MATERIALS, ENGINEERING, AND THE ECONOMY: AN INPUT-OUTPUT STUDY OF TECHNICAL DECISIONS IN THE UNITED KINGDOM

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VOLUME II

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TABLE (1.1) Typical production cost breakdown for a firm.

Labour	15%
Material	45%
Overheads	30%
Profit	10%
TOTAL	100%

Source: Rawicz-Szczerbo[2]

FIGURE (1.1) RESOURCES CONVERSION NETWORK. Natural resources are converted to final products in a network of interdependent engineering processes. Capital stock and manpower are used to operate the network.

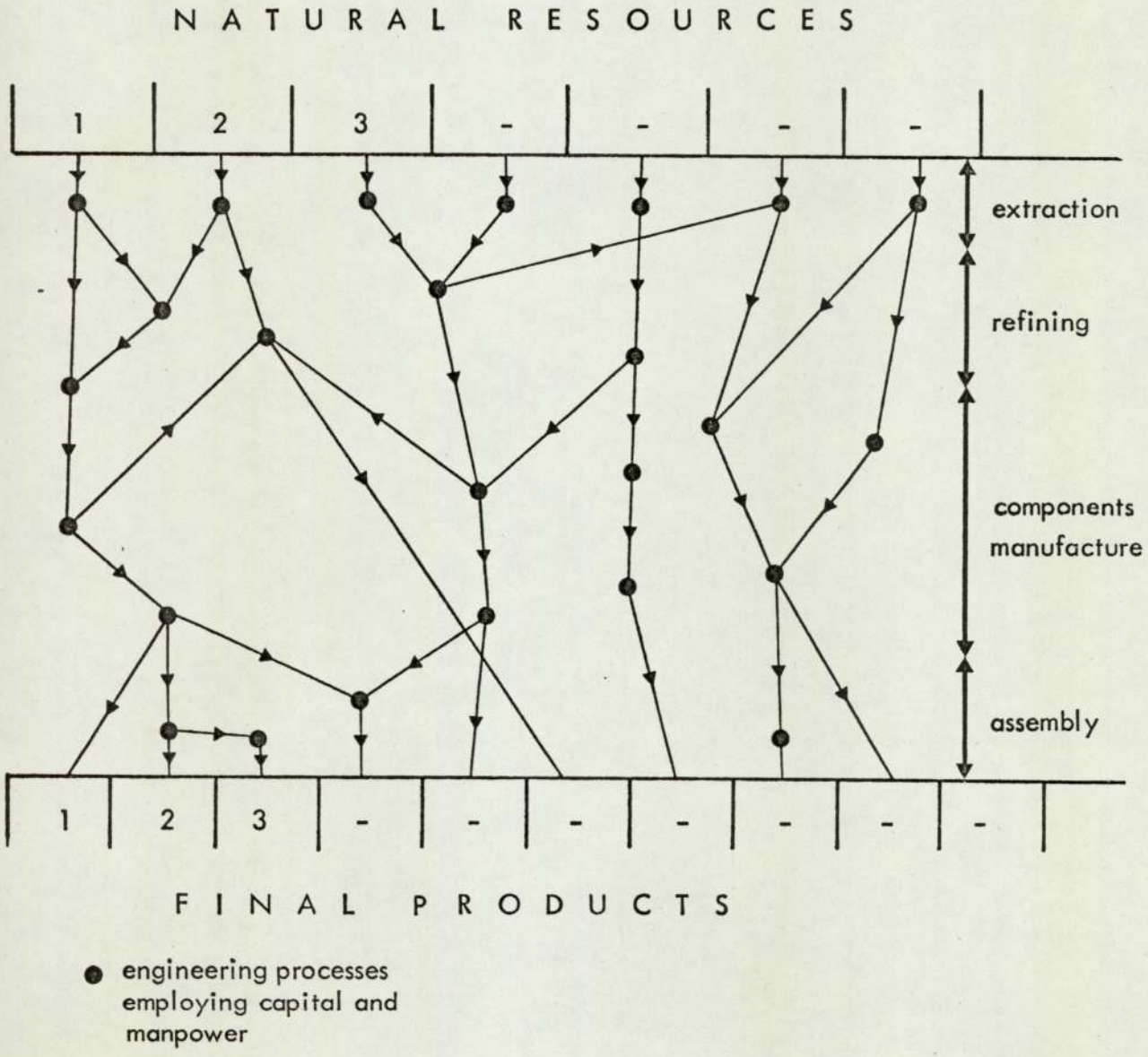


FIGURE (1.2) CONVERSION NETWORKS OF CHEMICAL PROCESSES.

(a) Plastic Products, showing proportion of crude oil in product price, early 1973, in ( ). * Naphtha price fluctuates independently of crude oil cost.

Source: ICI[7]

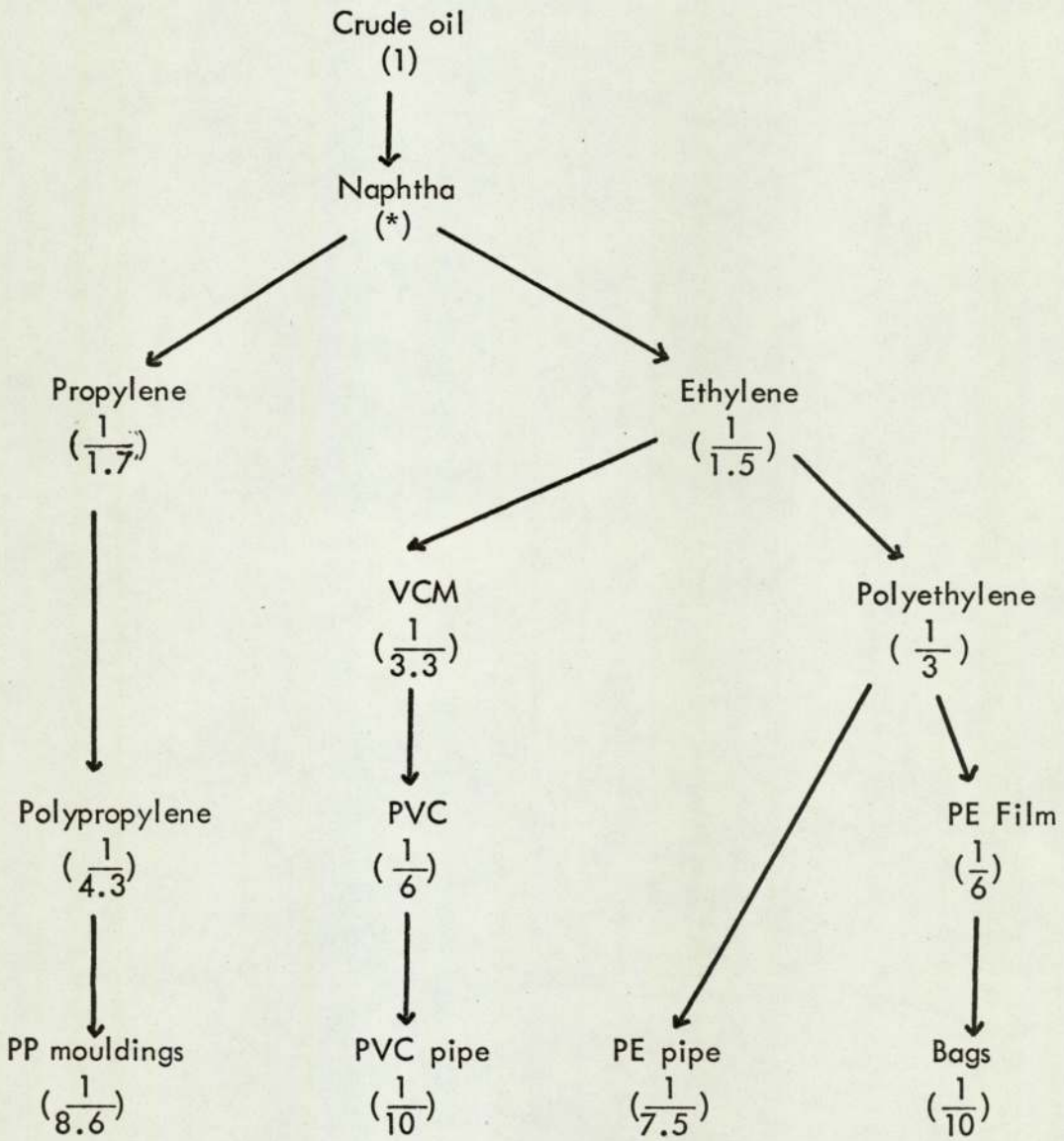


FIGURE (1.2) continued

(b) General Chemical Products

Source: NEDO[8]

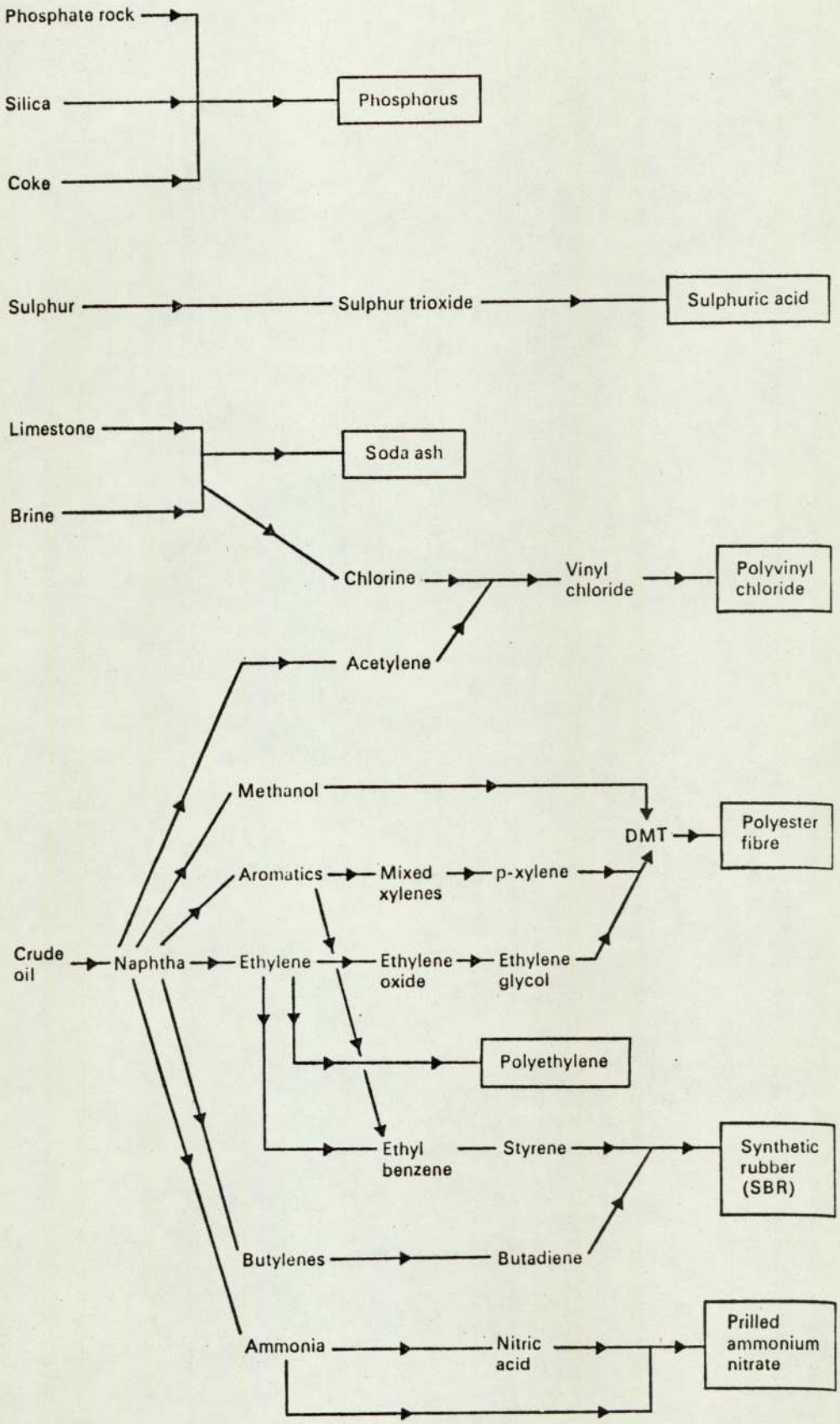


FIGURE (1.3) MATERIALS CONVERSION SEQUENCES

Source: Pick[1]

(a) Steel

IRON ORE (plus coke, limestone, sinter)	... £5/ton
↓ Blast furnace	
PIG IRON (plus ferro alloys, scrap, fluxes)	... £20/ton
↓ Steel making processes	
MOLTEN STEEL	
↓ Teeming	
INGOT	
↓ Primary cogging mill	
BLOOM	... £40/ton
↓ Rerolling	
BILLET	
↓ Rerolling	
HOT ROLLED PRODUCTS (Black bar, hot rolled strip)	... £55/ton
↓ Pickling	
↓ Cold roll or cold draw	
COLD FINISHED PRODUCTS	... £75/ton
↓ Machining, pressing, etc.	
ENGINEERING COMPONENTS (Car bodies, machine parts, etc.)	... (£300)/ton
↓ Assembly and finishing	

(b) Plastic

Raw materials in chemical industry	< 1d/lb.
↓ Intermediates	2d/lb.
↓ Monomers	6d/lb.
↓ Polymers	12d/lb.
↓ Plastics materials	16d/lb.
↓ Simple fabricated articles	50d/lb.

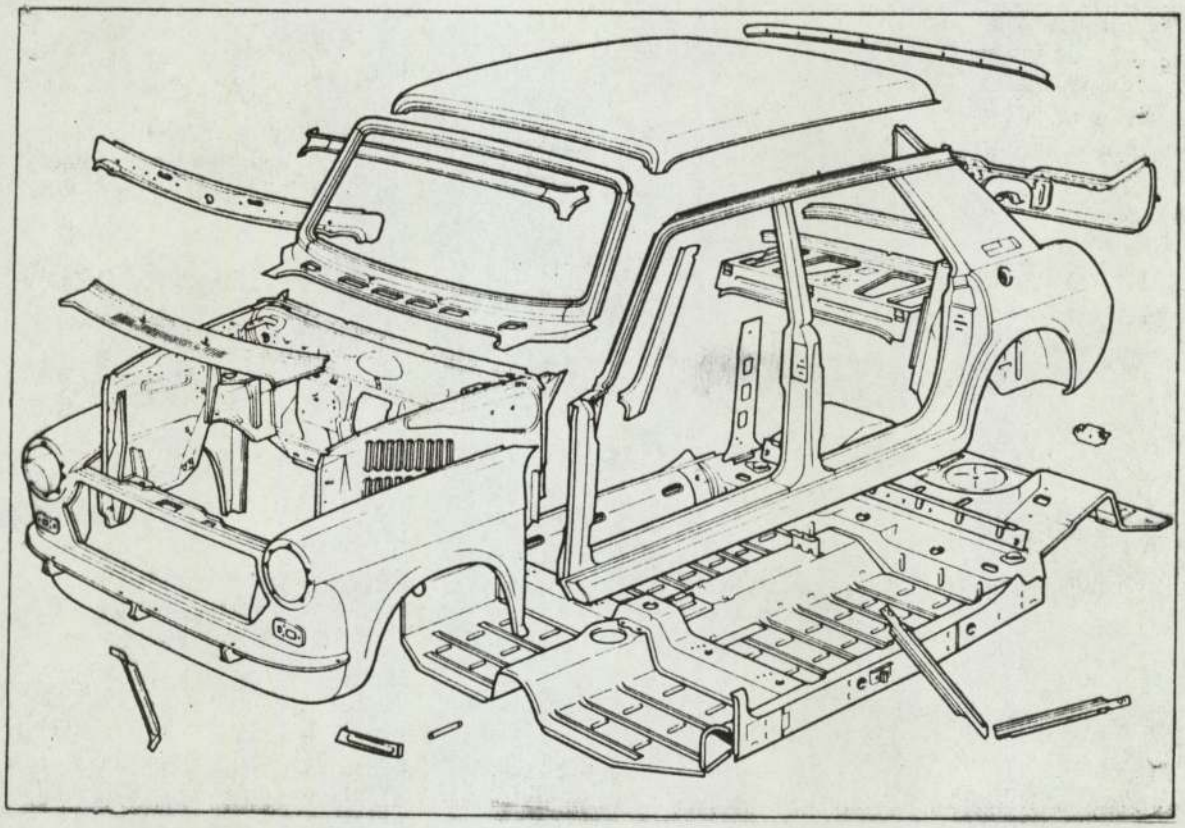
(c) Aluminium

PROCESS	PRODUCT (price)	WORLD PRODUCTION tons mil.	value $M	increase in value $M
mining	bauxite ($8/ton)	30	240	240
ore refining	alumina ($75/ton)	12	900	660
aluminium smelting & refining	primary aluminium ingot ($450/ton)	6	2700	1800
fabricating & casting	wrought semis & castings ($1000/ton)	6	6000	3300

FIGURE (1.4) PRODUCTION OF MASS PRODUCED MOTOR BODY.

Source: Butler, et al[9]

(a) Major Components



(b) Production Sequence

The production of each component of the above body entails a number of processing stages.

