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U.S. GEOLOGICAL SURVEY

A note on scrap in the 1992 U.S. input-output tables

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TABLES

Introduction

A key concern of industrial ecology and life cycle analysis is the disposal and recycling of scrap. One might conclude that the U.S. input-output tables are appropriate tools for analyzing scrap flows. Duchin, for instance, has suggested using input-output analysis for industrial ecology, indicating that input-output economics "can trace the stocks and flows of energy and other materials from extraction through production and consumption to recycling or disposal." Lave and others use input-output tables to design life cycle assessment models for studying product design, materials use, and recycling strategies, even with the knowledge that these tables suffer from a lack of comprehensive and detailed data that may never be resolved.

Although input-output tables can offer general guidance about the interdependence of economic and environmental processes, data reporting by industry and the economic concepts underlying these tables pose problems for rigorous material flow examinations. This is especially true for analyzing the output of scrap and scrap flows in the United States and estimating the amount of scrap that can be recycled. To show how data reporting has affected the values of scrap in recent input-output tables, this paper focuses on metal scrap generated in manufacturing. The paper also briefly discusses scrap that is not included in the input-output tables and some economic concepts that limit the analysis of scrap flows.

Scrap and Used and Secondhand Goods in the U.S. Input-Output Tables

Scrap is usually defined as pieces and fragments from manufacturing or discarded manufactured articles and parts that can be reprocessed or reused. In the 1992 U. S. input-output tables, the most recent benchmark tables produced by the Bureau of Economic Analysis (BEA), U.S. Department of Commerce, scrap is part of broad commodity group I-O 81, which is shown

in the 97-industry level tables. I-O 81 consists of sales of scrap sold by manufacturers, plus sales of used and secondhand goods and equipment by all segments of the economy, plus the imported values of scrap and used and secondhand goods that are resold in the United States. For the 498-industry input-output tables, the most detailed industry level, I-O 81 is split into two commodity subgroups, Scrap (81.0001) and Used and Secondhand Goods (81.0002).

Consumption and production for the commodity subgroups appear in the Use and Make Tables (matrices) of the U.S. input-output tables. Tables 1 and 2 are simplified examples of the official tables. Appendix 1 is a worksheet showing equations and matrices derived from the Use and Make Tables to produce economic models for performing impact analysis, and Appendices 2 and 3 show scrap output and use from the 97-industry level Use and Make Tables for 1992.

Table 1. -- Use Table (dollars)

	Industry 1	Industry 2	Final Demand	Total Commodity Output
Commodity 1	150	500	1050	1700
Commodity 2	400	125	1150	1675
Scrap	60	40	0	100
Value Added	1070	1130		
Total Industry Output	1680	1795		

Total value added equals total final demand or total gross domestic product (GDP).

Table 2. -- Make Table (dollars)

	Commodity 1	Commodity 2	Scrap	Total Industry Output
Industry 1	1400	180	100	1680
Industry 2	300	1495	0	1795
Total Commodity Output	1700	1675	100	

Those familiar with input-output tables know that the data in Table 1 trace the values of commodities used by each industry to produce its total output and the values of sales of commodities to final users, who consume and do not use the commodities in further production. Table 2 shows the industries that produce (make) each commodity and the values of commodities that each industry produces. One can see from the tables, for example, that Industry 1 produced a dollar value of 1400 of Commodity 1 (Table 2) and used a dollar value of 150 of Commodity 1 (Table 1) to produce its own industry output.

In the U.S. Use Tables, scrap (I-O 81.0001) and used and secondhand goods (I-O 81.0002) are combined as one commodity row (I-O 81) in the 97-industry Use Table, but are shown as separate rows in the 498-industry Use Table. Scrap (I-O 81.0001) is a separate commodity column in the Make Table of the 498-industry tables and accounts for almost all the commodity production of industry I-O 81 in the Make Table of the 97-industry tables. There are no data in the Make Tables for used and secondhand goods (I-O 81.0002) for the obvious reason that such products are made during earlier years, not during the year for which the input-output tables are constructed.

