises are ignored in this paper but can be easily inserted in the tables.

TABLE V

Basic International Data
Payments and Receipts[a]

PAYMENTS		RECEIPTS[b]	
	Imports[b]		*Exports*
7	Business	b	Business
14	Government	w	Government
	Income payments abroad[b]		*Income received from abroad*
3	Business	e	Business
11	Government	z	Government
	Transfer payments abroad	F	Individual
5	Business		
19	Government		
24	Individual		
18	Monetary gold imports[c]		
27	International lending		
Total International Payments		Total International Receipts	

[a] Items 5, 19, 24, 18, and 27 can, of course, all be negative.
[b] See Table IV, notes a, g, and h. [c] Including import of foreign currencies.

TABLE VI

Basic Relations between Net Capital Formation, Saving, and Borrowing[a]

A

g	Net business domestic capital formation	9	Business savings
f	Business income accruing abroad	I	Business borrowings[b]
		4	Business income accruing to non-residents

B

g	Net business domestic capital formation	9	Business savings
f-4	Net business income accruing abroad	26	Individual savings
C	Government deficit		
G	Individual income accruing abroad		
27	International lending		

C

I	Business borrowings	26	Individual savings
C	Government deficit		
G	Individual income accruing abroad		
27	International lending		

[a] The sum of the items in the two sides of Parts A, B, and C are equal. For the meanings of the items, see the notes to preceding tables. Most of the items in this table can, of course, be negative.
[b] Including reduction of cash, banking deposits, and security holdings, as well as actual borrowings from non-business sectors of the economy. 'Business borrowings', used for want of a better term, are naturally equal to the difference between business cash expenditures and cash receipts. In terms of Table I, 'business borrowings' = items $1 + 2 + 3 + 5 + 6 + 7 + 8 - a - b - c - d - e$.

APPENDIX II

Proof of the Consistency of the Seven National Income Tables

The end figures of net national product or net national income in Tables A-G (Sec. I) are either identical or can be adjusted to equal one another because all items in the seven National Income Tables are taken from the six Basic Tables (App. I) and the sum of payments is equal to the sum of receipts in each Basic Table. Naturally any National Income Table can be proved to be equivalent to any other. The system of proof used in this Appendix, adopted for its arithmetical convenience, is as follows: $A = B$; $A = C$; $C = E$; $D = E$; $E = F$; $B = G$.

Since each table is 'chained' to all the others, each is equivalent to the other six.

1) *Proof: Table A = Table B*

Items in Table A
$= a + b + e + f + g + k + m + q + w + z + A + F + G$
$\quad - 3 - 4 - 7 - 11 - 12 - 14$
$= (a + f + g + k + m + q + A + G - 4 - 12)$
$\quad + (b + e + w + z + F - 3 - 7 - 11 - 14)$
From Table V:
$b + e + w + z + F - 3 - 7 - 11 - 14 = 5 + 18 + 19 + 24 + 27$
$\therefore$ Items in Table A
$= (a + f + g + k + m + q + A + G - 4 - 12) +$
$(5 + 18 + 19 + 24 + 27)$
= Items in Table B.

Q.E.D.

2) *Proof: Table A = Table C*

Items in Table A
$= a + b + e + f + g + k + m + q + w + z + A + F + G$
$\quad - 3 - 4 - 7 - 11 - 12 - 14$
From Tables II and III:
$w = x + y = j + y; \quad q = r + s = h + s$
$\therefore$ Items in Table A
$= (a + b + e + f + g + y + z + A + F + G - 3 - 4 - 7 - 11 - 12 - 14)$
$\quad + (h + j + k + m + s)$
From Tables I, II and III:
$h + j + k + m + s = 16 - i - l + s = -l + s + v - 6 + 16$
and $c = 13$
$\therefore$ Items in Table A
$= (a + b + e + f + g + y + z + A + F + G - 3 - 4 - 7 - 11 - 12 - 14)$
$\quad + (-l + s + v - 6 + 16) + (c - 13)$
= Items in Table C.