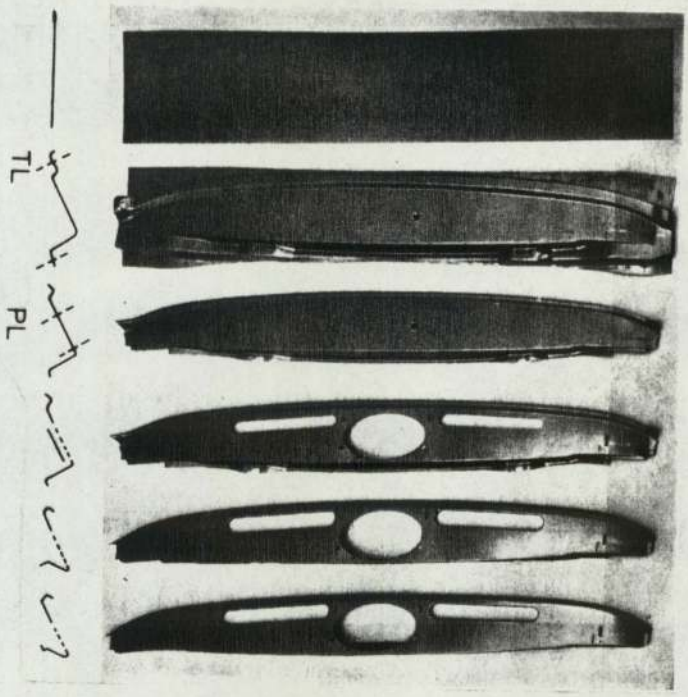


FIGURE (1.5) RESOURCE, PROCESS, AND PRODUCT INTERDEPENDENCE

Natural resource N and processes X are used to produce final product F

(a) Many Resources For One Final Product

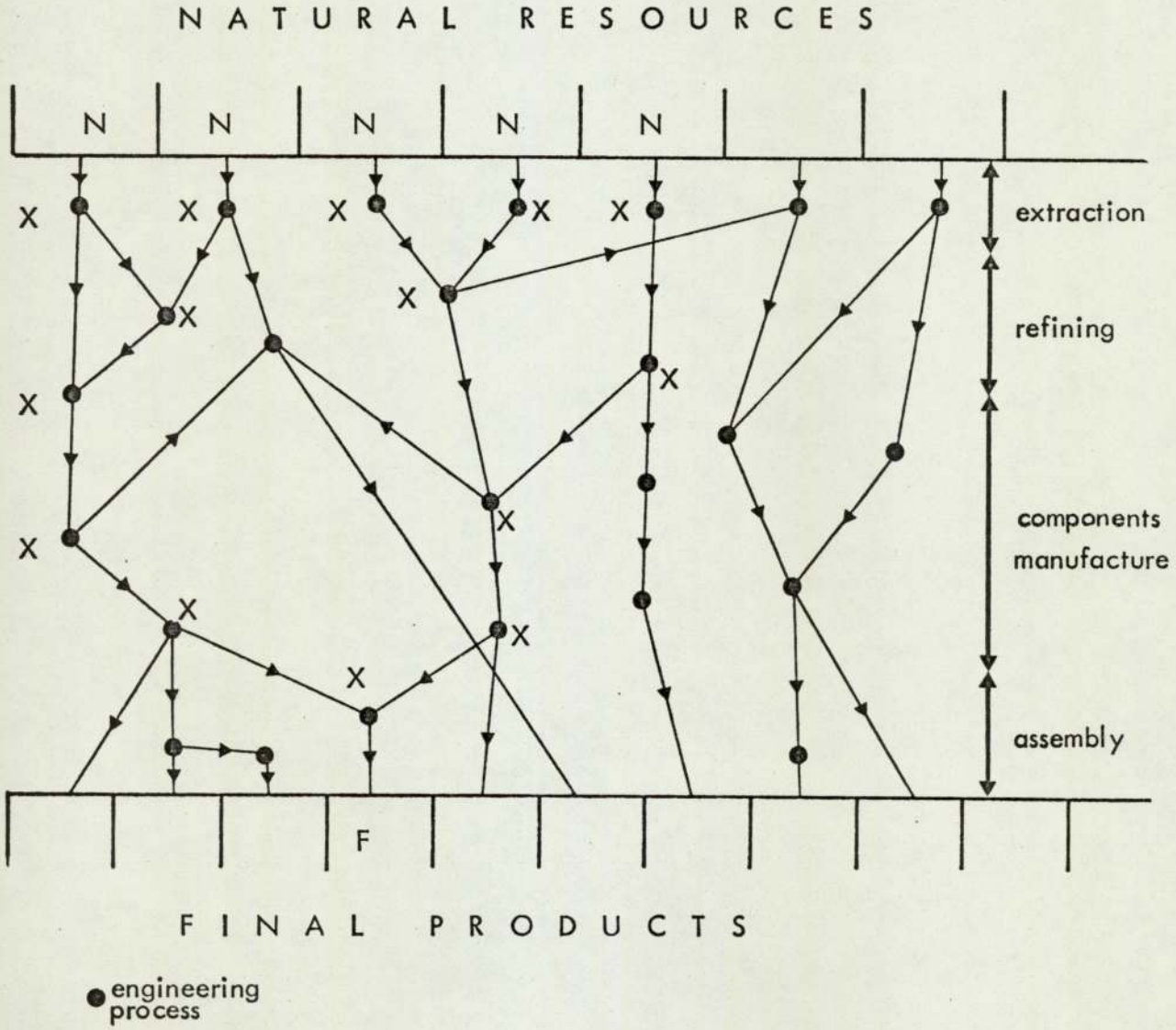


FIGURE (1.5) continued

(b) Many Products From One Natural Resource

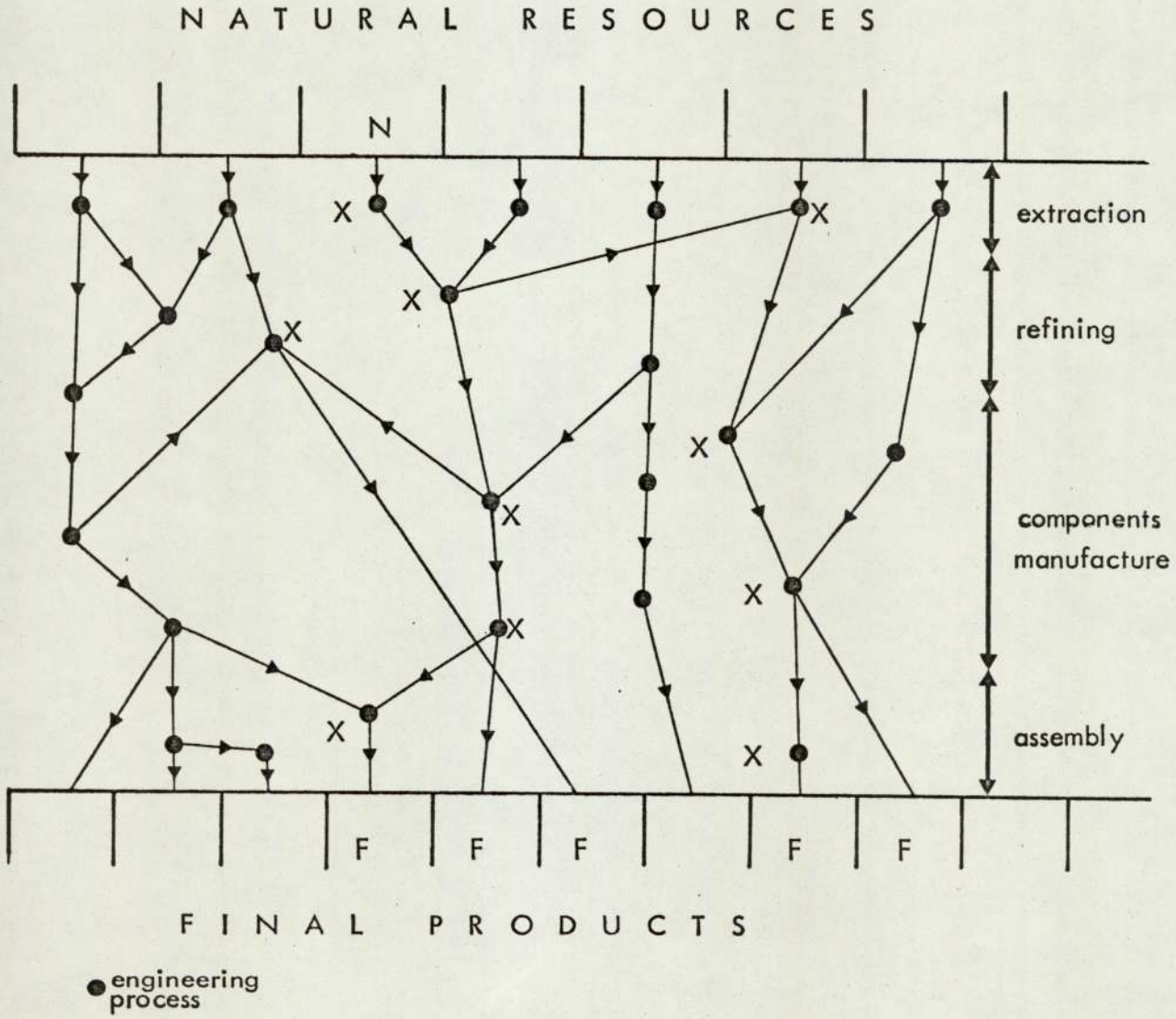


FIGURE (1.6) EFFECT OF TECHNICAL CHANGE

A technical change at any one point of the resources conversion sequence may effect many natural resources, and manpower and capital stock employed in many upstream processes. In the below example a technical change in the assembly process A of final product F is illustrated. If input a_y is decreased by substitution with input a_x then less natural resources N_y and more N_x are required. Net effect on total manpower and capital stock will depend on all processes X and Y.

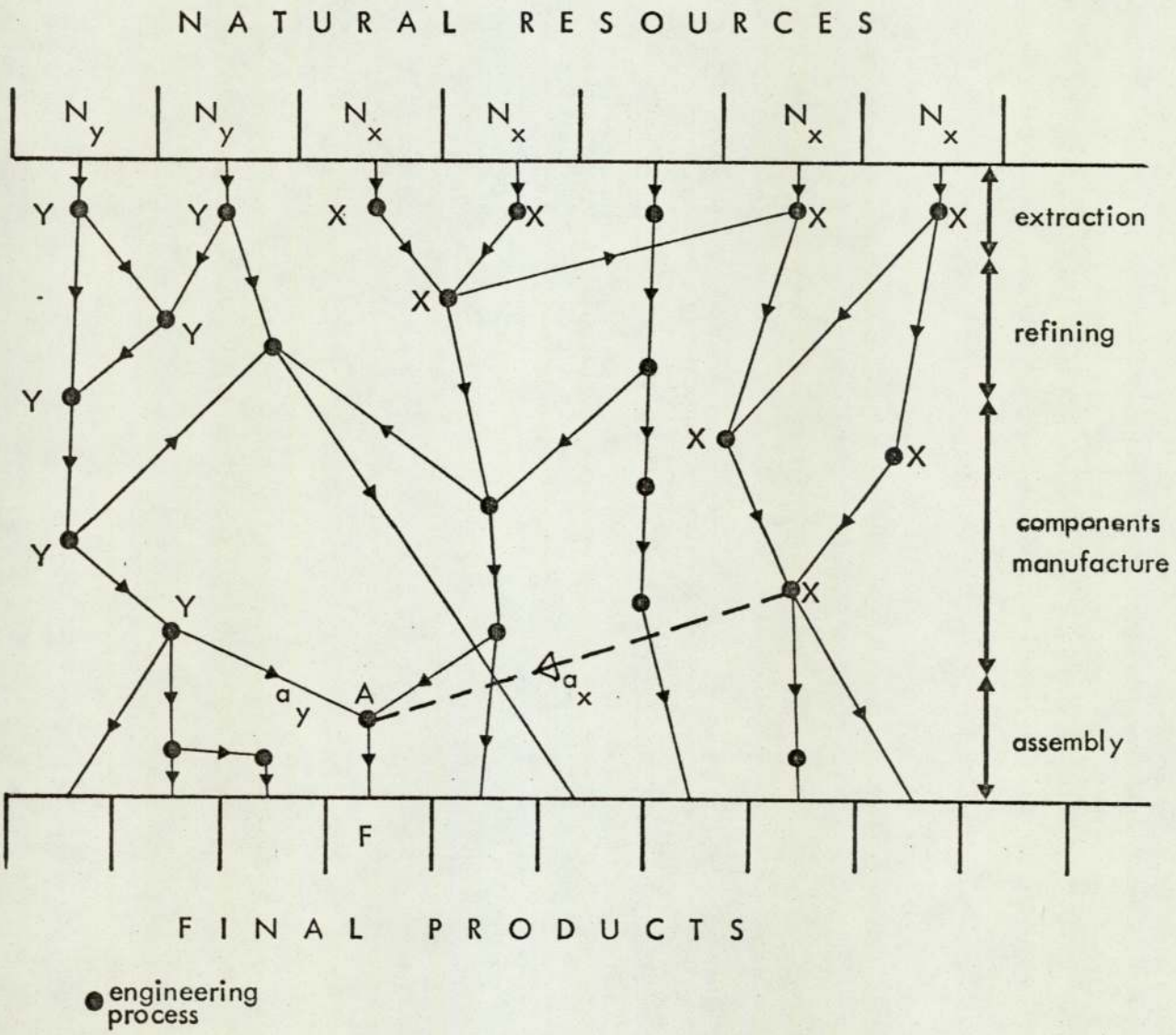


FIGURE (2.1) INPUT-OUTPUT PROCESS TABLE

Natural resource N flows from process to process in conversion to final product F. The input-output table records the conversion as an input of N into process P_i, then an input from P_i into process P_k, then an input from P_k into process P_ℓ, ..., and so forth until final buyers purchase F from process P_m.

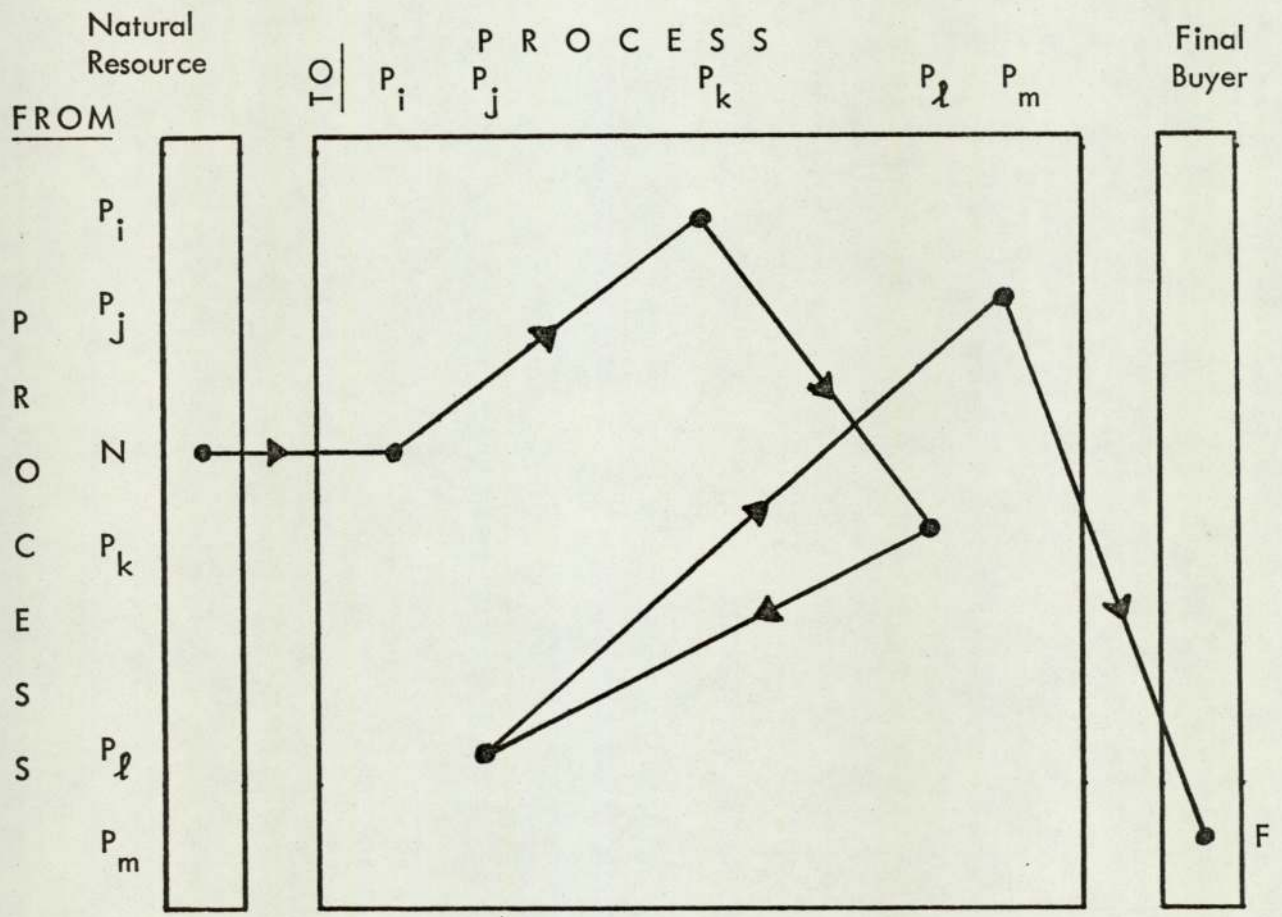


FIGURE (2.2) AGGREGATION OF PROCESSES INTO INDUSTRIES

All processes in the same industry are aggregated . Natural resource N flows through industries I_1, I_2, I_3 in its conversion to final product F.

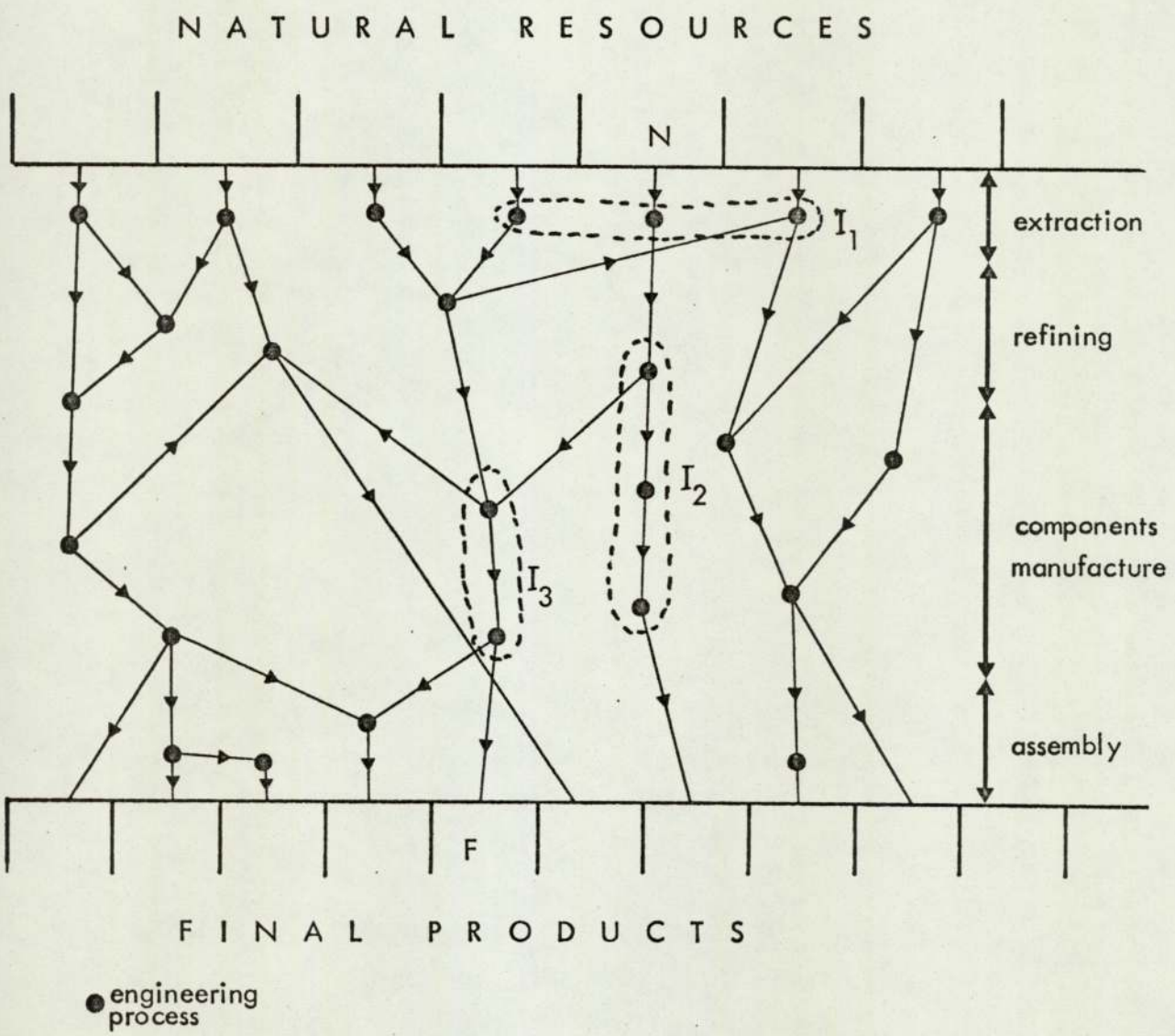


FIGURE (2.3) UNITED KINGDOM INPUT-OUTPUT TABLES

Natural Resource N flows from industry to industry in conversion to final product F. The input-output table records the conversion as an import of N by industry I_i which converts the material to commodity C_n; this commodity is then bought by industry I_k which makes commodity C_ℓ from it and this is sold to industry I_j; .....; and so forth until final buyers purchase F as commodity C_m.

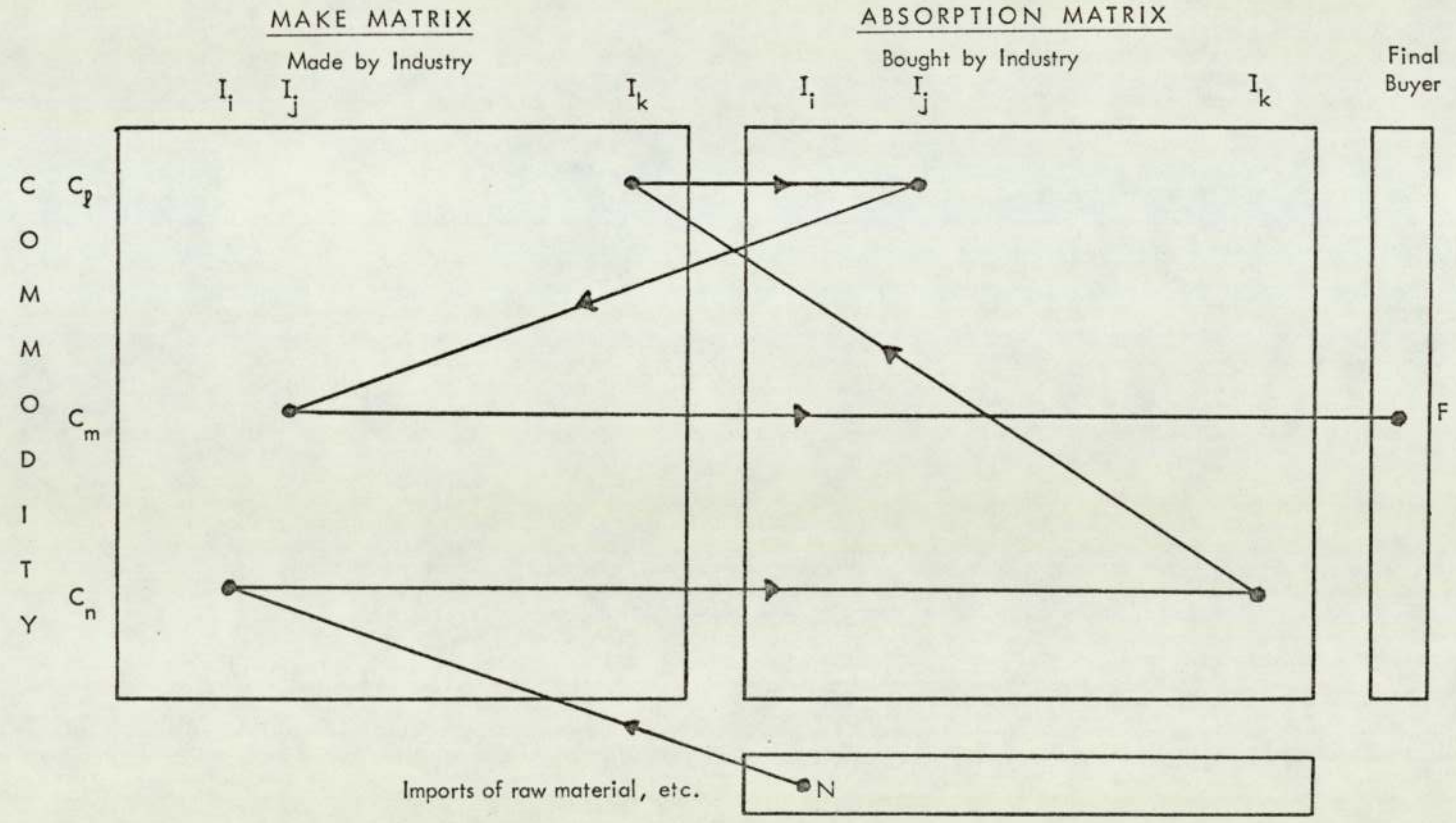


TABLE (2.1) Materials, engineering and other purchases by U.K. industries; £M, 1968.
From Input-Output Table D.
Materials: 2 (½), 4, 13, 17, 19 - 21, 52 - 54, 56, 57, 60.
Engineering: 22 - 42, 55, 58, 61, 62.