Although I-O's 81.0001 and 81.0002 are combined into I-O industry 81, Scrap, Used and Secondhand Goods, in the 97-industry tables, this is not a problem for analyzing industry scrap inputs. Only a small portion of the output of used and secondhand goods are intermediate inputs, almost all used by the rebuilt automotive parts and retread tire industries. The remaining used goods flow to consumers for final use and are not industry inputs. For I-O 81.0001, scrap, the U.S. census of manufactures provides most of the dollar values shown in the Make Tables.[1]

[1]Respondents report sales of scrap as miscellaneous receipts in Table 5b of the *Census of Manufactures Industry Series*. As such, the Bureau of Economic Analysis relies heavily on the data in these reports, which are collected every five years.

The Decline of Scrap Sales in the U.S. Input-Output Tables

In recent years, industry reporting of scrap sales in the census of manufactures appears to have deteriorated, with the result that industry scrap sales that appear in earlier input-output tables do not necessarily appear in later tables. For example, the 1992 U.S. input-output Make Table does not show any sales of scrap from industry 39, metal containers, but the 1987 Make Table shows a scrap sales value of $256 million from this industry.

This is also the case for several other industries that should have scrap sales in the 1992 Make Table, but do not, even though such sales appear in the 1987 Make Table. If one computes the 1987 scrap value as a percentage of each industry's total value of output for 1987 and assumes that the same percentage applies in 1992, one can compute rough estimates of what could be missing scrap sales that are shown in Table 3.

Table 3. -- Estimates of missing scrap in the 1992 U.S. Input-Output Make Table

Industry		millions of dollars
13	Ordnance and accessories	2.5
39	Metal containers	281.5
53	Electrical industrial equipment	30.7
54	Household appliances	29.2
60	Aircraft and parts	192.0
63	Ophthalmic and photographic equipment	17.1
	Total	553.0

Source: U.S. Geological Survey

If one further assumes that these estimates are reasonable and adds them to the published total of $2175 million for I-O 81.0001 in the 1992 Make Table, then the new value of $2728 million is 25% higher than the published total.[2] It should also be noted that an even earlier table,

[2]The Census Bureau will usually ask selected industries during the economic census to report scrap sales as miscellaneous receipts, sometimes as separate item labeled "sales of scrap

the 1982 U.S. Input-Output Make Table, shows scrap sales by metal consuming industries for which there are no sales reported in either the 1987 or the 1992 Make Tables. These industries are industry 56, audio, video, and communications equipment, $22 million in 1982; industry 57, electronic components and accessories, $62 million; industry 58, miscellaneous electrical machinery and supplies, $18.5 million; and industry 65A, railroads and related services, passenger ground transportation, $85.7 million.

It may be argued that part of the reason that scrap sales by industry fluctuate from one input-output year to another is because of changes in scrap prices. Industries sometimes have contractual agreements with wholesalers who buy scrap. If prices are low, there is little incentive for a wholesaler to purchase scrap from manufacturers or others if he or she may not be able to resell the scrap at an adequate profit. For the input-output years in question, however, prices for commodities related to scrap do not appear to have declined to levels that would have caused wholesalers to completely stop purchases.

The result of missing scrap sales means that total commodity output of scrap in the last four official input-output tables has been on a downward trend. This trend contrasts with the upward trends of economic activity that imply more scrap generation and sales, i.e., increasing gross domestic product (GDP) from durable goods manufacturing and increasing shipments by

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and refuse." For industries 13, 53, and 54, Census did not ask for specific sales of scrap, but asked the industries to report such sales under total miscellaneous receipts. However, for industries 13 and 54, miscellaneous receipts were not published for proprietary reasons. Total miscellaneous receipts were published for industry 53, but no separate scrap sales could be identified. For industry 39, metal containers, Census did include a separate item asking for sales of scrap and refuse on the questionnaires of the two sub industries that compose industry 39. But scrap sales were not published for proprietary reasons for one sub industry and the other sub industry did not report any sales. Industries 60 and 63 also had separate items for sales of scrap and refuse on their 1992 census questionnaires. Again, scrap sales were either withheld by Census for proprietary reasons or there were no scrap sales reported.

secondary nonferrous metals producers (SIC 3342). Overall, it appears that a large amount of scrap sales are not fully accounted for in recent input-output tables because industry did not report sales or because the Census Bureau cannot disclose sales for proprietary reasons.

Table 4. –- Scrap sales compared to gross domestic product for durable goods and shipments of secondary nonferrous metals (billions of dollars)

Year	Total sales of scrap, I-O 81.0001	Gross domestic product for durable goods	Value of shipments of secondary nonferrous metals
1977	2.3	384	3.6
1982	2.4	550	4.9
1987	2.3	833	4.4
1992	2.2	1027	6.2

Source: U.S. Bureau of Economic Analysis and *Census of Manufacturers*, U.S. Bureau of the Census.