Q.E.D.

3) *Proof: Table C = Table E*

Items in Table C*
$= a + b + c + e + f + g + y + z + A + F + G$
$- 3 - 4 - 6 - 7 - 11 - 12 - 13 - 14 + 16 +$ Adjustment Items $(17 - n)$
$= (y + z + A + F + G)$
$+ (a + b + c + e + f + g - n - 3 - 4 - 6 - 7 - 11 - 12 - 13 - 14 + 16 + 17)$
From Table I, and because $d = 17$ and $n = 1$,
$\therefore a + b + c + e + f + g - n - 3 - 4 - 6 - 7 + 17$
$= 2 + 5 + 8 + 9$
From Tables II and III:
$-11 - 12 - 13 - 14 + 16 = 10 + 15$
$\therefore$ Items in Table C
$= (y + z + A + F + G) + (2 + 5 + 8 + 9 + 10 + 15)$
= Items in Table E.
*Items l, s, and v cancel out.

Q.E.D.

4) *Proof: Table D = Table E*

Items in Table D
$= y + z + A + B + D + E + F + G + 5 + 8 + 9$
$= (y + z + A + F + G + 5 + 8 + 9) + (B + D + E)$
Because $B = 15$, $D = 2$, and $E = 10$,
$\therefore$ Items in Table D
$= (y + z + A + F + G + 5 + 8 + 9) + (15 + 2 + 10)$
= Items in Table E.

Q.E.D.

5) *Proof: Table E = Table F*

Items in Table E
$= y + z + A + F + G + 2 + 5 + 8 + 9 + 10 + 15$
$= (y + z + A + F + G) + (2 + 5 + 8 + 9 + 10 + 15)$
From Table I:
$2 + 5 + 8 + 9 = a + b + c + d + e + f + g - 1 - 3 - 4 - 6 - 7$
From Table VI A:
$f + g - 4 = 9 + I$
$\therefore 2 + 5 + 8 + 9 = a + b + c + d + e + I - 1 - 3 - 6 - 7 + 9$
From Tables II and III, and because $21 = A - 12$,
$\therefore 10 + 15 = n + o + p + q + t + w + z + B + C$
$- 11 - 13 - 14 - 17 - 18 - 19 - 20$
$\therefore$ Items in Table E
$= (y + z + A + F + G) + (a + b + c + d + e + n + o + p + q + t + w$
$+ z + B + C + I - 1 - 3 - 6 - 7 + 9 - 11 - 13 - 14 - 17 - 18 - 19 - 20)$
= Items in Table F.

Q.E.D.

6) *Proof: Table B = Table G*

Items in Table B
$= a + f + g + k + m + q + A + G - 4 + 5 - 12 + 18 + 19 + 24 + 27$
$= (f + A + G - 4 + 5 - 12 + 19 + 24 + 27) + (a + g + k + m + q + 18)$
From Table IV, and because $a = 22$, $q = 23$, and $H = 20$,
$a + q = 22 + 23$
$= D + E + F + G + 20 - 24 - 25 - 26$
From Table VI A:
$g = 9 + I + 4 - f$
From Tables II and III, and because $21 = A - 12$, $h = r$,
$i = u$, and $j = x$,
$k + m + 18 = n + o + p + r + s + u + v + x + y + z + A + B + C$
$- 17 - 19 - 20 - 21 - h - i - j - l$
$= -l + n + o + p + s + v + y + z + B + C + 12 - 17 - 19 - 20$
$\therefore$ Items in Table B
$= (f + A + G - 4 + 5 - 12 + 19 + 24 + 27)$
$+ (D + E + F + G + 20 - 24 - 25 - 26) + (9 + I + 4 - f)$
$+ (-l + n + o + p + s + v + y + z + B + C + 12 - 17 - 19 - 20)$
= Items in Table G (including Adjustment Items).

Q.E.D.