	DOMESTIC			IMPORTED			
	Mats.	Engin.	Other	Mats.	Engin.	Other	GROSS OUTPUT
1 Agriculture	47.6	80.9	1378.3	1.9	5.1	111.3	2437.1
2 Forestry, fishing	0.7	10.6	30.3	-	-	1.8	121.9
3 Coal mining	55.9	90.1	94.9	2.1	2.6	2.2	821.9
4 Other mining, quarrying	10.1	32.9	118.3	-	1.0	1.9	296.5
5 Grain milling	1.2	11.2	132.2	-	-	140.8	353.0
6 Other cereal foodstuffs	12.5	48.6	528.1	-	1.0	171.2	1083.0
7 Sugar	2.8	6.2	83.7	-	0.1	94.0	218.5
8 Cocoa, chocolate, etc.	10.4	23.4	120.1	0.4	0.2	49.1	317.5
9 Other food	30.2	78.9	1156.6	2.0	1.0	292.4	2019.5
10 Drink	46.1	88.5	341.0	6.7	1.1	21.0	906.2
11 Tobacco	22.8	39.5	59.1	0.5	0.2	117.5	336.6
12 Mineral Oil Refining	3.8	25.0	284.6	617.9	-	45.9	954.9
13 Paint	18.5	16.1	71.8	-	-	7.5	182.5
14 Coke ovens	2.3	7.6	179.8	-	-	0.2	235.7
15 Pharmaceutical Chemicals	25.4	46.3	181.9	1.0	-	19.6	443.6
16 Soap and detergents	7.1	18.9	94.7	0.1	-	10.3	166.1
17 Plastic, synth.resins, etc.	35.0	25.9	178.7	44.0	0.3	10.9	454.0
18 Other chemicals	76.9	140.7	585.2	35.9	4.4	209.0	1674.4
19 Iron and steel	699.1	170.7	430.3	134.0	7.3	11.2	2206.3
20 Aluminium and alloys	65.1	12.6	30.8	88.8	0.3	0.7	305.2
21 Other non-ferrous metals	199.8	84.8	98.4	314.8	1.9	1.0	885.9
22 Agricultural machinery	11.3	20.4	11.2	0.8	0.9	-	80.0
23 Machine tools	33.1	54.6	20.5	1.2	3.0	0.3	242.0
24 Engineers' small tools	19.6	17.1	19.2	4.5	2.7	0.1	155.8
25 Industrial engines	22.4	30.1	11.2	1.4	7.2	0.1	122.7
26 Textile machinery	17.6	48.8	24.1	1.0	3.1	0.1	168.9
27 Const.& mech. handling equip.	69.8	149.8	42.2	3.7	15.7	0.4	465.8
28 Office machinery	9.4	30.3	8.7	0.4	16.0	-	105.6
29 Other non-electrical mach.	147.1	271.4	108.8	5.7	24.7	1.0	1085.8
30 Indust.plant & Steelworks	121.7	182.3	84.3	8.7	5.2	0.4	659.7
31 Other mechanical eng.	111.3	64.6	65.7	3.4	12.7	1.2	570.5
32 Instrument engineering	32.4	87.9	51.3	4.8	27.8	1.2	436.0
33 Electrical machinery	71.8	128.0	43.8	12.9	12.2	1.4	526.1
34 Insulated wires and cables	73.1	53.9	37.3	70.9	2.2	0.1	324.6
35 Electronics and telecom.	61.2	319.5	126.9	10.0	103.2	1.4	1063.7

TABLE (2.1) Continued

		DOMESTIC			IMPORTED			GROSS OUTPUT
		Mats.	Engin.	Other	Mats.	Engin.	Other	
36	Other electrical goods	92.5	141.9	109.8	19.6	15.4	1.5	638.0
37	Cans and metal boxes	65.1	20.2	15.3	4.7	-	-	141.1
38	Other metal goods	400.5	274.8	237.4	97.7	77.3	2.4	1757.9
39	Shipbuilding etc.	63.1	131.3	55.8	2.6	13.9	0.5	503.3
40	Motor vehicles, etc.	429.1	991.7	243.6	24.8	80.7	3.1	2636.7
41	Aerospace equipment	55.2	302.5	47.3	2.0	48.4	0.1	807.7
42	Other vehicles	24.2	33.7	13.3	0.8	5.8	0.3	167.5
43	Man-made fibres	48.0	15.7	92.2	32.2	0.8	3.6	336.1
44	Cotton, etc.	2.2	13.0	269.8	2.2	3.7	119.4	575.2
45	Wool	2.9	10.4	266.4	-	3.4	115.6	559.7
46	Hosiery and lace	3.9	13.7	286.6	-	1.8	0.9	471.5
47	Textile finishing	4.1	4.8	35.0	-	-	9.8	128.3
48	Other textiles	16.0	17.6	227.8	4.0	0.2	71.1	515.2
49	Leather, etc.	6.1	13.1	73.9	-	1.2	51.5	200.6
50	Clothing	5.5	25.0	362.4	-	0.3	71.8	797.4
51	Footwear	12.3	21.0	86.0	2.1	0.6	11.2	235.8
52	Cement	6.4	8.1	40.1	-	0.2	1.6	99.3
53	Other building materials	113.5	49.8	166.7	28.5	1.4	6.5	627.4
54	Pottery and glass	37.4	28.3	71.6	2.5	0.7	3.3	340.0
55	Furniture, etc.	60.2	57.8	70.7	16.5	0.4	7.9	369.0
56	Timber and misc. wood manuf.	106.6	42.9	99.3	202.3	0.6	0.9	679.7
57	Paper and board	28.8	24.5	129.5	129.8	0.7	6.3	451.2
58	Paper products	138.7	28.3	121.0	102.0	4.4	0.7	628.7
59	Printing and Publishing	137.8	47.0	329.5	54.7	0.9	8.0	1226.7
60	Rubber	61.0	27.8	122.7	17.3	0.7	36.1	482.3
61	Other manufacturing	103.6	72.9	162.6	22.3	3.2	6.2	663.2
62	Construction	1321.6	1435.7	426.3	151.0	27.2	6.9	6084.1
63	Gas	49.7	44.0	213.9	14.2	0.4	26.3	586.4
64	Electricity	12.3	91.4	488.7	0.5	5.9	13.5	1613.0
65	Water supply	13.7	10.5	27.3	-	0.2	0.3	178.3
66	Road and rail transport	40.4	168.3	180.1	3.3	5.6	16.7	1779.0
67	Other transport	15.8	99.2	256.3	-	16.3	6.4	2076.3
68	Communication	1.9	49.3	82.8	1.0	0.3	0.5	1006.0
69	Distributive trades	60.5	213.4	1267.4	9.6	7.1	18.3	5990.2
70	Miscellaneous services	76.8	441.6	1620.6	1.2	30.8	32.1	8062.2

TABLE (2.2) Materials as a percent of gross output for engineering industries. From Table (2.1)

		Domestic	Imported	Total
22	Agricultural machinery	14.1	1.0	15.1
23	Machine tools	13.7	0.5	14.2
24	Engineers' small tools	12.6	2.9	15.5
25	Industrial engines	18.3	1.1	19.4
26	Textile machinery	10.4	0.6	11.0
27	Construction and mechanical handling equipment	15.0	0.8	15.8
28	Office machinery	8.9	0.4	9.3
29	Other non-electrical machinery	13.5	0.5	14.1
30	Industrial Plant & Steelworks	18.4	1.3	19.8
31	Other mechanical engineering	19.5	0.6	20.1
32	Instrument engineering	7.4	1.1	8.5
33	Electrical machinery	13.6	2.5	16.1
34	Insulated wires & cables	22.5	21.8	44.4
35	Electronics and telecommunications	5.8	0.9	6.7
36	Other electrical goods	14.5	3.1	17.6
37	Cans and metal boxes	46.1	3.3	49.5
38	Other metal goods	22.8	5.6	28.3
39	Shipbuilding and marine engineering	12.5	0.5	13.1
40	Motor vehicles and tractors	16.3	0.9	17.2
41	Aerospace equipment	6.8	0.2	7.1
42	Other vehicles	14.4	0.5	14.9
55	Furniture, etc.	16.3	4.5	20.8
58	Paper products	22.1	16.2	38.3
61	Other manufacturing	15.6	3.4	19.0
62	Construction	21.7	2.5	24.2

TABLE (2.3) Materials purchased by U.K. motor industry, 1968.

	PURCHASES £'000	PERCENT OF GROSS OUTPUT
IRON & STEEL	294593	11.0
ALUMINIUM & ALLOYS	41404	1.5
OTHER NON-FERROUS METALS	19478	0.7
PAINT AND VARNISH	13118	0.5
GLASS	18451	0.7
TIMBER	16890	0.6
PLASTIC	11657	0.4
PAPER	3052	0.1
TEXTILES	5767	0.2
LEATHER	2533	0.1
TOTAL MATERIALS	427820	15.9
DROP FORGINGS	11691	0.4
WIRE	8861	0.3
BOLTS, ETC.	31938	1.2
UNSPECIFIED MATERIALS	95181	3.5
OTHER PURCHASES*	981440	40.9
GROSS OUTPUT	2683500	100.0

* excluding canteen purchases for merchanting

Source: Census of Production (27)

TABLE (2.4) Aggregation of input output table into 3 x 3 form, including primary inputs; £M, th. man-years. Gross output free from duplication.
TIFE = total income from employment.
GP & OTI = gross profits plus other trading income.
Valuation, coverage, insurance and freight on imports adjusted pro rata.

	BUYER				
PURCHASE	Materials	Engineering	Other	Final	TOTAL
Materials	(1381.6)	3555.6	855.3	1236.8	5647.7
Engineering	525.4	(4949.5)	2014.4	12913.8	15453.6
Other	1557.2	2158.3	(11402.2)	23275.3	26990.8
IMPORTS					
Materials	873.7	428.9	719.6		
Engineering	13.7	384.1	86.3		
Other	80.7	27.9	1689.0		
Service	60.3	245.0	853.1		
Final Buyers	108.0	70.6	79.5		
Taxes, etc.	104.9	356.4	1142.8		
TIFE	1632.6	6348.8	12753.6		
GP & OTI	691.2	1878.0	6797.2		
TOTAL	5647.7	15453.6	26990.8		

CAPITAL STOCK	7936.0	14329.0	65779.0
LABOUR			
Operatives (th.)	838.5	3950.1	7811.6
Others (th.)	259.6	1351.1	2715.8
Operatives (£M)	863.1	3932.6	9232.8
Others (£M)	327.0	1688.8	3472.6

TABLE (2.5) Aggregated 3 x 3 direct coefficient input-output table; £, 10^{-3} man-years per £ output. Duplication excluded. From Table (2.4).

	BUYER		
PURCHASE	Materials	Engineering	Other
Materials	-	0.2301	0.0317
Engineering	0.0930	-	0.0746
Other	0.2757	0.1397	-
IMPORTS			
Materials	0.1547	0.0278	0.0267
Engineering	0.0024	0.0249	0.0032
Other	0.0143	0.0018	0.0626
Service	0.0107	0.0159	0.0316
Final Buyers	0.0191	0.0046	0.0029
Taxes, etc.	0.0186	0.0231	0.0423
TIFE	0.2891	0.4108	0.4725
GP & OTI	0.1224	0.1215	0.2518
TOTAL	1.0000	1.0000	1.0000

CAPITAL STOCK	1.4052	0.9272	2.4371
LABOUR			
Operatives (no.)	0.1485	0.2556	0.2894
Others (no.)	0.0460	0.0874	0.1006
Operatives (£M)	0.1528	0.2545	0.3421
Others (£M)	0.0579	0.1093	0.1287

TABLE (2.6) Aggregated 3 x 3 direct plus indirect input-output table; £, 10^{-3} man-years per £ output. Duplication excluded. From Table (2.5).

	BUYER		
PURCHASE	Materials	Engineering	Other
Materials	1.0370	0.2457	0.0512
Engineering	0.1190	1.0387	0.0813
Other	0.3025	0.2128	1.0255
IMPORTS			
Materials	0.1713	0.0714	0.0377
Engineering	0.0070	0.0296	0.0058
Other	0.0338	0.0174	0.0646
Service	0.0225	0.0258	0.0342
Final Buyers	0.0213	0.0101	0.0044
Taxes, etc.	0.0348	0.0375	0.0462
TIFE	0.4916	0.5984	0.5328
GP & OTI	0.2176	0.2099	0.2744
CAPITAL STOCK	2.3049	1.8272	2.6465
LABOUR			
Operatives (th.)	0.2719	0.3636	0.3252
Others (th.)	0.0885	0.1235	0.1126
Operatives (£M)	0.2923	0.3747	0.3793
Others (£M)	0.1120	0.1551	0.1438

TABLE (2.7) Final destination of materials; £M, 1968.

	Consumer	Public Authorities	Fixed Capital	Stocks	Exports	TOTAL FINAL
U.K. MATERIALS						
Direct	225.1	77.9	61.6	21.6	820.6	1236.8
Indirect	1318.0	456.8	1647.9	45.6	1015.7	4410.8
Total	1543.1	534.7	1709.5	24.0	1836.3	5647.7
%	27.3	9.5	30.3	0.4	32.5	100
IMPORTED						
Direct	56.4	-	0.4	12.7	-	69.5
Indirect	885.2	219.9	607.3	13.8	602.7	2328.9
Total	941.6	219.9	607.7	26.5	602.7	2398.4
%	39.3	9.4	25.3	1.1	25.1	100.0
TOTAL*	2484.7	754.6	2317.2	50.5	2439.0	8046.1
%	30.9	9.4	28.8	0.6	30.3	100

* Duplication of imported materials to domestic materials producing industries is removed.

FIGURE (2.4) FINAL DESTINATION OF MATERIALS

Percentage distribution of domestic and imported materials, final destination.

Based on Table (2.7)

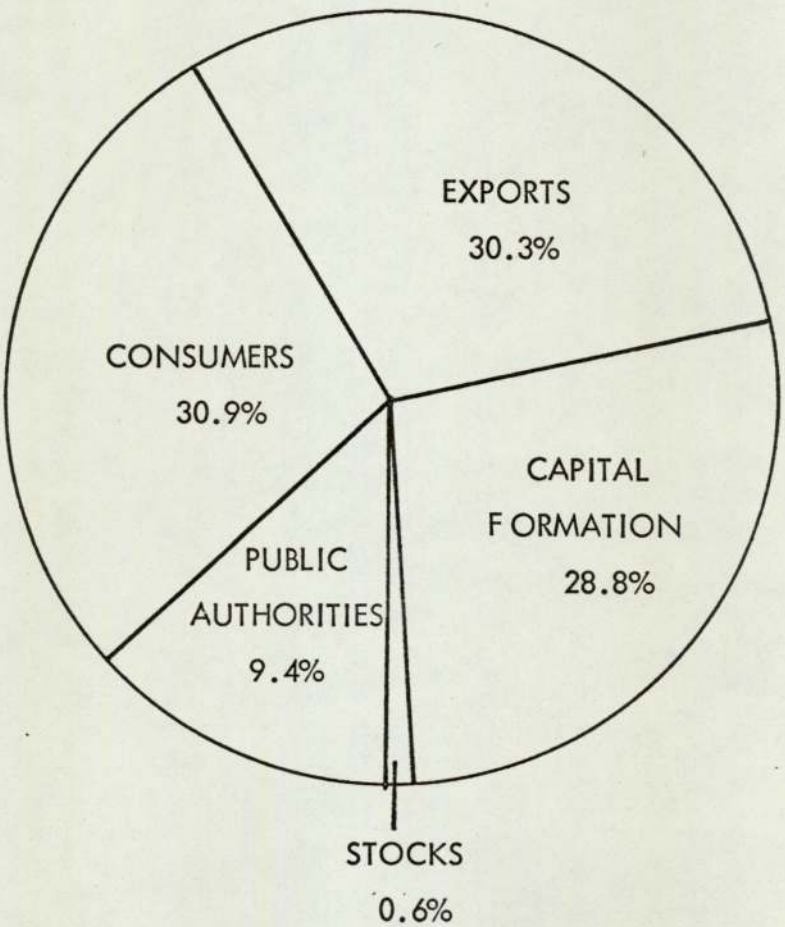


TABLE (2.8) Value added in aggregated 3 x 3 input-output table; £ of value added per £ of output. From Tables (2.5) and (2.6).

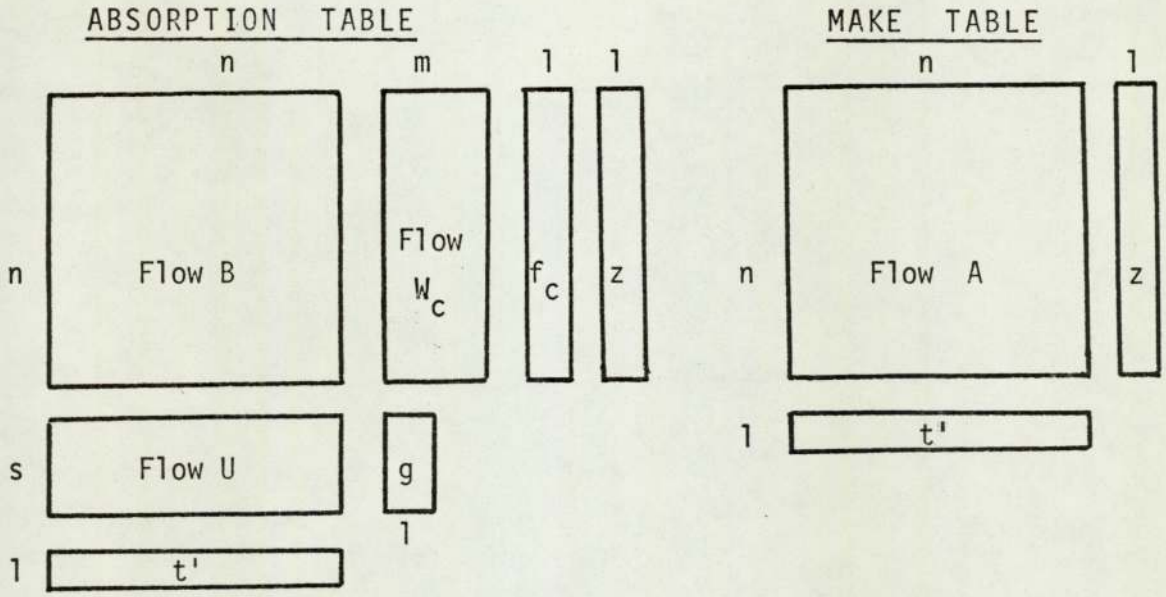
	INDUSTRY		
SOURCE	Materials	Engineering	Other
Materials			
TIFE	0.2998	0.0710	0.0148
GP & OTI	0.1269	0.0301	0.0063
Total	0.4267	0.1011	0.0211
Engineering			
TIFE	0.0489	0.4267	0.0334
GP & OTI	0.0145	0.1262	0.0099
Total	0.0634	0.5529	0.0433
Other			
TIFE	0.1429	0.1005	0.4845
GP & OTI	0.0762	0.0536	0.2582
Total	0.2191	0.1541	0.7427
Total U.K. Industry			
TIFE	0.4916	0.5982	0.5327
GP & OTI	0.2176	0.2099	0.2744
Total	0.7092	0.8081	0.8071
IMPORTS			
Materials	0.1713	0.0714	0.0377
Engineering	0.0070	0.0296	0.0058
Other	0.0338	0.0174	0.0646
Service	0.0225	0.0258	0.0342
Total	0.2347	0.1442	0.1423
Final Buyers	0.0213	0.0101	0.0044
Taxes, etc.	0.0348	0.0375	0.0462
TOTAL	1.0000	1.0000	1.0000

TABLE (2.9) Total direct plus indirect inputs required by materials and engineering industries, including engineering-via-materials; £M, th. man-years, 1968. From Tables (2.4), (2.5) and (2.6).

	Materials	Engineering			
INPUT	direct & indirect	direct	ind.-mat.	ind.-nes.	Total
Materials	208.8	3555.6	131.6	110.4	3797.6
Engineering	672.4	-	423.1	175.7	598.8
Other	1708.7	2158.3	1075.6	55.1	3289.0
IMPORTS					
Materials	967.5	428.9	609.1	65.4	1103.4
All Other	357.5	657.0	225.1	242.9	1125.0
CAPITAL STOCK	13017.1	14329.0	8195.3	5711.8	28236.1
LABOUR.					
Operatives (th.)	1535.9	3950.1	966.8	702.0	5618.9
Other (th.)	499.9	1351.1	314.7	243.1	1908.9
Operatives (£M)	1650.6	3932.6	1039.3	818.5	5790.4
Other (£M)	632.4	1688.8	398.2	310.3	2397.3
TIFE	2776.4	6348.8	1747.9	1150.0	9246.7
Total Value Added	4005.3	8226.8	2521.6	1742.7	12491.1

FIGURE (3.1) DIAGRAM OF DEFINITIONS FOR INPUT-OUTPUT ANALYSIS

The data is gathered as Absorption and Make tables showing which commodities are bought and made, respectively, by each industry. Subsequently these two data tables are translated into an Interindustry table showing total purchases of each industry from all other industries.