Underreporting and the consequent low values of scrap ultimately lower the output of all commodities and industries when the input-output total requirements matrices are computed. Economists and others use these matrices to estimate impacts on the output of all industries when major changes in economic activity occur. For scrap flows, the matrix most affected is the commodity-by-commodity total requirements matrix, since this is the matrix that can best estimate the total amount of scrap generated when economic activity changes.[3]

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[3]There are two technology assumptions in input-output analysis that deal with industry production of primary and secondary commodities. With industry-based technology, it is assumed that industries produce both primary and secondary commodities with the same fixed industry input structure, no matter what type of commodity. With commodity-based technology, it is assumed that each commodity is produced with the same unique commodity input structure regardless of which industry produces the commodity. The industry-based technology assumption is used in the published U.S. input-output tables, and the commodity-by-commodity total requirements matrix shows the direct and indirect scrap inputs from all industry activity needed to produce each commodity. The industry-by-industry total requirements matrix, one of the most used matrices, particularly for regional input-output tables, does not show separate scrap inputs because no industries exist whose primary production is scrap.

Metal Scrap Purchases in the U.S. Input-Output Tables

Not surprisingly, low scrap totals mean lower values of scrap for recycling allocated as inputs to manufacturers in the input-output tables. An example of this is seen in Table 5, which compares values of scrap consumption in the 1987 and 1992 input-output tables for two broad industries: Primary Iron and Steel Manufacturing and Primary Nonferrous Metals Manufacturing. In the 97-industry tables for 1992, these industries used 78% of the total intermediate value of scrap and used and secondhand goods, with the iron and steel industry consuming almost one third of the total value.

Table 5. –- Industry output and scrap consumption for primary metals industries

	1987	1992	% change
Primary iron and steel manufacturing			
Total industry output (millions of dollars)			
Current producers' prices	68091	76565	12
1982 dollars	65117	68689	5
Value of scrap consumed (millions of dollars)			
Current producers' prices	2583	2320	-10
1982 dollars	2012	1667	-17
Primary nonferrous metals manufacturing			
Total industry output (millions of dollars)			
Current producers' prices	56376	63773	13
1982 dollars	51583	58976	14
Value of scrap consumed (millions of dollars)			
Current producers' prices	2376	3276	38
1982 dollars	1888	2269	20

Source: U.S. Input-Output Tables and producer price indexes, Bureau of Labor Statistics.

According to Table 5, the value of output generated by the U.S. iron and steel industry increased between 1987 and 1992, yet the value scrap consumed declined. This decline in scrap inputs for iron and steel is reflected in the input-output coefficients published in the direct and total requirements matrices shown in Table 6. These coefficients are used to measure the total direct

and indirect impacts on scrap consumption when major changes in economic activity occur.

Table 6. -- Scrap and secondhand goods requirements coefficients for primary metals industries, commodity by industry

	1987	1992
Direct requirements		
Primary iron and steel	0.03794	0.03030
Primary nonferrous metals	0.04215	0.05137
Total requirements		
Primary iron and steel	0.04800	0.04088
Primary nonferrous metals	0.06204	0.07592

Source: U.S. Input-Output Tables.

Specifically, to produce an extra dollar of output, the 1992 input-output table shows that primary iron and steel manufacturing requires 3.0 cents (100 cents x 0.03030) of scrap and secondhand goods instead of 3.8 cents in 1987. While this change may seem small, the 1992 input-output table indicates that the direct requirement for mostly recycled ferrous scrap has dropped about 20%. The overall effect, of course, is larger when the direct and indirect requirements are considered, i.e., the ripple effect on all industries in the economy. Assume that export demand for primary iron and steel commodities increases by $1.0 billion. In 1987, the value of commodities for scrap and secondhand goods needed directly and indirectly throughout the economy to meet this demand would have totaled $48.0 million. But in 1992, it totals $41.0 million, a 15% drop.[4]

[4]There are other industries for which the scrap input changed dramatically in 1992. One that stands out is the input of scrap and secondhand goods into industry 59B, trucks and bus bodies, trailers, and motor vehicle parts. The 1987 Use Table shows a total input of $155 million, compared to an input of $20 million in the 1992 table. Industry 59B is the industry that recycles discarded automotive products. Shipments of rebuilt parts for motor vehicles, excluding carburetors and engine electrical equipment, from Industry 59B totaled $1.4 billion in 1992 and $1.2 billion in 1987.

Moreover, there is evidence from other sources that the value of ferrous scrap consumed by the iron and steel industry as shown in the 1992 input-output table is too low. Another table in the *Census of Manufactures* shows the delivered cost (purchasers' value) of scrap consumed by industry.[5] This value is reported for most of the industries that compose primary iron and steel manufacturing in the input-output tables. One is therefore able to determine roughly if purchases increased or decreased between 1987 and 1992.[6]

In 1992, blast furnaces and steel mills, which consumed almost 85% of the scrap purchased by primary iron and steel manufacturing, reported a purchased scrap value totaling $4.1 billion. In 1987 the same industry reported a total purchasers' value of $3.7 billion. Assuming all the scrap was iron and steel scrap, and using the producer price index for iron and steel scrap to adjust for price changes, the purchasers' values in 1982 dollars are about $2.9 billion for 1992 and 1987. Both the current and constant dollar figures imply that scrap consumption, at a minimum, did not decrease in 1992 compared to 1987.

Another source for checking whether scrap inputs into iron and steel manufacturing increased or decreased between 1987 and 1992 is the former U.S. Bureau of Mines production and consumption data in the annual *Mineral Commodity Summaries*. The *Mineral Commodity Summaries* reported that all domestic consumers purchased $5.0 billion of iron and steel scrap in 1992, with about 76% of this scrap, or $3.8 billion, consumed by the steel industry. In 1987,

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[5]Table 7. *Census of Manufactures Industry Series*.

[6]To compute a producers' value, the value used in constructing the U.S. input-output tables, one must remove transportation and wholesale margin. This is very difficult to do accurately for specific commodities, because most margins in the input-output table are estimated from gross margin rates for broad industry groups. Estimates of producers' values for commodities therefore are very crude.

domestic consumers purchased $4.0 billion of iron and steel scrap, and the steel industry consumed 74% or about $3.0 billion. Again, it appears that scrap consumption by the primary iron and steel industries did not decrease in 1992 compared to 1987.

Scrap That Is Not Included in the U.S. Input-Output Tables

Input-output tables measure only financial transactions for economic activity during the input-output year, i.e., sales and purchases. Only sales and purchases of scrap therefore are recorded in the tables, and these sales and purchases are based mostly on data collected in the census of manufactures. Scrap that is not involved in a financial transaction and scrap that may be sold by other industries, such as the service industries, is usually not found in the U.S. input-output tables. If, for example, a manufacturer generates scrap and then uses this scrap in its own manufacturing process, the scrap is not included in the input-output tables. To summarize, scrap that is generated by any industry or final user, but not sold, i.e., it just sits, is given away, or is recycled in-house, is not included in the input-output tables. This means that the U.S. input-output tables cannot be used meaningfully to gauge the full impact of scrap flows from all economic activity and the potential recycling that could occur in the economy.

Unfortunately, there is no estimate of the total value of such scrap particularly scrap that is not involved in a sale or that is recycled in-house. To improve at least the input-output accounting for scrap sales only, the Census Bureau must obtain better estimates of sales in manufacturing if they can be published and investigate the extent of scrap sales in other industries. Including sales of scrap in industries other than manufacturing may be the quickest way to improve scrap flows in the input-output tables. Estimating the generation and flow of

scrap that is not sold or involved in a financial transaction would require new research and thinking in terms of National Income and Product Accounting.

The Bureau of Economic Analysis apparently has found evidence of scrap sales by at least one industry other than manufacturing. The largest scrap sale listed in the 1992 Make Table is a Bureau estimate of $521 million for used restaurant grease sold by industry 74, eating and drinking places. However, this value appears to be unusually large and the estimating procedure should be reexamined. Neither the National Restaurant Association nor the Fats and Proteins Research Foundation, Inc., could verify the reasonableness of this estimate. Moreover, the purchase of such grease implies that used grease should be an input to rendering establishments classified in the animal and marine fats and oils industry (SIC 2077). But, the input-output Use Table does not show any allocations of scrap to industry 14, food and kindred products, which includes rendering plants.