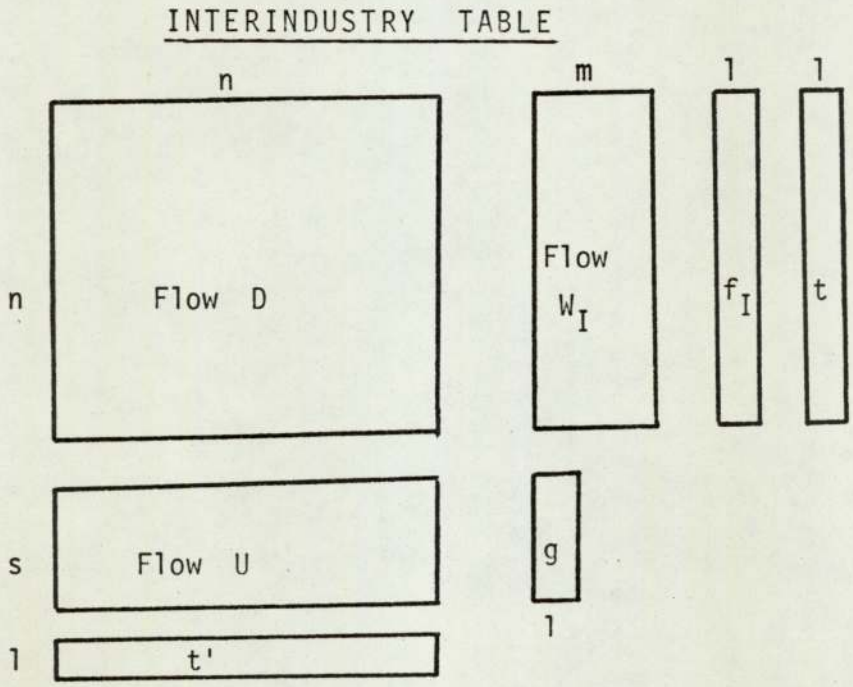
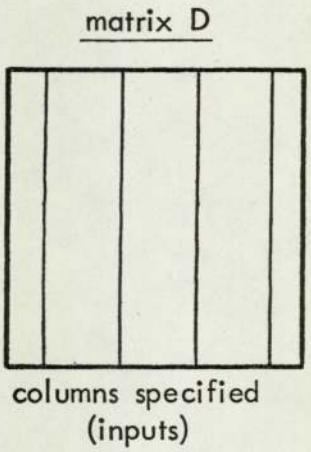


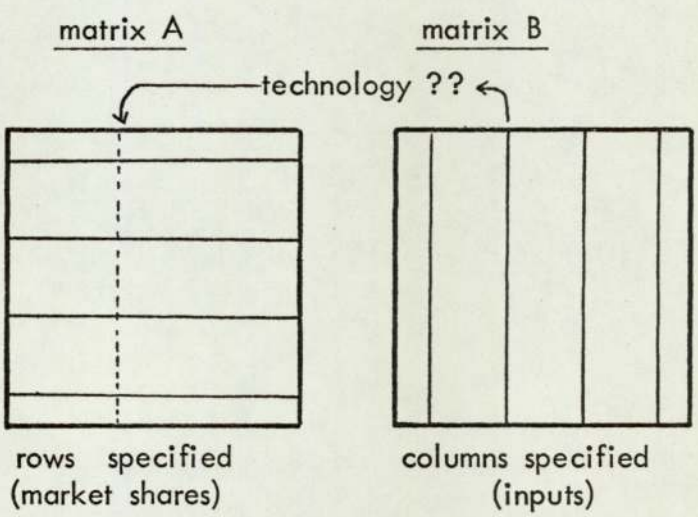
FIGURE (3.2) COMPARISON OF SPECIFICATION IN ALTERNATIVE INPUT-OUTPUT FORMULATIONS.

In formulation II inputs and outputs may not be technologically balanced.

FORMULATION I



FORMULATION II



FORMULATION III

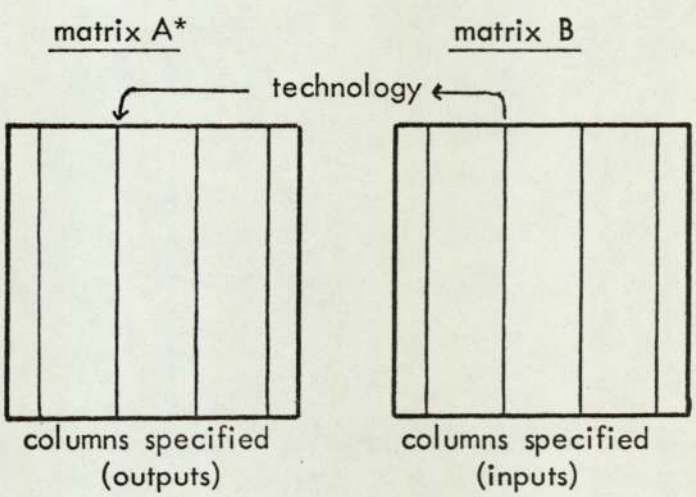


FIGURE (4.1) DISAGGREGATION OF INPUT-OUTPUT TABLES FOR PLASTIC MOTOR BODY STUDY.

For each table, A, B, and D (see Figure (3.1)), industries 17 (plastic), and 40 (motor vehicle) were disaggregates as shown below.

17(a) ABS

17(b) Other plastic

40(a) Car body

40(b) The rest of the motor car

40(c) Assembly of motor car

40(d) Other— non-passenger car sections of motor industry

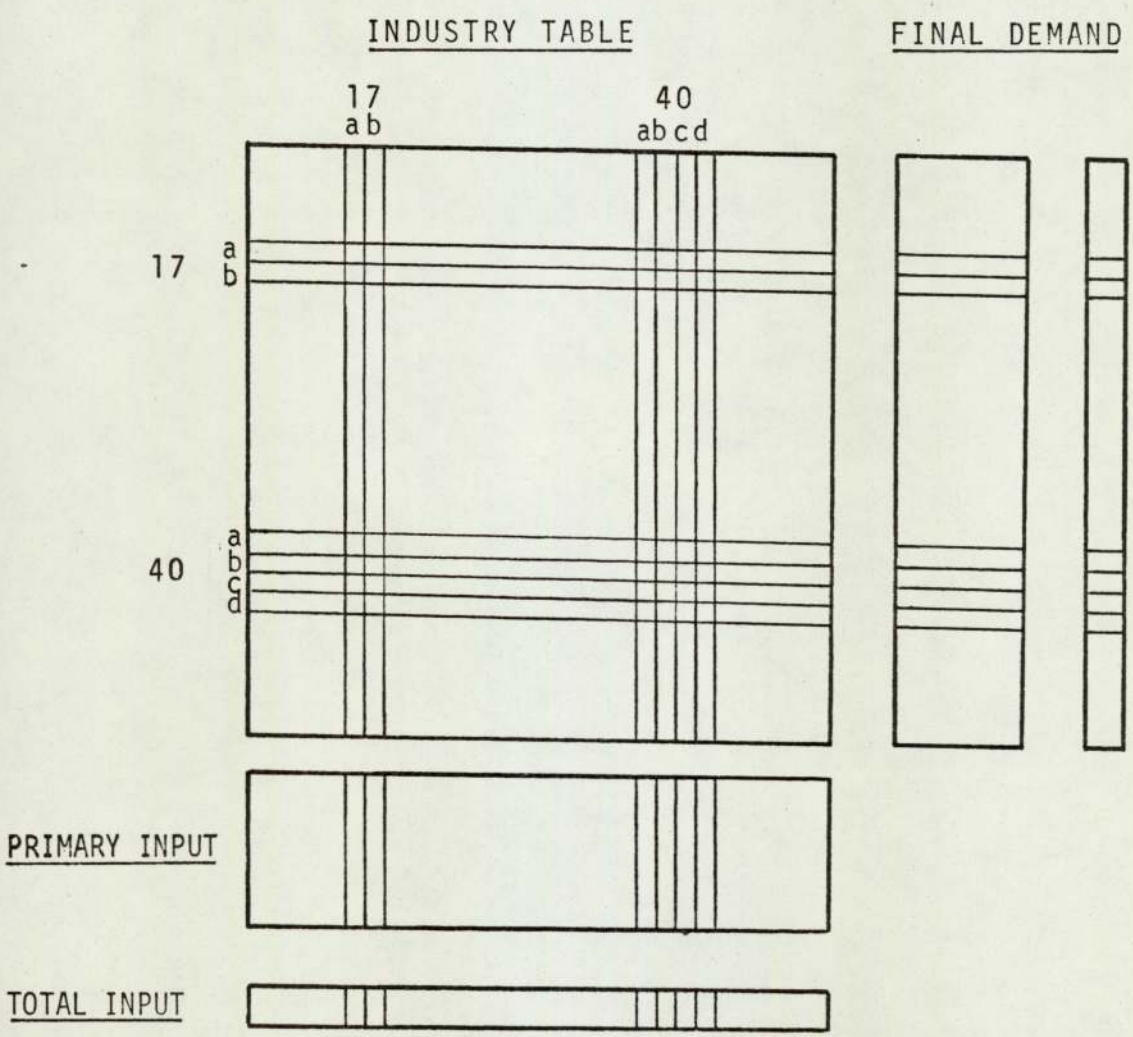


TABLE (4.1) Summary U.K. motor vehicle production, 1968.

	NUMBER	VALUE (£'000)	AVERAGE VALUE (£)
MOTOR CAR			
less than 1000 cc	277,469	90,172	325
1000 - 1600 cc	1,139,477	470,756	413
1600 - 1800 cc	375,902	227,559	605
greater than 2800 cc	52,227	62,331	1,193
Three wheeled cars	6,742	2,421	359
TOTAL PASSENGER CARS	1,851,817	853,240	461
TOTAL OMNIBUSES	17,750	29,454	1,659
TOTAL TRUCKS	399,682	347,518	869
OTHER	1,958	2,201	1,124
TOTAL	2,271,207	1,232,413	543

Source: Census of Production (27)

FIGURE (4.2) FLOW DIAGRAM FOR PASSENGER VEHICLE PRODUCTION

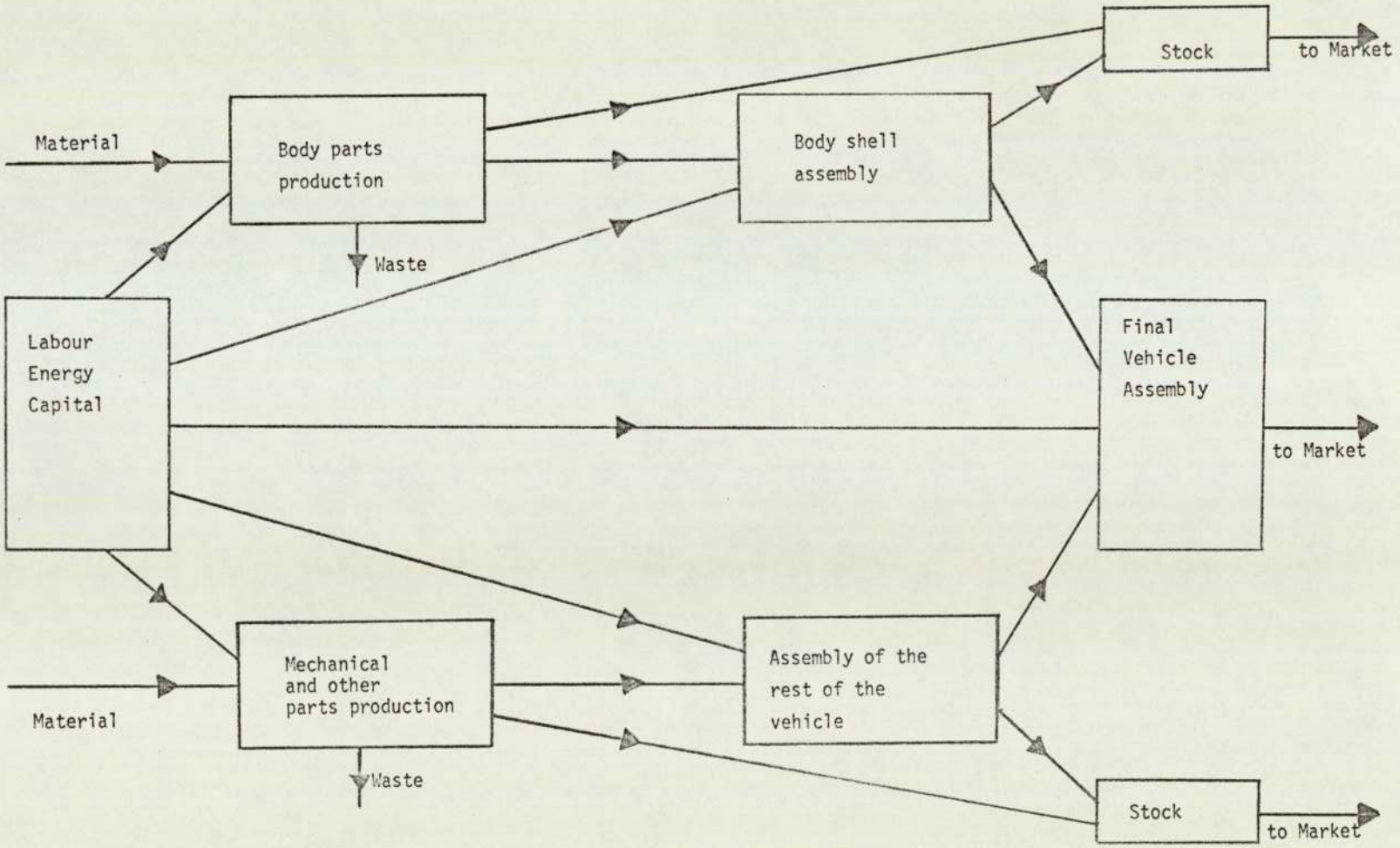


TABLE (4.2) Breakdown of costs in the U.K. motor vehicle industry, 1968.

<table>
<tr><td colspan="3">56% of all Motor Vehicle commodities are complete assembly vehicles (C)</td><td colspan="3">44% of all Motor Vehicle commodities are parts, or trailers etc. (C)</td></tr>
<tr><td colspan="2">70% of all complete assembled vehicles are passenger cars (C)</td><td rowspan="4">30% of all complete assembled vehicles are not passenger cars (C)</td><td colspan="2">70% of all parts relate to passenger cars (E)</td><td rowspan="3">30% of all parts do not relate to passenger cars (E)</td></tr>
<tr><td colspan="2">95% of the assembled car is parts (E)</td><td rowspan="3">5% of the value of the car is accounted for by assembly (E)</td><td rowspan="2">10% of the passenger car parts store are body parts (E)</td><td rowspan="2">90% of the passenger car parts store are non body parts (E)</td></tr>
<tr><td>25% of the assembled passenger car parts are body parts (E)</td><td>75% of the assembled passenger car parts are non body parts (E)</td></tr>
<tr><td colspan="5">Scrap metal and other waste products are included as spare parts to be sold to the relevant buying industry</td></tr>
</table>

(C) Census (E) Estimate

TABLE (4.3) Summary breakdown of cost in U.K. motor vehicle industry, 1968.

40 (a)	Body parts and assembly of body	12.4%
40 (b)	Other parts and assembly of other parts	55.6%
40 (c)	Assembly of body and other parts	2.0%
40 (d)	Other	30.0%
TOTAL		100.0%

TABLE (4.4) Breakdown of iron and steel used in a 1300 cc motor vehicle.

		WEIGHT	
Material	Cost Effect pence/lb.	Power Unit/Mech.	Body
Steel - P.S.F.	3.7	-	476 lb.
- other	3.7	546 lb.	129 lb. 12 oz.
Cast Iron	1.7	199 lb. 14 oz.	-

Source: Private consultation.

TABLE (4.5) Purchase of iron and steel as divided into the categories of the motor vehicle industry, 1968.

For use in	Value (£M)
Body	59.5
The Rest	95.9
Assembly	-
Other	66.6
TOTAL	222.0

TABLE (4.6) Breakdown of U.K. Iron and Steel Industry's purchases from Motor Vehicle Industry.

	40(a) Body	40(b) Rest	40(c) Assembly	40(d) Other	TOTAL
Scrap	2.4	4.0	-	3.2	9.6
Motor Vehicles	-	0.5	0.8	4.8	6.1
TOTAL	2.4	4.5	0.8	8.0	15.7

TABLE (4.7) Costs incurred in production of 1300 cc motor vehicle.

Part	Production Costs £	%
Body - Overheads	37.50	12.0
- Materials	17.60	5.6
- Labour	23.15	7.4
The Rest	225.50	71.9
Vehicle Assembly	9.75	3.1
TOTAL	313.5	100.0

Source: Private consultation

TABLE (4.8) Summary of production cost breakdown of steel motor body.

F A C T O R	PERCENTAGE
Labour	35
Iron and steel	25
Profit, Capital & Overheads	15
Energy	5
Other tooling & material	10
Transport & Distribution	10
TOTAL	100

Source: Private consultation.

TABLE (4.9) Input to motor body industry and alternative technical coefficients; column B(40) (a)

	TOTAL INPUT £M	COEFFICIENT X 10^4	
		Steel	Plastic
3 Coal mining	0.5	24	4
4 Other mining, quarrying			
12 Mineral oil refining			
13 Paint			
14 Coke ovens	0.2	9	1
17 Plastic, synth. resins, etc.	See below		
18 Chemicals (15+16+18)	0.4	19	400
19 Iron and steel	55.0	2599	200
20 Aluminium and alloys	0.5	24	4
21 Other non-ferrous metals	0.9	43	30
22 Agricultural machinery			
23 Machine tools			
24 Engineers' small tools			
25 Industrial engines			
26 Textile machinery			
27 Const.& mech. handling equip.	0.1	5	1
28 Office machinery			
29 Other non-electrical mach.			
30 Indust. plant and steel works			
31 Other mechanical engineering			
32 Instrument engineering			
33 Electrical machinery			
34 Insulated wires and cables			
35 Electronics and telecom.			
17(a) ABS	0.1	5	5800
17(b) Other plastic	0.1	5	440

TABLE (4.9) Continued

	TOTAL INPUT £M	COEFFICIENT X 10^4	
		Steel	Plastic
36 Other electrical goods			
37 Cans and metal boxes			
38 Other metal goods	10.0	473	200
39 Shipbuilding, etc.			
40 Motor vehicles, etc.	See below		
41 Aerospace equipment			
42 Other vehicles			
52 Cement			
53 Other building materials			
54 Pottery and glass			
55 Furniture, etc.			
56 Timber and misc. wood manuf.			
57 Paper and board			
58 Paper products			
60 Rubber			
61 Other manufacturing			
62 Construction			
63 Gas	0.5	24	20
64 Electricity	4.5	213	200
65 Water supply	0.1	5	10
66 Road and rail transport	2.3	109	5
67 Other transport	1.4	66	4
ALL OTHER	5.0	236	236
40(a) Motor body	5.0	236	236
40(b) Other car	1.0	47	47
40(c) Car Assembly	3.0	142	100
40(d) All other motor	15.0	709	500
Primary inputs	106.0	5009	1562
TOTAL	211.6	10000	10000

TABLE (4.10) Change in industrial gross output under various models when plastic is substituted for steel in motor body manufacture: percent change.

Note: Plastic and motor industry disaggregations are given at foot of page. X indicates not applicable.

	MATRIX ORDER/FORMULATION				
	72/1	72/2	72/3	74/3	71/3
3 Coal mining	-0.1	-0.1	-0.2	-0.2	-0.2
4 Other mining, quarrying	-	-	-	-	-
12 Mineral oil refining	0.3	0.3	0.3	0.3	0.3
13 Paint	-0.1	-0.1	-0.1	-0.1	-0.1
14 Coke ovens	-1.2	-1.0	-1.5	-1.5	-1.5
17 Plastic, synth. resins, etc.	29.7	26.7	30.9	31.0	31.5
18 Chemicals (15+16+18)	2.1	2.1	2.2	2.2	2.1
19 Iron and steel	-3.1	-3.0	-3.3	-3.3	-3.3
20 Aluminium and alloys	-0.2	-0.2	-0.3	-0.3	-0.2
21 Other non-ferrous metals	-0.2	-0.2	-0.3	-0.3	-0.2
22 Agricultural machinery	-	-	-	-	-
23 Machine tools	-0.1	-	-0.2	-0.2	-0.2
24 Engineers' small tools	1.3	0.9	1.6	1.6	0.4
25 Industrial engines	-	-	-	0.1	-
26 Textile machinery	-	-	-	-	-
27 Const.& mech. handling equip.	-	-	-	-	-
28 Office machinery	-	-	-	-	-
29 Other non-electrical mach.	0.2	0.1	0.2	0.2	-
30 Indust. plant and steel works	0.6	0.5	0.3	0.3	-0.1
31 Other mechanical engineering	-0.1	-0.1	-0.1	-0.1	-
32 Instrument engineering	0.1	0.1	0.1	0.1	0.1
33 Electrical machinery	-	-	-	-	-
34 Insulated wires and cables	-	-	-	-	-
35 Electronics and telecom.	-	-	-	-	-
17(a) ABS	1940	1740	2040	2040	X
17(b) Other plastic	2.8	2.6	2.7	2.7	X

TABLE (4.10) Continued

	MATRIX ORDER/FORMULATION				
	72/1	72/2	72/3	74/3	71/3
36 Other electrical goods	-	-	-	-	-
37 Cans and metal boxes	0.3	0.3	0.3	0.4	0.4
38 Other metal goods	-0.3	-0.2	-0.2	-0.2	-0.3
39 Shipbuilding, etc.	-	-	-	-	-
40 Motor vehicles, etc.	-0.2	-0.3	-0.3	-0.3	0.3
41 Aerospace equipment	-	-	-0.3	-0.3	-
42 Other vehicles	-0.1	-0.1	-	-0.1	-0.1
52 Cement	-	-0.1	-0.2	-0.2	-0.1
53 Other building materials	-0.1	-0.1	-0.2	-0.2	-0.1
54 Pottery and glass	-	0.1	-	0.1	0.1
55 Furniture, etc.	-	-	-	-	-
56 Timber and misc. wood manuf.	-	-	-	-	-
57 Paper and board	0.7	0.6	0.7	0.7	0.5
58 Paper products	0.5	0.4	0.5	0.5	0.5
60 Rubber	-	-	-0.1	-0.1	-
61 Other manufacturing	1.0	1.4	0.8	0.8	-
62 Construction	-	-	-	-	-
63 Gas	-0.2	-0.2	-0.2	-0.2	-0.1
64 Electricity	0.2	0.2	0.2	0.2	0.2
65 Water supply	0.2	0.2	0.2	0.2	0.6
66 Road and rail transport	-	-	-	-	-
67 Other transport	-	-	-	-	-
ALL OTHER	0.1	0.1	0.1	0.1	0.1
40(a) Motor body	-0.3	-0.3	-0.3	-0.1	-0.3
40(b) Other car	X	X	X	-0.1	X
40(c) Car Assembly	X	X	X	-0.1	X
40(d) All other motor	-0.3	-0.3	-0.3	-0.6	-0.3

TABLE (4.11) Cost variation of car body with production rate.

		PRODUCTION RATE PER WEEK							
		Less than 500		500 → 1,000		1,000 → 2,000		Over 3,000	
No. of types		26		6		6		4	
Total production per week		4,312		4,984		7,868		17,717	
% of total		12.4%		14.3%		22.6%		50.8%	
Average per week		166		831		1,311		4,429	
Factor cost per car		Steel	Plastic	Steel	Plastic	Steel	Plastic	Steel	Plastic
Labour	£	40	8	31	7	29	7	27.4	7
Steel or Plastic	£	21	50	24	58	22	53	20	50
Other material and adhesive	£	1	10	1	12	1.0	11	0.7	10
CAPITAL & PROFIT	Total Tooling £	1.1M	.25M	2.0M	1.0M	2.5M	3.0M	4.0M	11.5M
	Tooling per car £	17	4	9.3	4.6	7.3	5.9	3.5	10.0
	Other (Space etc) £	8	2	8	7.0	8	12	8	4
Bought out Components (Bolts)	£	10	2	11	2	10	3	10.4	4
Energy	£	2	2	2	2	2	2	2.1	2
Transport, distribution, etc	£	5	1	5.5	2	5.8	3	5.9	3
TOTAL COST	£	104	79	91.8	94.6	85.1	96.9	78.0	100

Source: Consultation with Professor B. B. Hundy, Cranfield Institute of Technology

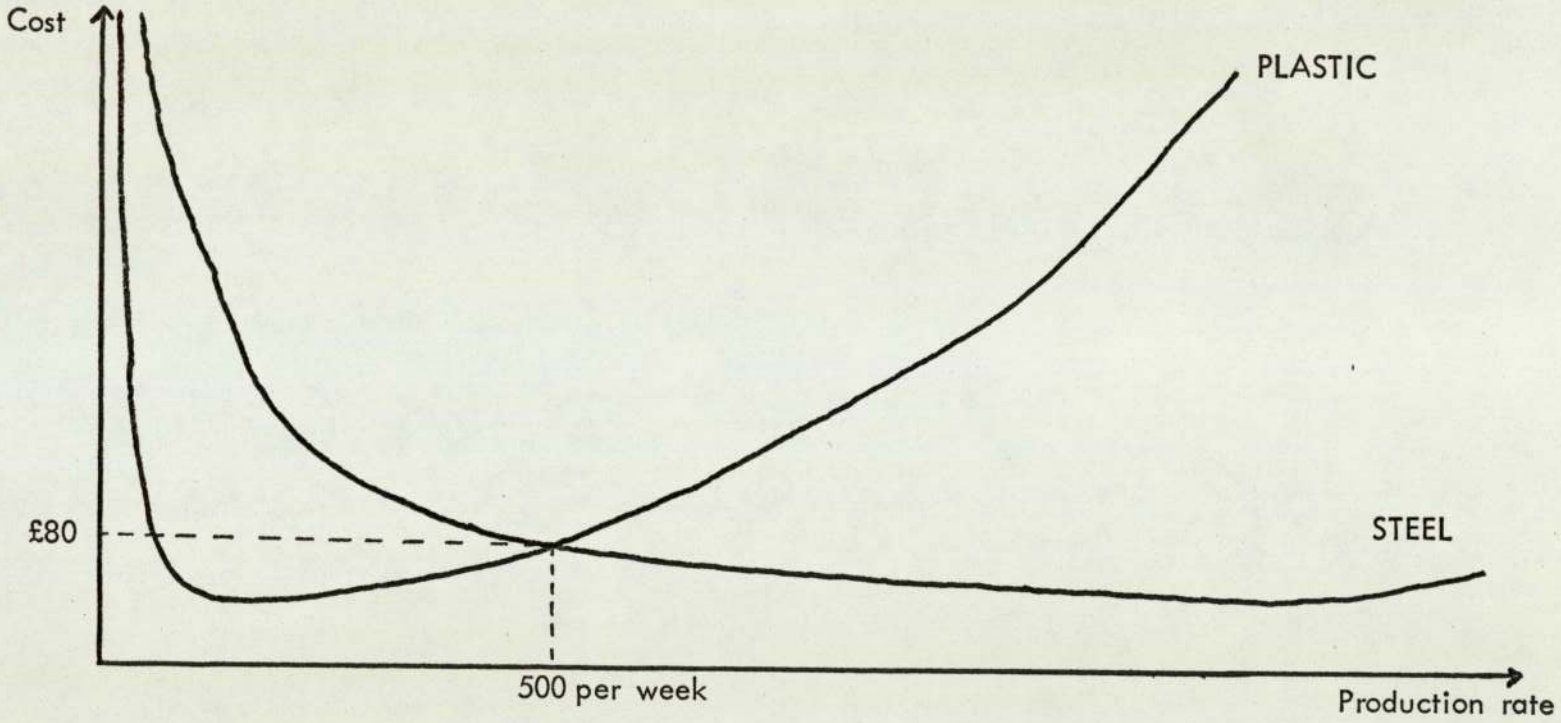


FIGURE (4.3) ECONOMIES OF SCALE FOR MOTOR BODY PRODUCTION IN STEEL AND PLASTIC

Source: Consultation with Professor B.B. Hundy, Cranfield Institute of Technology.

TABLE (4.12) Disaggregation of motor industry purchases and technical coefficients, column B(4).

(a) Industry Table

	TOTAL INDUSTRY PURCHASES £M	BODY INDUSTRY PURCHASES £M	STEEL BODY COEFF. X 10^4	PLASTIC BODY COEFF. X 10^4
3 Coal mining	2.9	0.5	30	4
4 Other mining, quarrying				
12 Mineral oil refining	10.1			
13 Paint	10.7			
14 Coke ovens	0.2	0.2	12	1
17 Plastic, synth. resins, etc.	2.1	0.2	12	5900
18 Chemicals (15+16+18)	8.4	0.4	24	288
19 Iron and steel	222.1	43.0	2550	150
20 Aluminium and alloys	33.2	0.5	30	4
21 Other non-ferrous metals	36.9	0.9	54	15
22 Agricultural machinery				
23 Machine tools	2.6			
24 Engineers' small tools	12.7			
25 Industrial engines	0.2			
26 Textile machinery				
27 Const.& mech. handling equip.	1.4	0.1	6	1
28 Office machinery				
29 Other non-electrical mach.	3.3			
30 Indust. plant and steel works	1.3			
31 Other mechanical engineering	36.1			
32 Instrument engineering	4.3			
33 Electrical machinery	7.4			
34 Insulated wires and cables	7.9			
35 Electronics and telecom.	3.0			

TABLE (4.12) Continued

	TOTAL INDUSTRY PURCHASES £M	BODY INDUSTRY PURCHASES £M	STEEL BODY COEFF. X 10^4	PLASTIC BODY COEFF. X 10^4
36 Other electrical goods	96.8			
37 Cans and metal boxes				
38 Other metal goods	163.8	10.0	593	100
39 Shipbuilding, etc.				
40 Motor vehicles, etc.	575.9		See below	
41 Aerospace equipment				
42 Other vehicles	1.3			
52 Cement				
53 Other building materials	0.9			
54 Pottery and glass	12.6			30
55 Furniture, etc.	37.9			
56 Timber and misc. wood manuf.	12.8			
57 Paper and board	2.3			
58 Paper products	7.4			
60 Rubber	94.7			
61 Other manufacturing	21.2			
62 Construction	4.4			
63 Gas	5.7	0.5	30	30
64 Electricity	22.0	4.5	267	250
65 Water supply	1.1	0.1	6	10
66 Road and rail transport	24.3	2.3	136	36
67 Other transport	7.9	1.4	83	10
ALL OTHER	164.6	5.0	297	297
40(a) Motor body	X	3.0	178	78
40(b) All other motor	X	6.6	392	50
Primary Inputs	972.3	89.4	5303	27460
TOTAL	2636.7	168.6	10000	10000

TABLE (4.12) Continued

(b) Primary Input Table.

			TOTAL INDUSTRY PURCHASES £M	BODY INDUSTRY PURCHASES £M	STEEL BODY COEFF. X 10^4	PLASTIC BODY COEFF. X 10^4
IMPORTS			119.1	1.1	66	66
CAPITAL STOCK			3354	416	24674	27944
LABOUR	Number	Operatives	373.6	34.4	2040	431
		Other	108.3	10.0	593	125
	Wages, Salaries, etc.	Operatives	434.6	40.0	2372	502
		Other	148.7	13.7	813	172
		T.I.F.E.	640.3	59.0	3499	740
Total Value Added			817.5	84.7	5024	2466

TABLE (4.13) Per.cent change in Gross Output of industries when plastic is used for motor bodies.

3	Coal mining	-0.1	
4	Other mining, quarrying	0.1	
12	Mineral oil refining	0.2	
13	Paint	-0.1	
14	Coke ovens	-1.1	
17	Plastic, synth. resins, etc.	26.6	
18	Chemicals (15+16+18)	1.7	
19	Iron and steel	-2.6	
20	Aluminium and alloys	-0.2	
21	Other non-ferrous metals	-0.2	
22	Agricultural machinery	0.1	
23	Machine tools	-0.1	
24	Engineers' small tools	0.3	
25	Industrial engines	0.1	
26	Textile machinery	-	
27	Const.& mech. handling equip.	-	
28	Office machinery	-	
29	Other non-electrical mach.	-	
30	Indust. plant and steel works	-0.1	
31	Other mechanical engineering	-	
32	Instrument engineering	0.1	
33	Electrical machinery	-	
34	Insulated wires and cables	-	
35	Electronics and telecom.	-	
36	Other electrical goods	-	
37	Cans and metal boxes	0.3	
38	Other metal goods	-0.4	
39	Shipbuilding, etc.	-	
40	Motor vehicles, etc.	-0.3	
41	Aerospace equipment	0.1	
42	Other vehicles	-0.1	
52	Cement	-0.1	
53	Other building materials	-0.1	
54	Pottery and glass	0.3	
55	Furniture, etc.	-	
56	Timber and misc. wood manuf.	0.1	
57	Paper and board	0.4	
58	Paper products	0.4	
60	Rubber	-	
61	Other manufacturing	-	
62	Construction	-	
63	Gas	-0.1	
64	Electricity	0.2	
65	Water supply	0.5	
66	Road and rail transport	-	
67	Other transport	-	
	ALL OTHER	0.1	

TABLE (4.14) Changed use of primary inputs by industries when plastic is used for motor bodies; £M, th. man-years.

			Motor vehicle	Plastic material	Iron & steel	All Other	TOTAL
IMPORTS			-0.3	13.8	-3.7	8.1	17.9
CAPITAL STOCK			44.9	206.4	-93.6	89.5	247.2
LABOUR	Number	Operatives	-28.2	9.2	-8.4	4.4	-23.0
		Other	-7.9	5.9	-2.4	2.9	-1.5
	Wages, Salaries, etc.	Operatives	-32.8	10.5	-9.0	4.8	-26.5
		Other	-11.2	8.7	-2.9	4.0	-1.4
		T.I.F.E.	-48.2	21.5	-13.3	13.2	26.8
Total Value Added			-45.3	41.2	-18.0	22.1	0

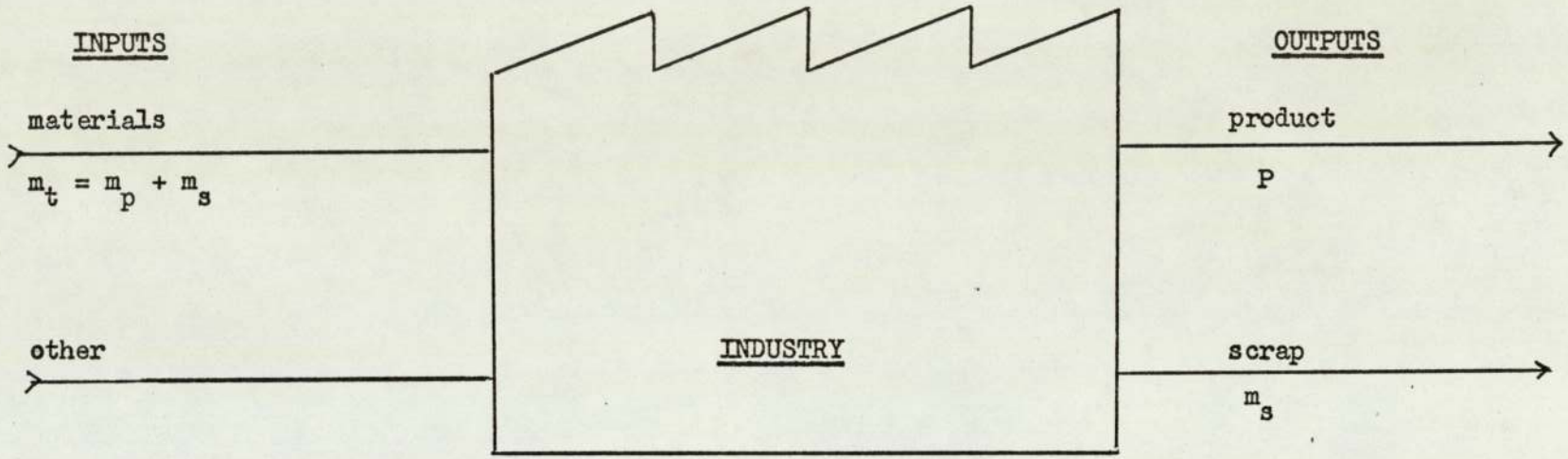


FIGURE (5.1) INDUSTRY INPUTS AND OUTPUTS

m_t ... the total material input

m_s ... the material which ends up as scrap

m_p ... the material which ends up in the product

P ... the value of the commodities produced

FIGURE (5.2) TECHNICAL POSSIBILITIES FOR MATERIAL SAVING.

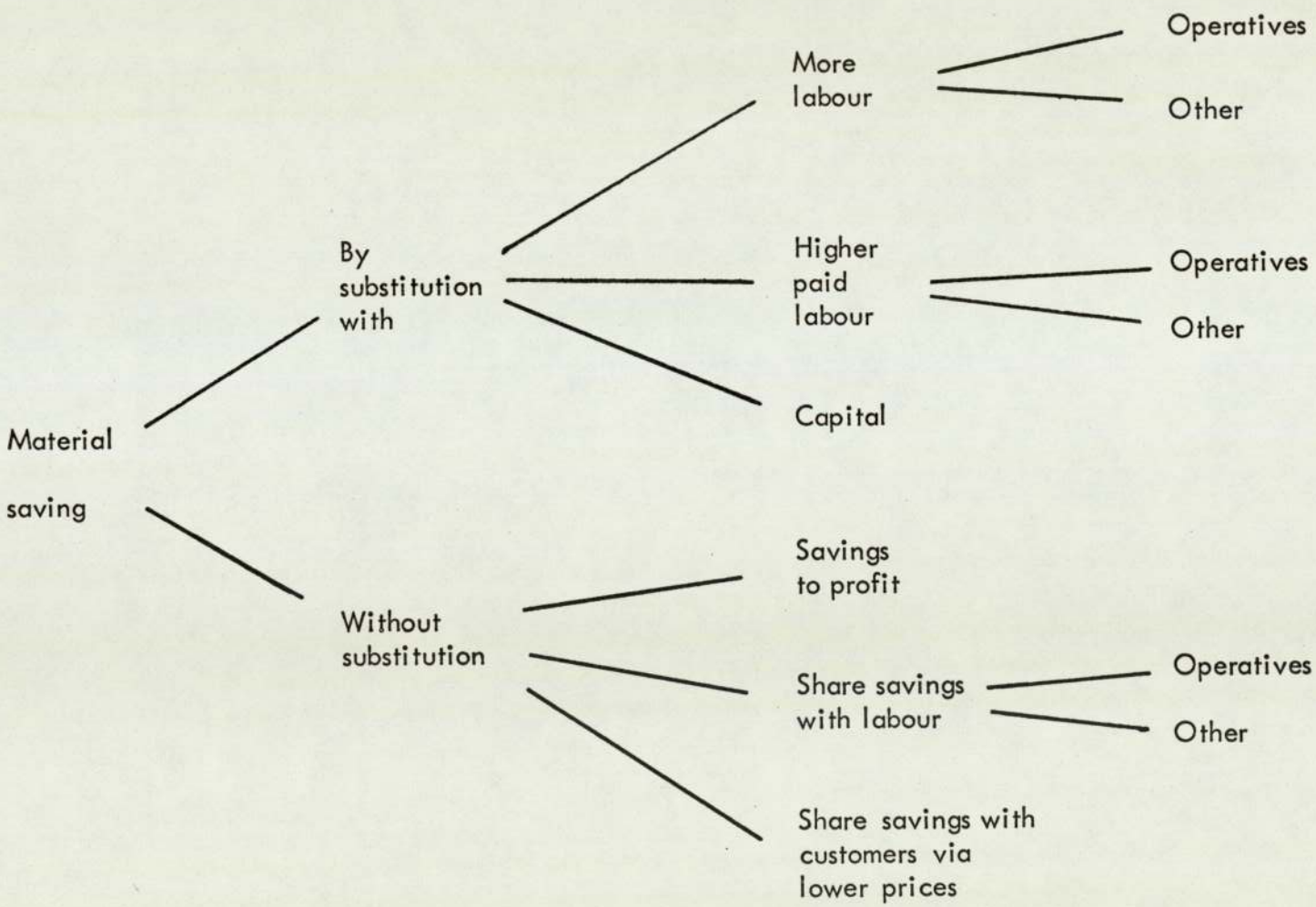


FIGURE (5.3) TETRAHEDRON FOR ALLOCATION OF MATERIAL COST SAVING.

The saving of material could be achieved by a combination of the options illustrated in Figure (5.2). The money saved via material saving can be allocated within the options of the below tetrahedron

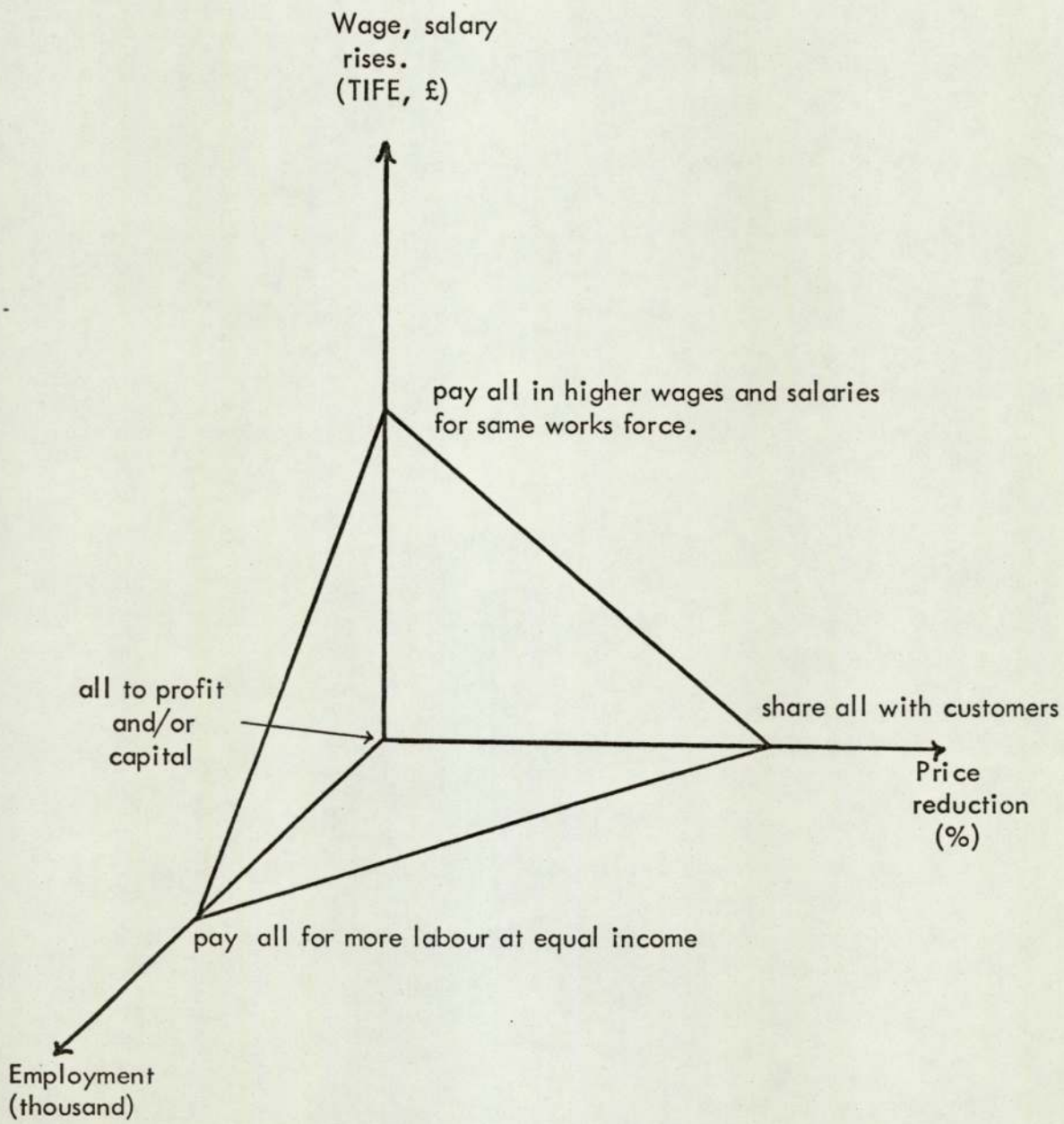


TABLE (5.1) Results for 10% reduction in material content of engineering and construction commodities.