If scrap sales by non-manufacturing industries have not been large in the past, that may be changing because of efforts in recent years to increase recycling and lower the accumulation of waste. Several World Wide Web sites indicate that scrap generated in construction activity, for example, may be sold or recycled, even though no actual figures are available.[7] In fact, the classification description for one U.S. construction industry, SIC 1795 (now NAICS 235940), wrecking and demolition contractors, states that "establishments engaged in wrecking and demolition work *may or may not sell* materials derived from demolition operations."

Because there is no data showing scrap sales by industries other than manufacturing, analysts concerned with such sales are forced to use crude estimating methods. One very crude

[7]See Recyclers World at URL http://www.recycle.net and The Blue Book of Building and Construction at URL http://www.thebluebook.com.

way to estimate the possible total value of scrap sales for all construction is to assume that the ratio of scrap sales to the value of total industry output for manufacturing is the same for construction. This method suggests that the value of scrap that may have been sold by construction in 1992 is about $540 million. Such a methodology, however, cannot substitute for a thorough investigation of construction activity to determine how widespread scrap sales are and if they are significant.

Another industry that generates large amounts (and possibly sales) of scrap is the automotive services industry. According to trade groups such as the Automotive Service Association and the Automotive Recycling Association, scrap metal, cardboard, paper, batteries, tires, oil, and antifreeze are all being recycled, either in-house or by other recycling businesses. In addition, the Automotive Service Association reports that the Environmental Protection Agency has mandated that automotive repair facilities install recovery/recycling equipment for air-conditioning refrigerants. The questions for input-output analysis and materials flow analysis is whether or not these facilities sell significant amounts of scrap to recyclers and how this scrap, if it is not sold, flows to recyclers. Both associations indicate that some scrap is sold, but there is no formal data regarding dollar amounts.

One of the recycling success stories in recent years has been the collection and recycling of used motor oil. The American Petroleum Institute (API) reports that in 1997, 43 to 62 million gallons of used oil was collected and recycled from individuals who change their own oil, while service stations and automotive service facilities recycled 194 million gallons. The API further reports that about 75% of this oil is reprocessed and sold to asphalt plants, industrial boilers, utilities, steel mills, and other heavy industry. About 14% of used oil is collected and turned

over to refiners and re-refined but the input-output tables do not show any scrap inputs into the industries that would refine and process this used oil. The value of used oil that is re-refined could total at least $500.0 million, based on product line data for petroleum refining appearing in the 1992 *Census of Manufactures*.

Wholesale Scrap Dealers

If scrap is sold, given away, or hauled away for a fee, it may go briefly to the wholesale scrap and waste industry. However, because of the economic assumptions used to construct the input-output tables, it is very difficult, if not impossible, to trace flows of scrap into and out of these wholesalers. There are two reasons for this. In the input-output tables, scrap and other commodities flow directly from producers to consumers, not from producer to consumer via the wholesale and transportation industries as they often do in the actual economy.[8] Second, in the input-output tables, industry output for the wholesale and transportation industries is total gross margin, not total sales, and the margin output cannot be related directly to sales of scrap dealers published elsewhere.

Wholesale scrap and waste dealers, for example, reported total sales of all types of scrap of $24.5 billion in the 1992 *Census of Wholesale Trade*. For metal scrap, sales of ferrous scrap from all types of wholesalers totaled just over $10.0 billion, while sales of nonferrous scrap totaled just over $9.0 billion. It should be remembered that the $24.5 billion value is a purchasers' value and includes sales for scrap that was generated in other years and scrap from discarded finished goods purchased before 1992. Therefore, this total is not the sales total for scrap generated only in 1992. Yet, one can get some idea of the large size of all scrap sales that

[8]A matrix cannot be built showing flows through the trade and transportation industries.

occurred, much of it for recycling, when the $24.5 billion is compared to the total producers' value of $2.2 billion for Scrap and Used and Secondhand Goods shown in the 1992 Make Table.

Conclusion

Researchers who use U.S. input-output tables to measure flows of scrap generated when economic activity changes will always underestimate this value. This is because only sales of scrap, almost all occurring in manufacturing, are included in the input-output tables. Sales of scrap that may occur in other industries are almost never included in the tables because their size is not known and no reliable data are available. More importantly, recent economic censuses show that the reported values of scrap sold by manufacturers have been declining or disappearing. Finally, scrap that is generated by other industries and final users or disposed of in ways other than by a sale is also not included and cannot be traced in the tables. The input-output tables will remain, at best, an incomplete tool for analyzing scrap flows until improved data collection, new estimating methods, and new research determines which industries generate scrap that is both sold and not sold and what happens to it.