(a) Industry Table

	Saving of Gross Output		Cost Saving	Price Red.	TIFE rise	Emp. rise
	£M (1)	% (2)	£M (3)	% (4)	% (5)	th. (6)
3 Coal mining	11.5	1.4		0.6		
4 Other mining, quarrying	17.5	5.9		0.6		
12 Mineral oil refining	8.6	0.9		0.2		
13 Paint	11.0	6.0		1.1		
14 Coke ovens	11.1	4.7		1.1		
17 Plastic, synth. resins, etc.	20.4	4.5		1.9		
18 Chemicals (15+16+18)	16.0	0.7		0.6		
19 Iron and steel	180.9	8.2		1.9		
20 Aluminium and alloys	24.4	8.0		4.4		
21 Other non-ferrous metals	65.6	7.4		5.2		
22 Agricultural machinery	0.2	0.2	1.2	3.6	4.9	1.0
23 Machine tools	0.5	0.2	3.3	2.8	3.5	2.5
24 Engineers' small tools	2.8	1.8	2.2	2.3	3.0	2.0
25 Industrial engines	-0.2	-0.2	2.3	3.3	5.8	1.9
26 Textile machinery	0.2	0.1	1.6	2.4	3.0	1.4
27 Const.& mech. handling equip.	1.4	0.3	6.9	3.3	5.6	5.7
28 Office machinery	-0.1	-0.1	0.9	2.0	2.6	0.8
29 Other non-electrical mach.	2.2	0.2	14.5	2.8	3.9	11.9
30 Indust. plant and steel works	2.0	0.3	12.8	3.4	5.6	9.1
31 Other mechanical engineering	4.0	0.7	11.0	3.2	4.6	9.0
32 Instrument engineering	0.9	0.2	2.8	1.5	1.5	2.5
33 Electrical machinery	1.1	0.2	8.0	2.6	4.1	6.8
34 Insulated wires and cables	1.9	0.6	14.3	4.1	23.1	12.4
35 Electronics and telecom.	1.1	0.1	6.3	1.6	1.8	6.1

TABLE (5.1) (a) continued

	Saving of Gross Output		Cost Saving	Price Red.	TIFE rise	Emp. rise
	£M (1)	% (2)	£M (3)	% (4)	% (5)	th. (6)
36 Other electrical goods	-	-	10.5	2.7	5.4	10.6
37 Cans and metal boxes	0.1	0.1	7.0	7.0	27.6	8.0
38 Other metal goods	-	-	47.5	3.9	10.0	44.0
39 Shipbuilding, etc.	1.0	0.2	6.0	2.5	2.8	5.2
40 Motor vehicles, etc.	0.2	-	43.4	3.4	6.8	32.7
41 Aerospace equipment	-	-	5.4	1.8	1.8	4.2
42 Other vehicles	1.0	0.6	2.4	2.3	3.0	2.0
52 Cement	2.8	2.8		0.6		
53 Other building materials	53.3	8.5		1.2		
54 Pottery and glass	16.7	4.9		0.7		
55 Furniture, etc.	0.4	0.1	5.2	2.6	4.5	3.8
56 Timber and misc. wood manuf.	18.4	2.7	24.9	4.0	14.9	5.2
57 Paper and board	2.7	0.6		0.5		
58 Paper products	3.8	0.6		0.3		
60 Rubber	22.2	4.6		0.9		
61 Other manufacturing	0.7	0.1	10.7	2.2	5.4	9.5
62 Construction	1.1	-	117.4	2.4	6.3	93.1
63 Gas	4.1	0.7		0.7		
64 Electricity	12.9	0.8		0.4		
65 Water supply	1.1	0.6		0.7		
66 Road and rail transport	17.8	1.0		0.4		
67 Other transport	6.2	0.3		0.2		
ALL OTHER	27.9	0.1		0.6		
TOTAL			368.5			291. 4

TABLE (5.1) continued

(b) Primary Input Table. Savings in primary inputs, £m, th. man-years.

			Engineering	Materials	Other	Total
IMPORTS			62.0	53.5	14.3	129.8
CAPITAL STOCK			31.4	640.9	309.5	981.8
LABOUR	Number	Operatives	7.1	53.3	25.9	86.3
		Other	3.1	16.3	8.4	27.8
	Wages, Salaries, etc.	Operatives	6.9	55.2	28.7	90.8
		Other	4.1	20.4	10.8	35.3
		T.I.F.E.	9.2	100.4	44.8	154.4
Total Value Added			11.6	139.8	68.0	219.4

(c) Final Buyer Table Price reduction and saving for final buyers.

	Price reduction %	Cost saving £M
Consumers	0.6	109.4
Public Authorities	1.0	32.5
Gross Domestic Fixed Capital	1.8	131.1
Stocks	-	-
Exports	1.2	95.0
TOTAL FINAL	1.0	368.5

TABLE (5.2) Per cent material waste in one firm, reported by Rawicz-Szczerbo.[2]

	Yield	Waste
Sheet and strip materials	67	33
Bar materials	52	48
Diecastings	88	12
Plastic mouldings	82	18
Paint and enamel	27	73

TABLE (5.3) Variation of material yield (%) found within one firm, by Morgan and Reis.[51]

	Hot Mill	Cold Mill
Average yield	85.6	76.6
Range	64.9 to 96.5	50.5 to 88.5
Standard deviation	5.5	6.8

TABLE (5.4) Variation of material yield found in metal working industries, by Institute of Production Engineers.[52]

MATERIAL	RANGE OF MATERIAL UTILIZATION (%)
Bar parts	12 - 80
Sheet metal	66 - 98
Brass sections	65 - 90
Iron castings	53 - 93
Aluminium alloy castings	67 - 93
Steel Stampings	46 - 86
Average for complete set of parts in light precision assemblies	73

FIGURE (5.4) A MODEL OF SCRAP IRON AND STEEL FLOW FOR THE U.K.

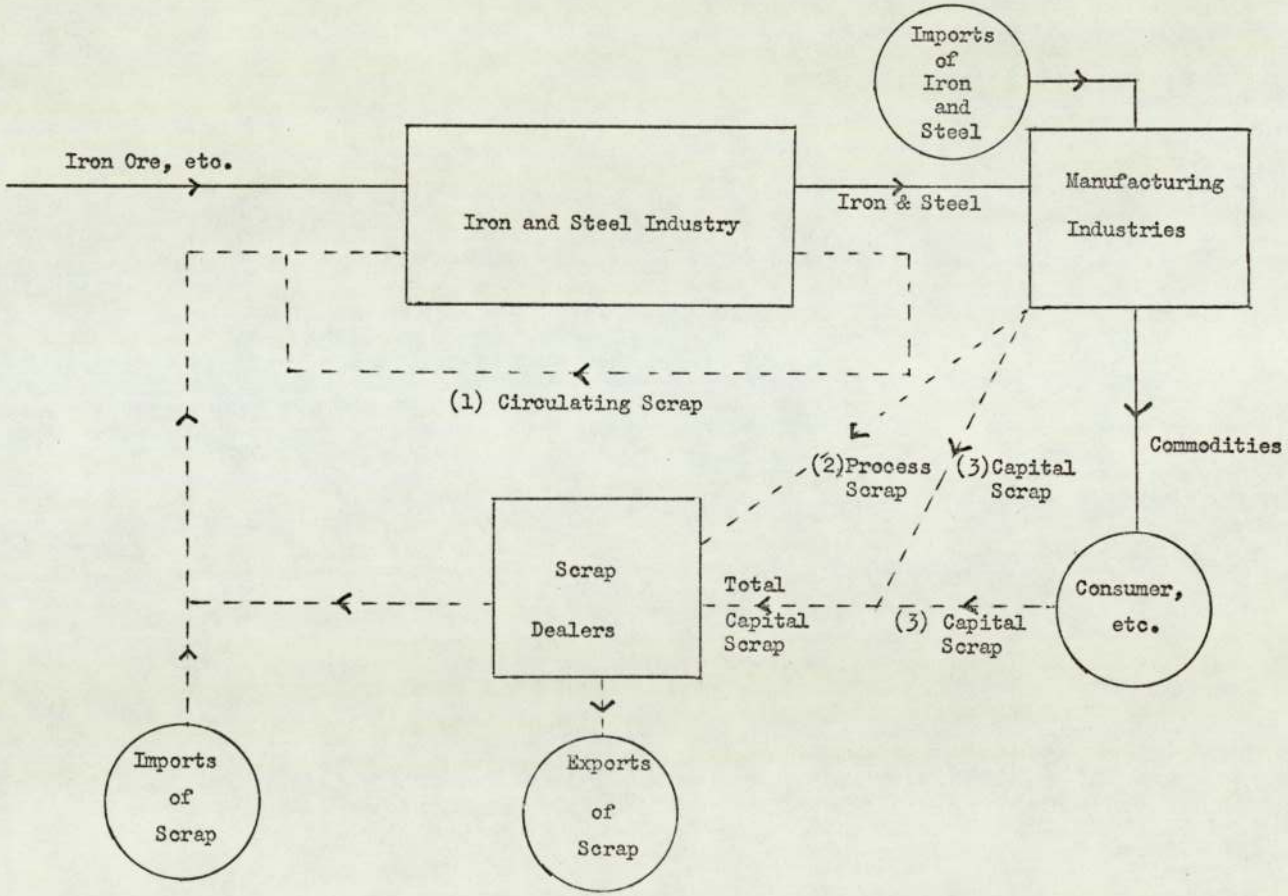


TABLE (5.5) Increase in material productivity within one firm, reported by Bahiri. (5)

Year	Labour Costs £	Paint Costs £	Coverage sq.yds.	Improved Material Utilization %	Reduction in labour Costs %
1959	3500	2070	31650		
1960	2850	4789	56755	79	18.5
1962	1697	3192	70664	123	51.5

TABLE (5.6) Total circulating, process, and capital iron and steel scrap arising in U.K., 1968.

SCRAP TYPE	SELLING			HANDLING		BUYING	
				VALUE ADDED BY SCRAP DEALER			
	TONS th.	VALUE £'000	PRICE PER TON £	GROSS £'000	PER TON £	VALUE £'000	PRICE PER TON £
Circulating (Purchased)	1740.2	22466.0	12.91	-	-	22466.0	12.91
Process	3024.5	28529.0	9.43	7531.0	2.49	36052.0	11.92
Capital	5897.2	48946.8	8.30	19490.4	3.31	68547.2	11.61
Imports	3.1	207.8	67.03	-	-	207.8	67.03
TOTAL	10665.0	100149.6	9.39	27021.4	3.03	127163.0	11.92
CIRCULATING (OWN ARISING)	8516.7						
TOTAL CONSUMPTION	19181.7						

SOURCE: Census of Production[27], Iron and Steel Annual Statistics[39]

FIGURE (5.5) FLOW OF MATERIAL AND MONEY BETWEEN THE UK IRON AND STEEL, ENGINEERING, AND SCRAP METAL INDUSTRIES.

Source: Census of production[27], Iron and Steel Industry - Annual Statistics[39]

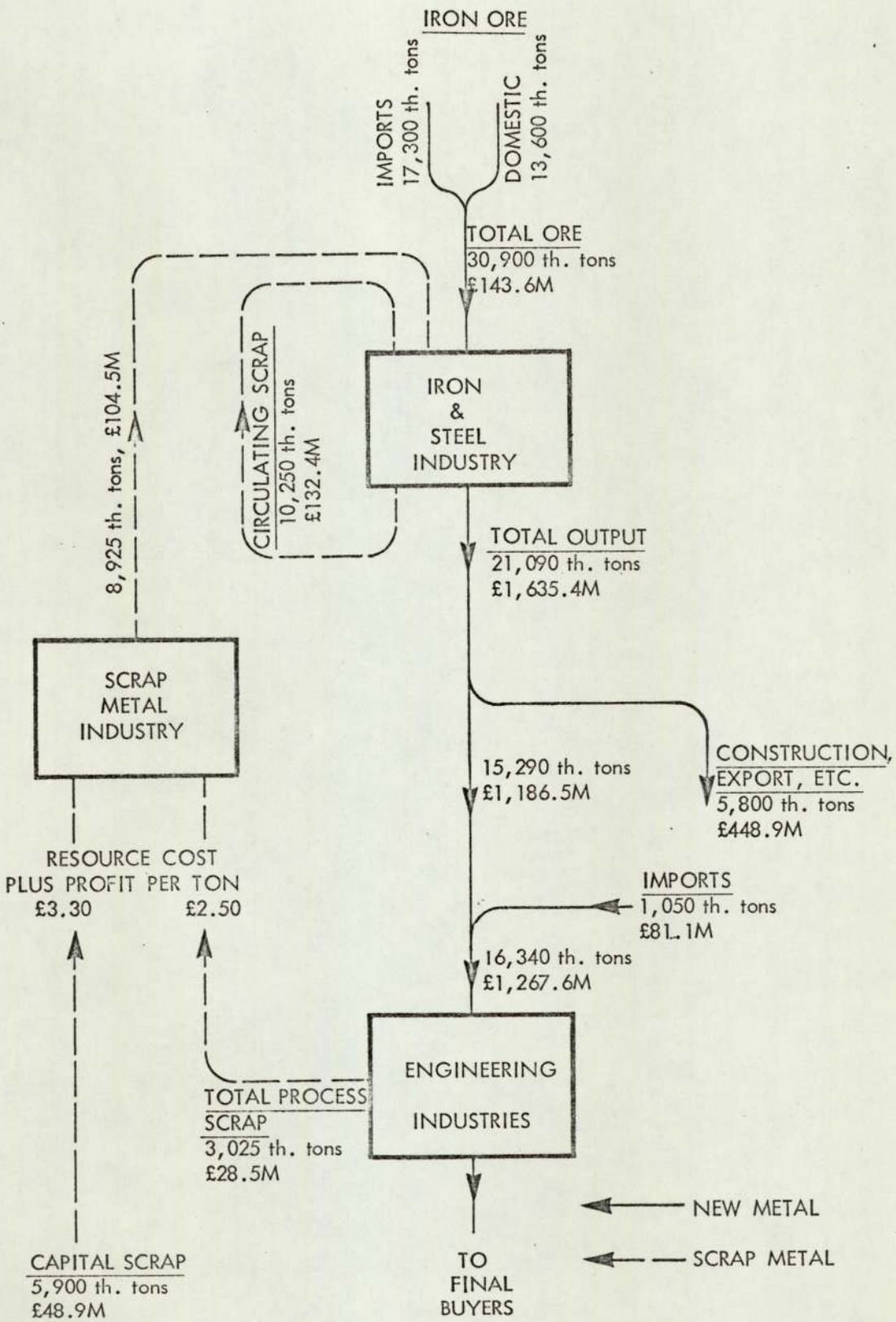


TABLE (5.7) Purchases of new metal of each type and sales of scrap. Based on Census of Production, 1968.

	1. Pig Iron			2. Iron castings			3. Ingots		
	th.tons	£'000	£/ton	th.tons	£'000	£/ton	th.tons	£'000	£/ton
22 Agricultural machinery	6.7	145	21.64	11.5	1278	111.13	9.0	482	53.56
23 Machine tools	8.1	291	35.93	93.3	11244	120.51	3.6	282	78.33
24 Engineers' small tools				11.1	1233	111.08	10.8	2190	202.78
25 Industrial engines	9.2	197	21.41	34.1	5115	150.00			
26 Textile machinery	11.1	256	23.06	34.2	4519	132.13	1.8	149	82.78
27 Const.& mech. handling equip.	11.3	305	26.99	75.1	7908	105.30	32.0	1758	54.94
28 Office machinery				2.0	254	127.00	0.7	65	92.86
29 Other non-electrical mach.	90.6	2129	23.50	149.4	19519	130.65	26.6	1936	72.78
30 Indust. plant and steel works	21.2	490	23.11	20.5	2373	115.76			
31 Other mechanical engineering	61.6	1601	25.99	59.4	7486	126.03	22.4	1888	84.29
33 Electrical machinery	19.5	485	24.87	42.9	5542	129.18	7.8	708	90.77
34 Insulated wires and cables	2.2	54	24.55	1.8	230	127.78			
35 Electronics and telecom.				0.7	98	140.00	4.4	333	75.68
36 Other electrical goods	6.4	136	21.25	16.7	1931	115.63			
37 Cans and metal boxes									
38 Other metal goods	88.7	1371	15.46	36.8	5269	143.18	439.5	35626	81.06
39 Shipbuilding, etc.				17.0	2311	135.94			
40 Motor vehicles, etc.	60.5	1335	22.07	851.0	88375	103.85			
41 Areospace equipment									
42 Other vehicles	6.6	147	22.27	11.7	1688	144.27	2.0	121	60.50
TOTAL, AVERAGE	403.7	8942	22.15	1469.2	166373	113.24	560.6	45538	81.23

TABLE (5.7) Continued

	4. Bars and Rods			5. Plates, over 3 mm.			6. Sheets, less than 3 mm.		
	th.tons	£'000	£/ton	th.tons	£'000	£/ton	th.tons	£'000	£/ton
22 Agricultural machinery	80.0	5082	63.53	39.4	2200	55.84	27.6	1823	66.05
23 Machine tools	94.9	6771	71.35	39.2	2324	59.29	5.6	564	100.71
24 Engineers' small tools	40.8	10273	251.79	11.1	1258	113.33	18.9	1330	70.37
25 Industrial engines	16.7	1298	77.72	14.0	738	52.71			
26 Textile machinery	59.0	4597	77.92	9.1	700	76.92	11.3	819	72.48
27 Const.& mech. handling equip.	237.5	14814	62.37	196.1	11085	56.53	36.1	2524	69.92
28 Office machinery	7.1	677	95.35	0.9	51	56.67	4.0	308	77.00
29 Other non-electrical mach.	303.2	23638	77.96	190.7	11166	58.55	149.9	11011	73.46
30 Indust. plant and steel works	669.5	36322	54.25	569.1	30991	54.41	66.3	4685	70.66
31 Other mechanical engineering	355.5	25428	71.53	65.8	3747	56.95	24.9	2148	86.27
33 Electrical machinery	90.4	6047	66.89	104.9	6715	64.01	123.4	13278	107.60
34 Insulated wires and cables	15.7	1338	85.22	0.8	55	68.75			
35 Electronics and telecom.	28.4	2457	86.51	5.5	441	80.18	37.6	3477	92.47
36 Other electrical goods	69.2	5837	84.35	8.7	595	68.39	216.6	15925	73.69
37 Cans and metal boxes							18.0	1182	65.67
38 Other metal goods	2234.4	119807	53.62	150.4	8487	56.43	871.4	57924	66.47
39 Shipbuilding, etc.	137.0	7089	51.74	442.4	21723	49.10	9.1	542	59.56
40 Motor vehicles, etc.	593.0	44191	74.52	247.2	13263	53.65	1177.0	71583	60.82
41 Areospace equipment	36.4	6587	180.96	5.0	584	116.80	28.3	2660	93.99
42 Other vehicles	73.8	4541	61.53	35.4	1820	51.41	16.9	1084	64.14
TOTAL, AVERAGE	5142.5	326794	63.55	2135.7	117943	55.22	2842.4	192867	67.85

TABLE (5.7) Continued

	7. Hoops and Strips			8. Tinplate			9. Forgings		
	th.tons	£'000	£/ton	th.tons	£'000	£/ton	th.tons	£'000	£/ton
22 Agricultural machinery	2.9	159	54.85				.7	105	150.00
23 Machine tools	.7	59	84.29				7.8	1275	163.46
24 Engineers' small tools	2.8	556	198.57				2.2	558	253.64
25 Industrial engines							18.6	4219	226.83
26 Textile machinery	3.9	331	84.87	.4	43	107.50	3.5	603	172.29
27 Const.& mech. handling equip.	8.5	426	50.12				19.6	2874	146.63
28 Office machinery	10.1	816	80.79						
29 Other non-electrical mach.	27.2	2534	93.16	4.0	303	75.75	23.8	4328	181.85
30 Indust. plant and steel works	28.3	1542	54.49				10.8	1840	170.37
31 Other mechanical engineering	71.5	5804	71.17	4.9	439	89.59	27.5	5074	184.51
33 Electrical machinery	16.1	1532	95.16	0.3	23	76.67	14.6	4382	300.14
34 Insulated wires and cables	15.4	987	64.09	2.0	140	70.00			
35 Electronics and telecom.	49.9	3944	79.04	1.1	96	87.27	1.1	243	220.91
36 Other electrical goods	106.2	7649	72.02				2.1	361	171.90
37 Cans and metal boxes				790.6	66783	84.47			
38 Other metal goods	252.3	20947	83.02	175.6	11550	65.77	4.4	707	160.68
39 Shipbuilding, etc.							12.6	2741	217.54
40 Motor vehicles, etc.	354.9	20871	58.81	11.3	968	85.66	180.1	26670	147.27
41 Areospace equipment							16.3	8409	515.89
42 Other vehicles	1.8	111	61.67				12.8	1546	120.78
TOTAL, AVERAGE	952.5	68268	71.67	990.2	80345	81.14	358.5	65935	183.92