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Appendix 1. Input-Output Matrices Worksheet

Table 1. Use Table (dollars)

	Ind 1	Ind 2	Final Demand	TCO
Com 1	150	500	1050	1700
Com 2	400	125	1150	1675
Scrap	60	40	0	100
VA	1070	1130	2200	GDP
TIO	1680	1795		

TCO - total commodity output
TIO - total industry output
VA - value added. Total value added is equal to total final demand or gross domestic product (GDP). TVA consists mostly of employee compensation, indirect business taxes, net interest income, depreciation, and profits.

Table 2. Make Table (dollars)

	Com 1	Com 2	Scrap	TIO
Ind 1	1400	180	100	1680
Ind 2	300	1495	0	1795
TCO	1700	1675	100	

e. Industry or commodity Final Demand

	e
	1050
	1150
	0

p. Ratio of scrap to total industry output in Make Table

	p
Ind 1	0.0595238
Ind 2	0

Matrix D. Share of total commodity output produced by each industry from data in Make table

	Com 1	Com 2	Scrap
Ind 1	0.8235294	0.1074627	0
Ind 2	0.1764706	0.8925373	0

Scrap values equal zero so that demand for scrap in input-output impact models does not generate scrap in industries where it originates.

Inverse of (I - ^p)

I		**^p**		**I - ^p**	
1	0	0.059524	0	0.940476	0
0	1	0	0	0	1

$(I - \hat{p})^{-1}$

1.0632914	0
0	1

Matrix B. Commodity-by-industry direct requirements computed from Use Table. Ratio of commodity input to total industry output.

	Ind 1	Ind 2
Com 1	0.0892857	0.2785515
Com 2	0.2380952	0.0696379
Scrap	0.0357143	0.0222841

Matrix W. $[(I-\hat{p})^{-1}]D$

	Com 1	Com 2	Scrap
Ind 1	0.8756517	0.1142641	0
Ind 2	0.1764706	0.8925373	0

Matrix W is an adjustment to Matrix D. The scrap of Industry 1 is added proportionally to Industry 1's output of Commodities 1 and 2.

Inverse of (I-WB). Industry-by-industry total requirements matrix

WB

0.1053889	0.2518712
0.2282652	0.1113106

I - WB

0.8946111	-0.251871
-0.228265	0.8886894

$(1 - WB)^{-1}$

	Ind 1	Ind 2
Ind 1	1.2049405	0.3415027
Ind 2	0.3094959	1.2129694

Inverse of (I-BW). Commodity-by-commodity total requirements matrix

BW

0.1273393	0.2588198	0
0.2207775	0.0893602	0
0.0352058	0.0239703	0

I - BW

0.8726607	-0.25882	0
-0.220778	0.9106398	0
-0.035206	-0.02397	1

$(1 - BW)^{-1}$

	Com 1	Com 2	Scrap
Com 1	1.2347026	0.3509244	0
Com 2	0.2993447	1.183208	0
Scrap	0.0506442	0.0407161	1

Commodity output required per dollar of each commodity delivered to final demand.

$W[(I-BW)^{-1}]$. Industry-by-commodity total requirements matrix

	Com 1	Com 2	Scrap
Ind 1	1.1153738	0.4424858	0
Ind 2	0.485065	1.1179852	0

Industry output required per dollar of each commodity delivered to final demand.

Economic Impact Models

$TIO = W[(I-BW)^{-1}]e$ **$TCO = (I-BW)^{-1}e$**

Any changes to e will change TIO and TCO.

	Com 1	Com 2	Scrap	e	TCO
Com 1	1.234703	0.350924	0	1050	1700
Com 2	0.299345	1.183208	0	1150	1675
Scrap	0.050644	0.040716	1	0	100

Source: Mathematical Derivation of the Total Requirements Tables, Benchmark Input-Output Accounts of the United States. Bureau of Economic Analysis, U.S. Department of Commerce.

Appendix 2. Scrap, used and secondhand goods commodity output by broad industry, in the 1992 U.S. Input-Output Make Table.