TABLE (5.7) Continued

	10. Steel Castings			11. Wrought Tubes			12. Other		
	th.tons	£'000	£/ton	th.tons	£'000	£/ton	th.tons	£'000	£/ton
22 Agricultural machinery	3.7	660	178.38	9.7	805	82.99	8.1	925	114.2
23 Machine tools	6.9	1197	173.48	2.7	346	128.15	2.1	337	160.48
24 Engineers' small tools	1.7	402	236.47				6.1	1151	188.69
25 Industrial engines	4.2	1287	306.43	2.2	262	119.09	5.0	628	125.60
26 Textile machinery	8.5	778	222.29	5.2	850	163.46	1.3	178	136.92
27 Const.& mech. handling equip.	60.0	11808	196.80	35.2	3655	103.84	42.7	4775	111.83
28 Office machinery				0.1	19	190.00	3.5	537	153.43
29 Other non-electrical mach.	78.9	15729	199.35	87.3	9296	106.58	46.6	7155	153.54
30 Indust. plant and steel works	12.2	1999	163.85	111.2	9998	89.91	76.5	9810	128.24
31 Other mechanical engineering	26.1	4833	185.17	32.3	4178	129.35	5.7	1087	190.70
33 Electrical machinery	19.7	4450	225.89	11.3	1465	129.65	61.0	7632	125.11
34 Insulated wires and cables				1.2	136	113.33	1.5	162	108.00
35 Electronics and telecom.	0.5	105	210.00	1.1	179	162.73	9.0	1122	124.67
36 Other electrical goods	5.7	724	127.02	10.5	1263	120.29	19.2	2517	131.07
37 Cans and metal boxes							18.2	1066	58.57
38 Other metal goods	2.9	462	159.31	31.5	3286	104.32	166.2	13433	80.82
39 Shipbuilding, etc.	22.2	4511	203.20	19.0	2229	117.32	6.2	751	121.13
40 Motor vehicles, etc.	37.8	9351	247.38	71.1	7999	112.50	179.8	19830	110.29
41 Areospace equipment	3.5	1848	528.00	1.7	676	397.65	11.2	4021	359.02
42 Other vehicles	26.6	3207	120.56	17.4	2100	120.69	47.7	5381	112.81
TOTAL, AVERAGE	316.1	63351	200.41	450.7	48742	108.15	717.6	82498	114.96

TABLE (5.7) Continued

	TOTAL NEW METAL BOUGHT			TOTAL SCRAP SOLD			Waste %	Loss in value per ton of scrap %
	th.tons	£'000	£/ton	th.tons	£'000	£/ton		
22 Agricultural machinery	199.3	13664	68.56	20.4	176	8.63	10.2	87
23 Machine tools	264.9	24690	93.20	27.2	211	7.76	10.3	92
24 Engineers' small tools	105.5	18951	179.63	23.7	1130	47.69	22.5	73
25 Industrial engines	104.0	13744	132.15	31.4	191	6.08	30.2	95
26 Textile machinery	144.3	13823	95.79	16.5	129	7.82	11.4	92
27 Const.& mech. handling equip.	754.1	61932	82.18	94.0	722	7.68	12.5	91
28 Office machinery	28.4	2727	96.02	5.2	34	6.54	18.3	93
29 Other non-electrical mach.	1178.2	108744	92.30	112.8	918	8.14	9.6	91
30 Indust. plant and steel works	1585.6	100050	63.10	128.5	1024	7.97	8.1	87
31 Other mechanical engineering	757.6	63713	84.10	163.8	1232	7.52	21.6	91
33 Electrical machinery	511.9	52259	102.09	99.5	755	7.59	19.4	93
34 Insulated wires and cables	40.6	3102	76.40	3.0	21	7.00	7.4	91
35 Electronics and telecom.	139.3	12495	89.70	22.0	232	10.55	15.8	88
36 Other electrical goods	460.8	36938	80.16	72.5	669	9.23	15.7	88
37 Cans and metal boxes	826.8	69031	83.49	142.2	997	7.01	17.2	92
38 Other metal goods	4454.1	278869	62.61	715.8	7527	10.51	16.1	83
39 Shipbuilding, etc.	665.5	41897	62.96	80.4	692	8.61	12.1	86
40 Motor vehicles, etc.	3763.7	304436	80.89	1106.0	10041	9.08	29.4	89
41 Areospace equipment	102.4	24785	242.04	24.4	418	17.13	23.8	93
42 Other vehicles	252.7	21746	86.05	135.2	1410	10.43	53.5	88
TOTAL, AVERAGE	16339.9	1266596	77.58	3024.5	28529	9.43	18.5	88

j	1	2	3	4	5	6	7	8	9	10	11	12
α_j	0.191	0.180	0.238	0.051	0.008	0.111	0.018	0.146	0.529	1.011	-0.326	1.397

Explained variation		65%
γ_i	Range	0.53, 1.83
γ_i	Standard deviation	0.356
Average error in total		28%

TABLE (5.8) RESULTS OF MULTILINEAR REGRESSION MODEL FOR SCRAP IRON AND STEEL.

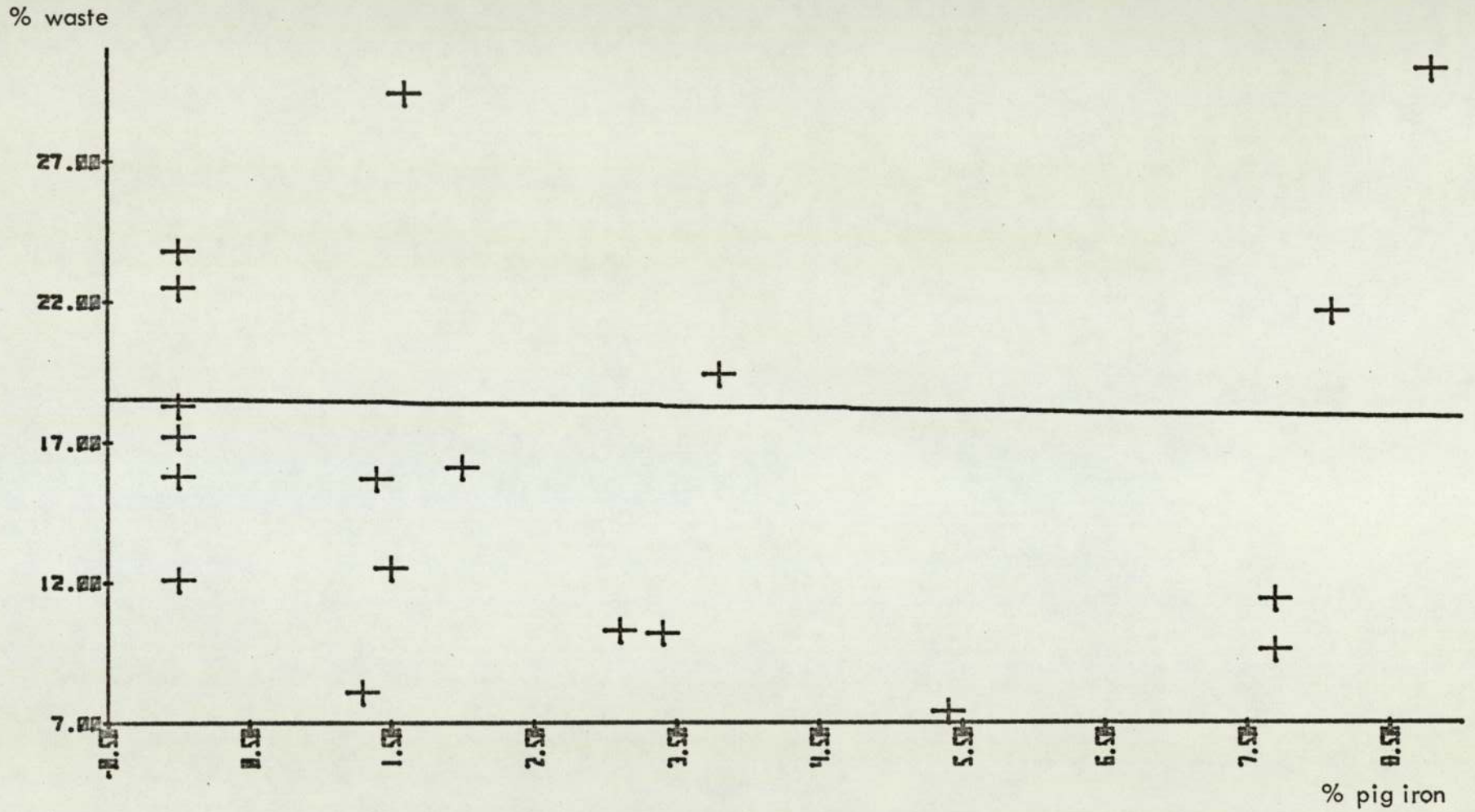


FIGURE (5.6) PROPORTION OF TOTAL MATERIAL WASTED AND PROPORTION OF SPECIAL TYPE OF NEW METAL PURCHASED. Least squares linear regression is shown. (Other vehicles industry not shown, 53.5% waste)