Millions of dollars at producers' prices

Input-output industry		Scrap, used and secondhand goods	Total industry output
15	Tobacco products	5	40,146
20+21	Lumber and wood products	36	86,865
22+23	Furniture and fixtures	12	42,977
24	Paper and allied products, except containers	79	99,613
25	Paperboard containers and boxes	132	31,938
26A	Newspapers and periodicals	19	56,711
26B	Other printing and publishing	72	110,564
27A	Industrial and other chemicals	57	109,880
27B	Agricultural fertilizers and chemicals	2	17,831
28	Plastics and synthetic materials	29	48,040
29A	Drugs	18	62,674
29B	Cleaning and toilet preparations	11	39,628
31	Petroleum refining and related products	19	145,709
32	Rubber and miscellaneous plastics products	64	111,361
35	Glass and glass products	12	17,815
36	Stone and clay products	28	42,904
37	Primary iron and steel manufacturing	31	76,565
38	Primary nonferrous metals manufacturing	57	63,773
40	Heating, plumbing, and fabricated metal products	50	49,491
41	Screw machine products and stampings	317	34,703
42	Other fabricated metal products	17	53,974
43	Engines and turbines	17	17,044
44+45	Farm, construction, and mining machinery	21	32,031
46	Materials handling machinery and equipment	4	8,152
47	Metalworking machinery and equipment	8	25,611
48	Special industry machinery and equipment	5	20,231
49	General industrial machinery and equipment	78	29,814
50	Miscellaneous machinery, except electrical	17	25,071
51	Computer and office equipment	3	63,924
52	Service industry machinery	36	26,455
55	Electric lighting and wiring equipment	3	19,111
59A	Motor vehicles (passenger cars and trucks)	24	150,738
59B	Truck and bus bodies, trailers, and motor vehicle parts	231	80,266
61	Other transportation equipment	11	30,000
62	Scientific and controlling instruments	9	105,489
64	Miscellaneous manufacturing	2	41,315
65A	Railroads and related services; passenger ground transport	4	55,754
68C	Water and sanitary services	114	19,182
74	Eating and drinking places	521	280,708
	Total	2,175	2,374,058

Source: Table 1. – The Make of Commodities by Industries, 1992, *Survey of Current Business*, v. 77, no. 11, November 1997, p. 71.

Appendix 3. Major broad-industry users of scrap, used and secondhand goods, in the 1992 U.S. Input-Output Use Table.

Millions of dollars at producers' prices

Input-output industry		Scrap, used and secondhand goods
35	Glass and glass products	100
37	Primary iron and steel manufacturing	2,320
38	Primary nonferrous metals manufacturing	3,276
58	Miscellaneous electrical machinery and supplies	79
59B	Truck, and bus bodies, trailers, and motor vehicle parts	20
75	Automotive repair and services	507
	Total	6,302
	Consumption by all industries	7,147

Source: Table 2.1 – The Use of Commodities by Industries, 1992, *Survey of Current Business*, v. 77, no. 11, November 1997, pp. 72-81.

The symmetric input-output table is accompanied by non-symmetric supply and use tables, tables of domestic and imported products use, tables of transport and trade mark-ups, and a tax table. All these tables include 24 producing sectors3 and commodity groups aggregated according to Russian national industrial classification (Obsherossiiskii klassifikator otraslei narodnogo hozaistva, OKONH4) on a commodity by industry basis. The full list of input-output tables published by Rosstat is presented in the Table A.3. By the time of creation of the Russian I-O tables for GTAP, there were available o...Â This level of details permitted us to build a one-to-one mapping to GTAP. INPUT-OUTPUT analysis plays so important a role in modern economics that its history deserves thorough study. The development of modern input-output methods is connected primarilywith the work of W. Leontief, The structureof the AmericanEconomy 1919-1929, (1941) and Studies in the structureof the American Economy, (1953), which was recognised when he was awarded the Nobel prize in Economics in 1973.Â This leads us to the conclusion that Nuti's attribution of a role to Chayanov in the development of input-output analysis is unfounded. Moreover, the author of this note has searchedthe Soviet economic literatureof the 1920s carefully and has found no evidence of Dmitriev's influence on planning concepts. Look at the other input values. Each term in the input became the term in the output when 3 was added to it. The rule states that four was added. Therefore, this is not a viable rule. Here is another function. Determine if is a function rule for the data in the table below. Input. Output.Â Then, see if the function rule works for each term in the table by plugging the input into the expression and seeing if it equals the listed output? The answer is yes, this rule works for this table. Example 2. Write a function rule to represent the data in this table. Input. Output.Â Found a content error? Tell us. Notes/Highlights. Color. Highlighted Text. Notes. Show More. Image Attributions.