(a) PIG IRON correlation: $r = -0.02$, $100r^2 = 0\%$

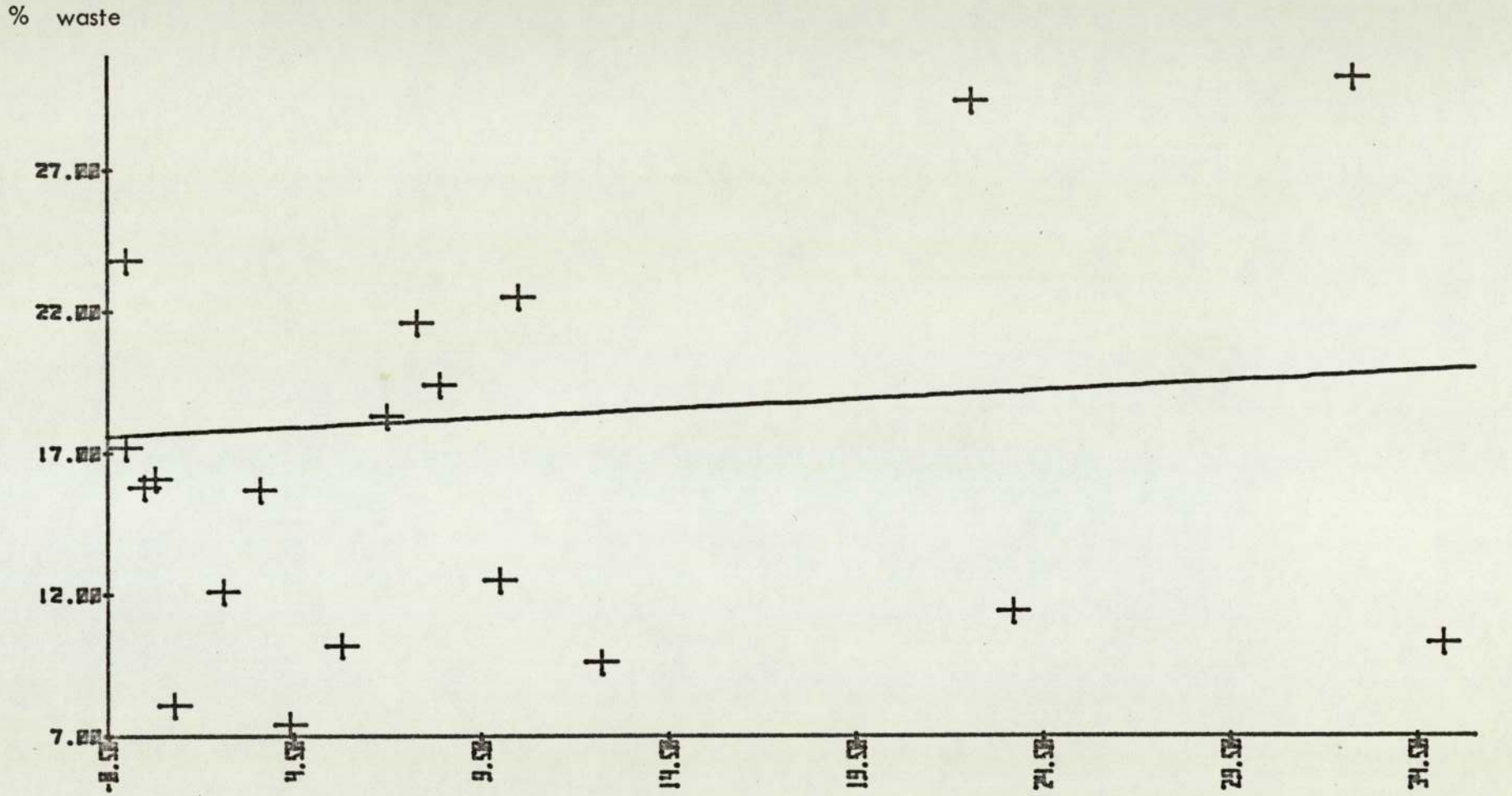


FIGURE (5.6) continued

(b) IRON CASTINGS correlation: $r = 0.07$, $100\ r^2 = 0\%$

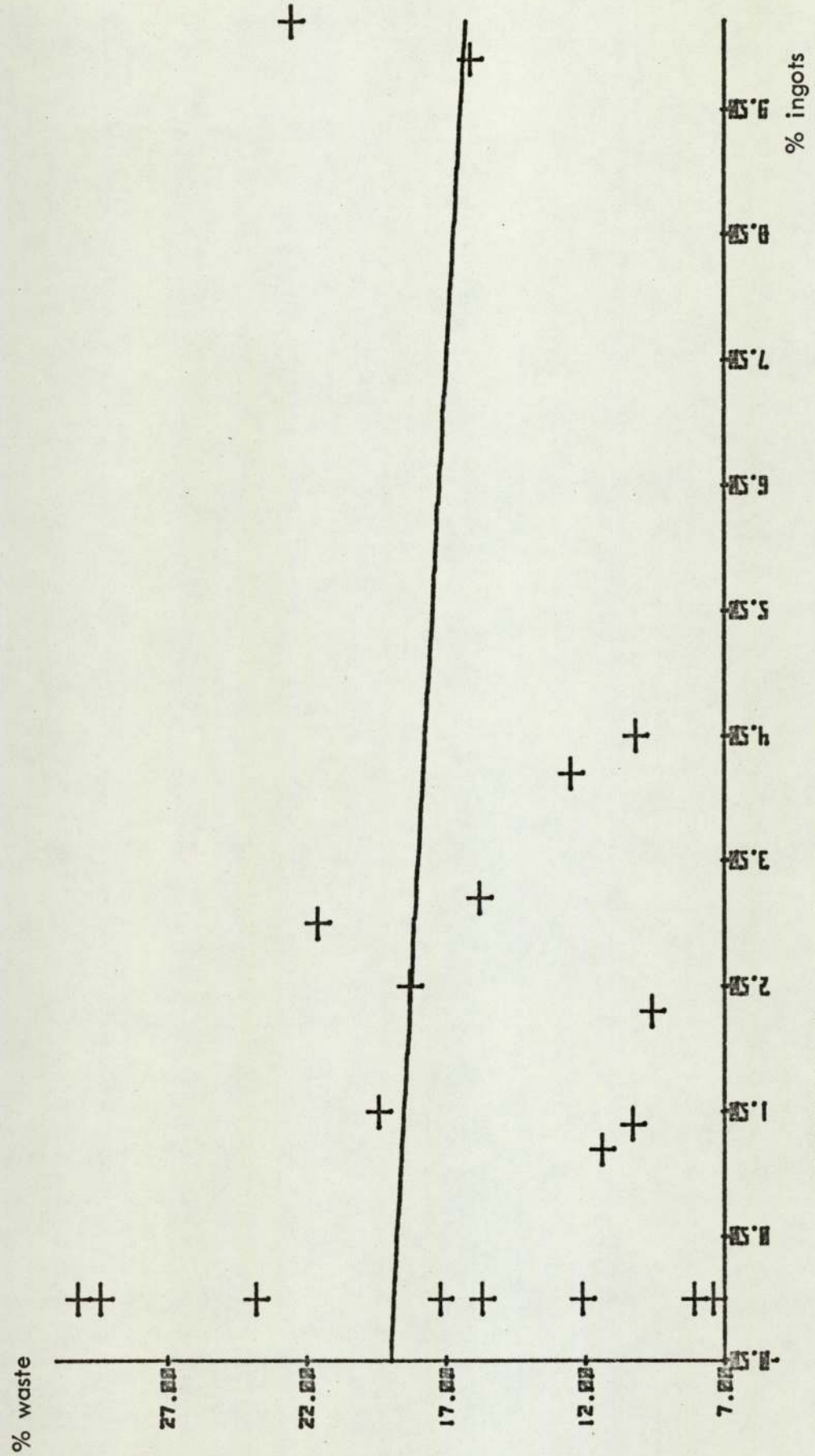


FIGURE (5.6) continued

(c) INGOTS correlation: $r = -0.07$, $100\,r^2 = 1\%$

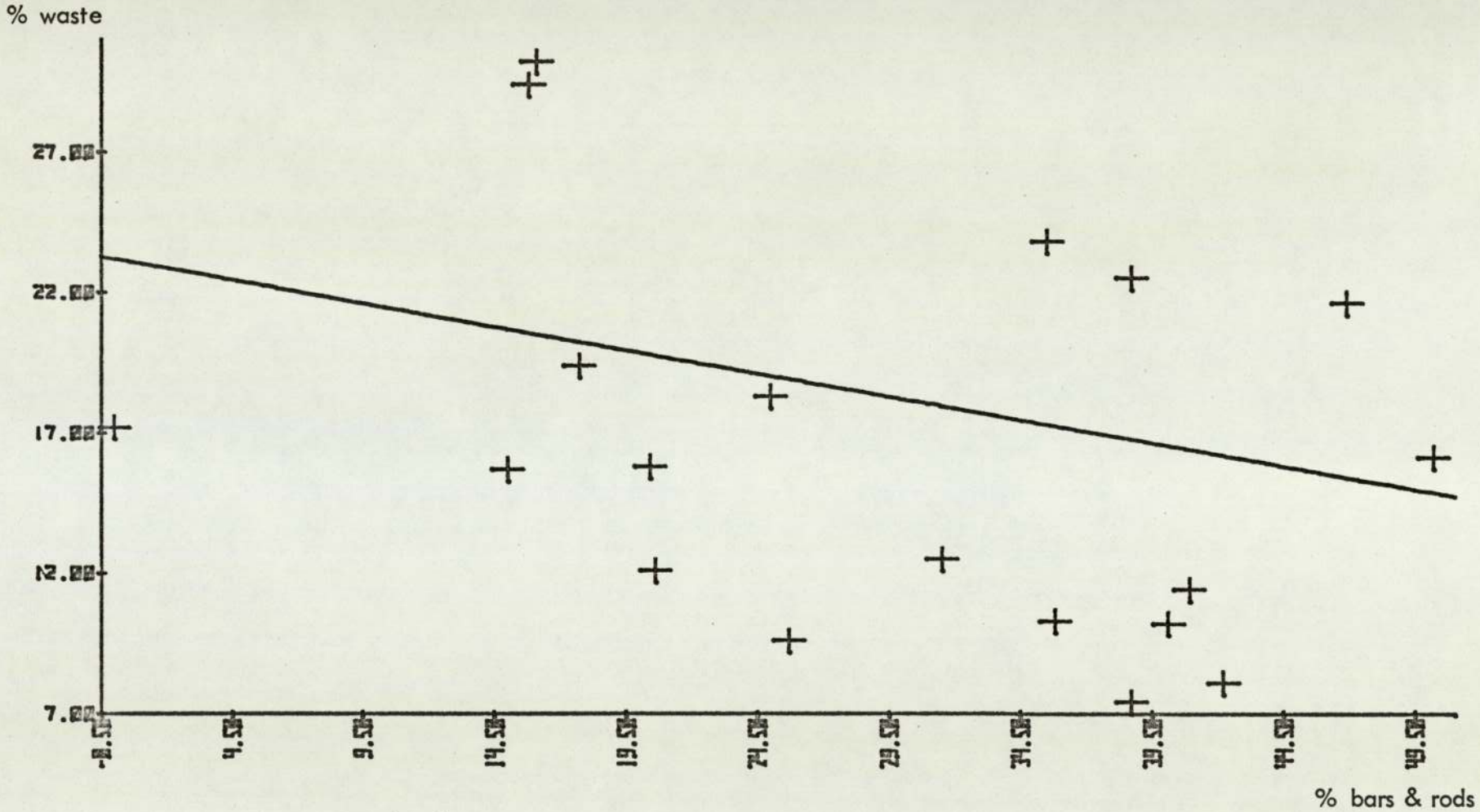


FIGURE (5.6) continued

(d) BARS AND RODS correlation: $r = -0.20$, $100\ r^2 = 4\%$

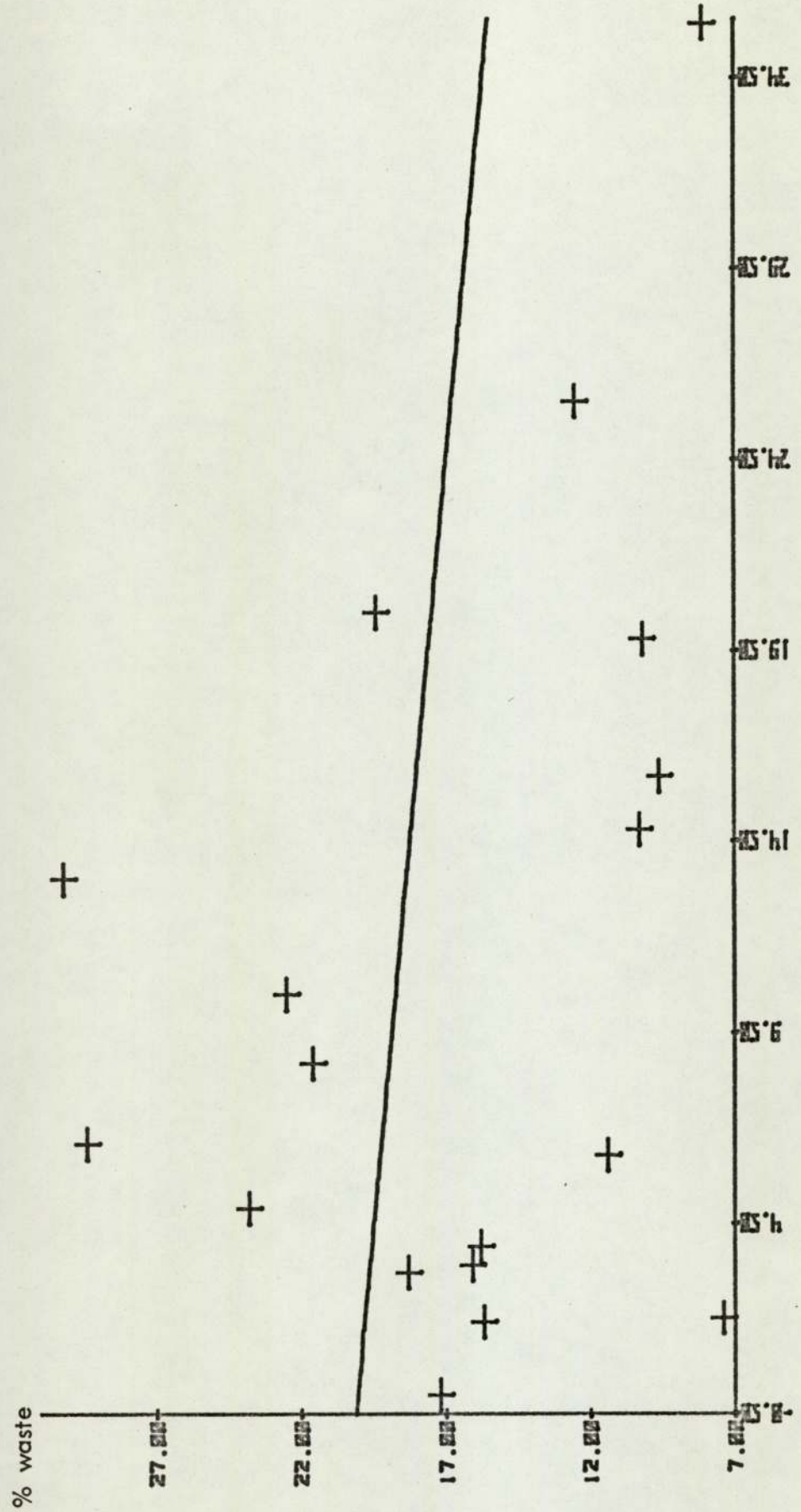


FIGURE (5.6) continued

(e) PLATES, over 3 mm correlation: $r = -0.19$, $100\,r^2 = 3\%$

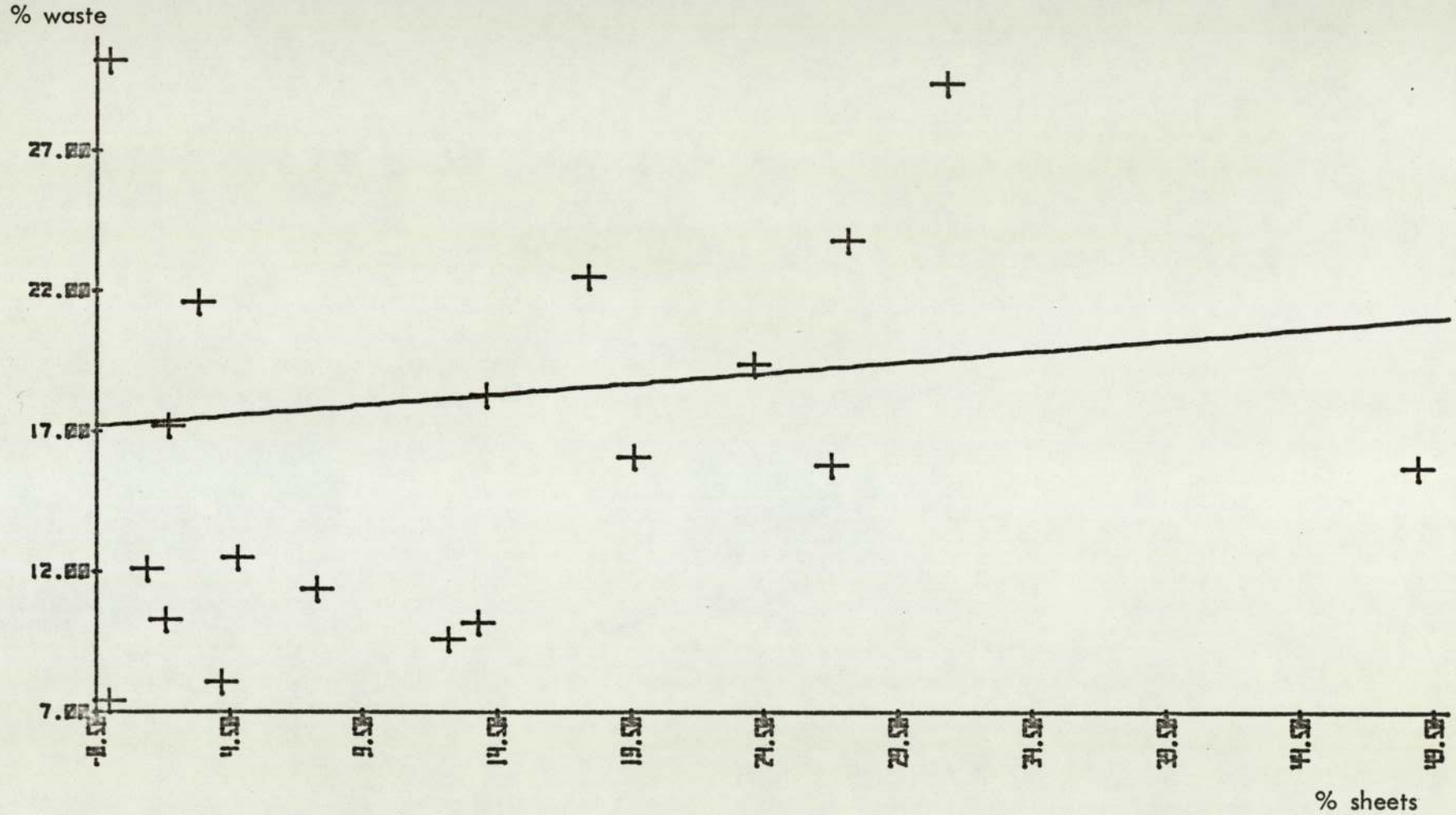


FIGURE (5.6) continued

(f) SHEETS, less than 3 mm correlation: $r = 0.09$, $100\,r^2 = 1\%$

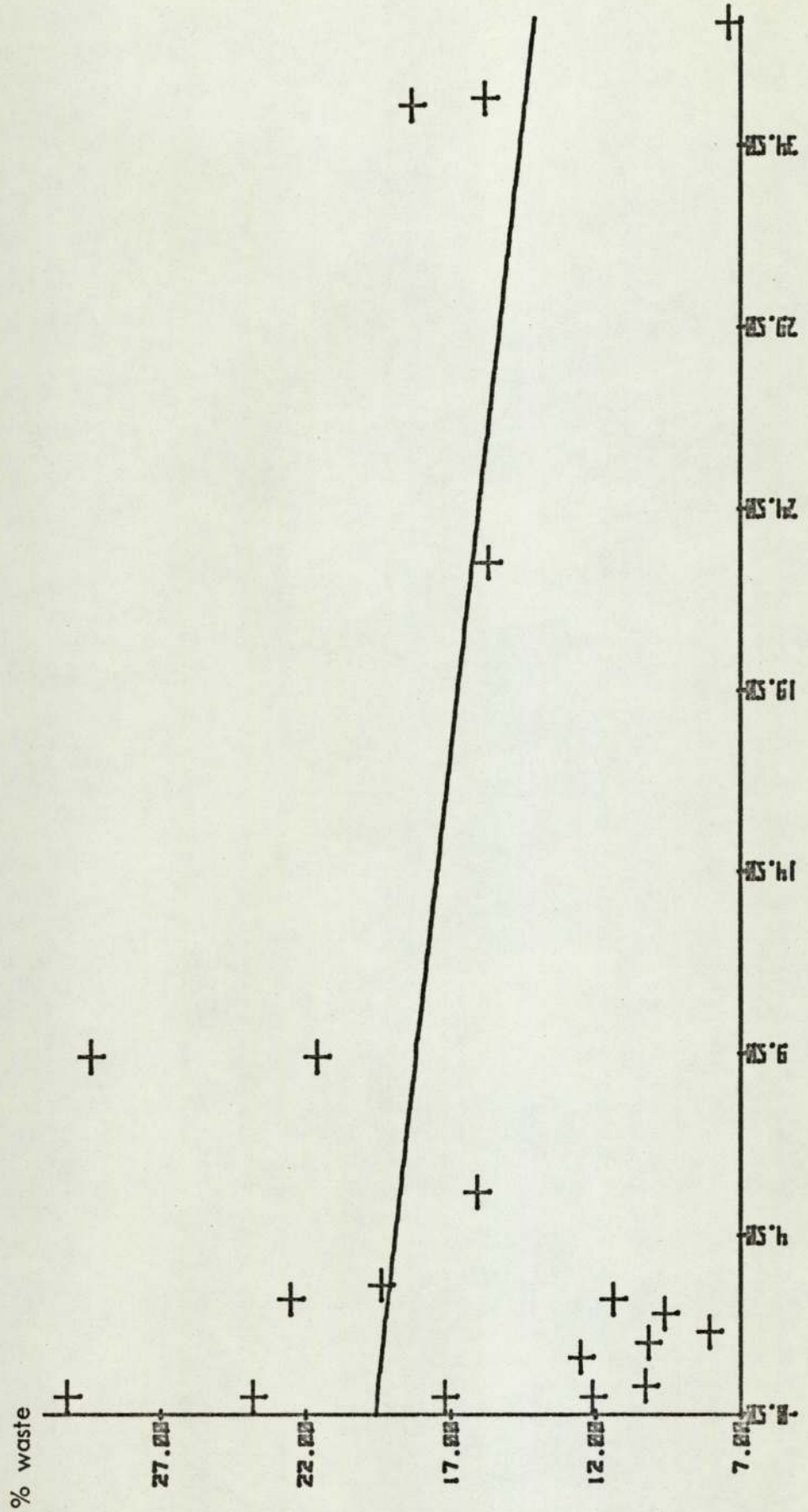


FIGURE (5.6) continued

(g) HOOPS AND STRIPS correlation: $r = -0.18$, $100\,r^2 = 3\%$

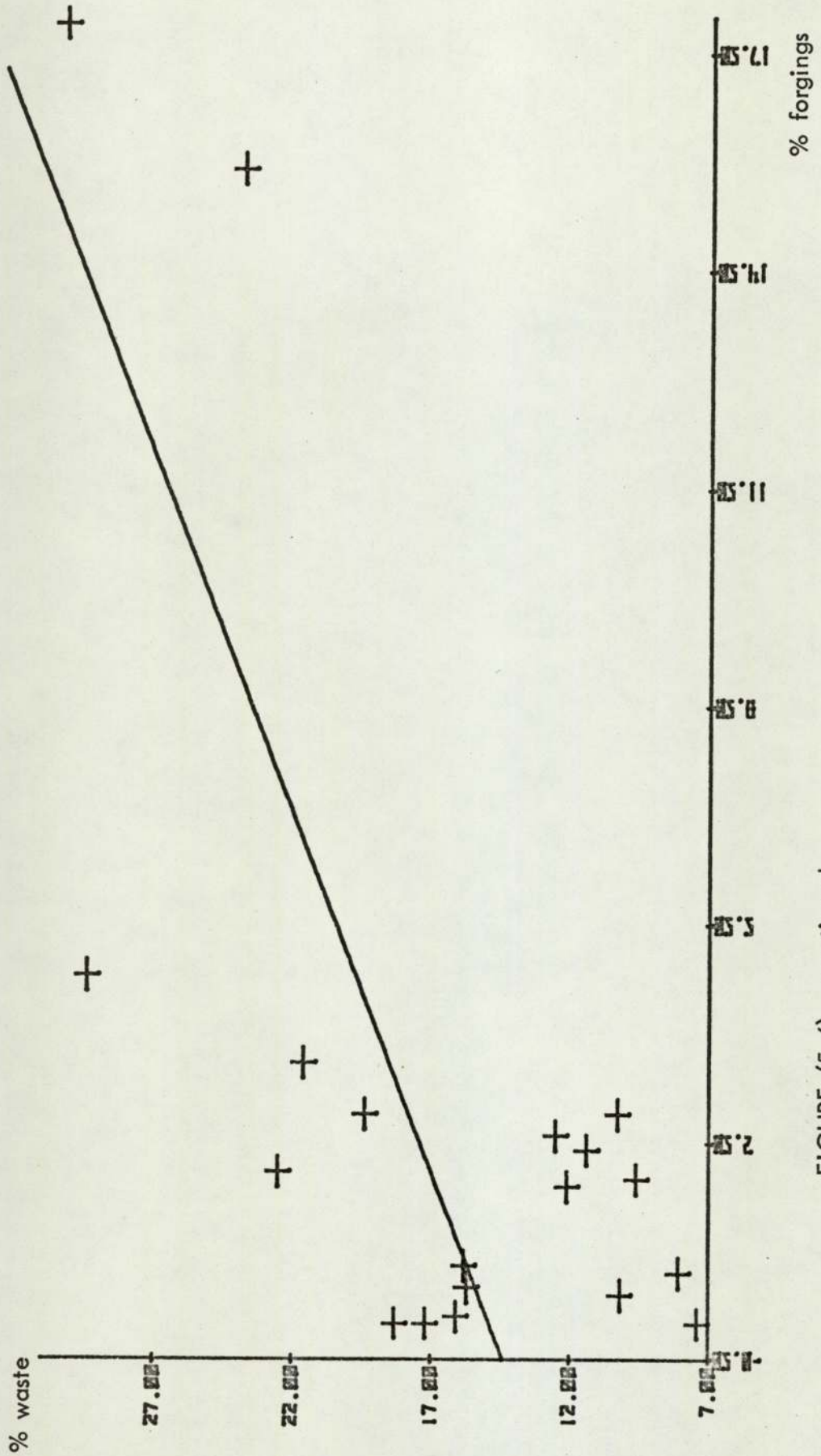


FIGURE (5.6) continued

(h) FORGINGS correlation: $r = 0.47$, $100\ r^2 = 22\%$

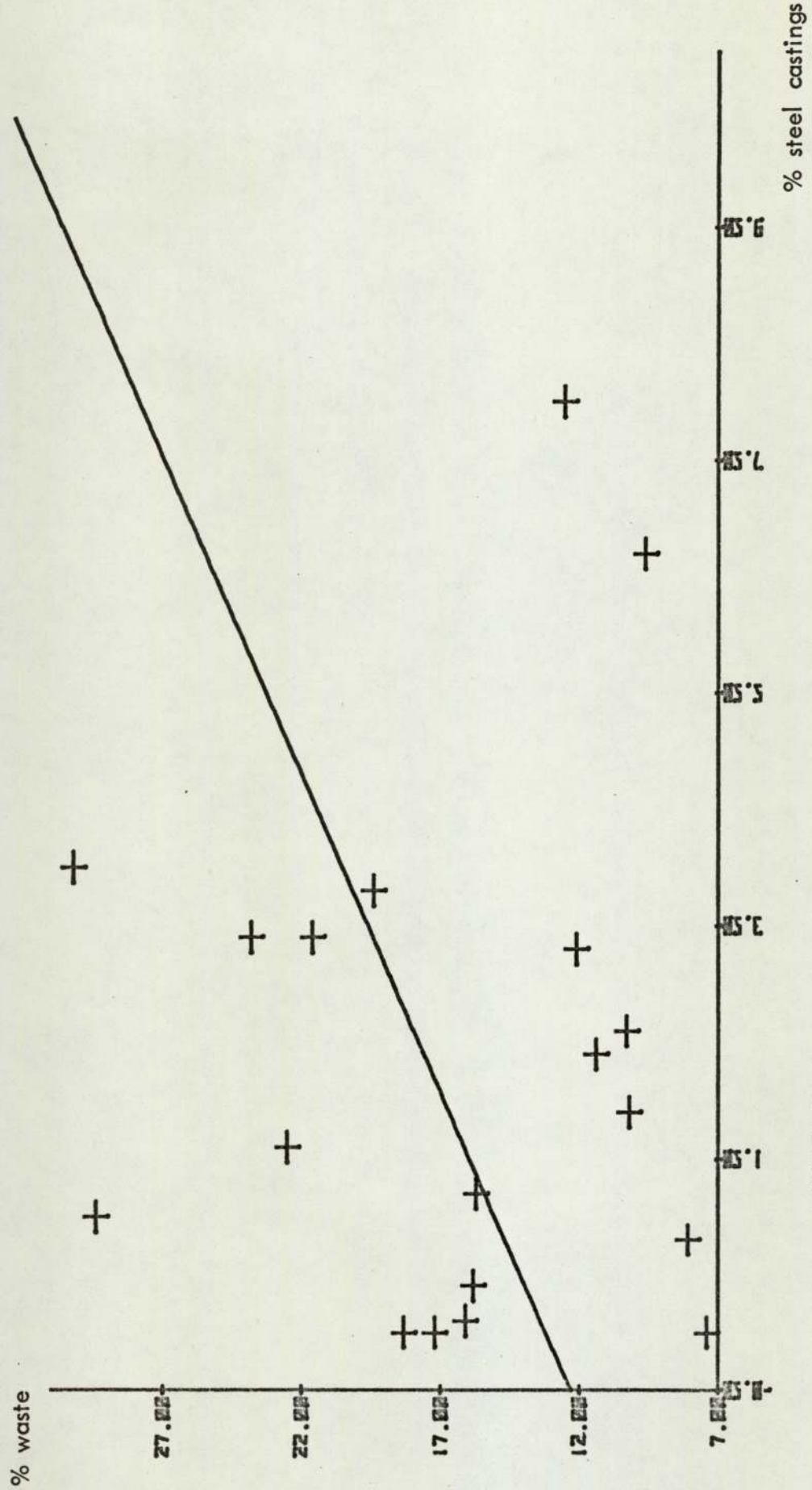


FIGURE (5.6) continued

(i) STEEL CASTINGS correlation: $r = 0.49$, $100\,r^2 = 24\%$

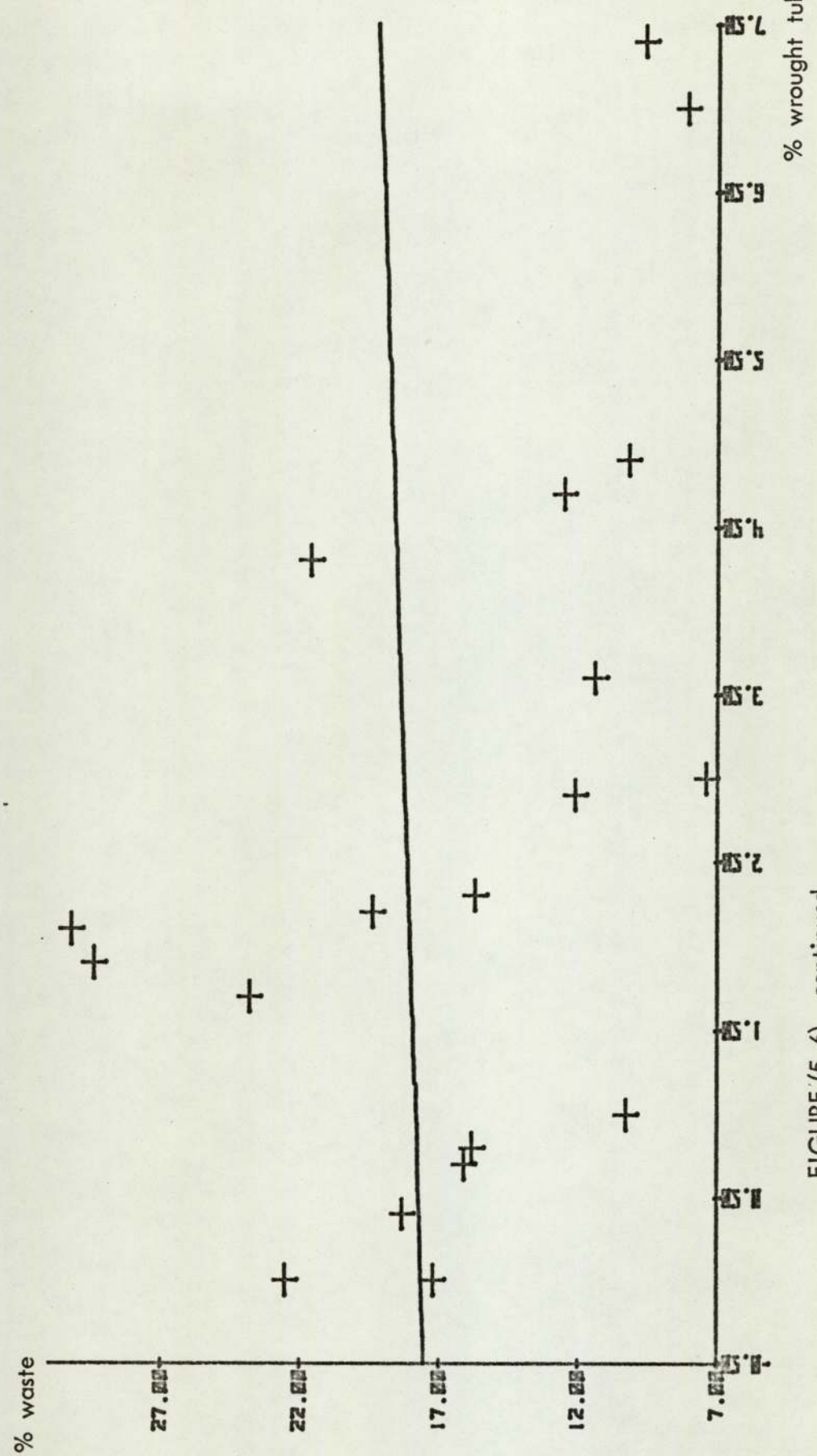


FIGURE (5.6) continued

(i) WROUGHT TUBES correlation: $r = 0.05$, $100\,r^2 = 0\%$

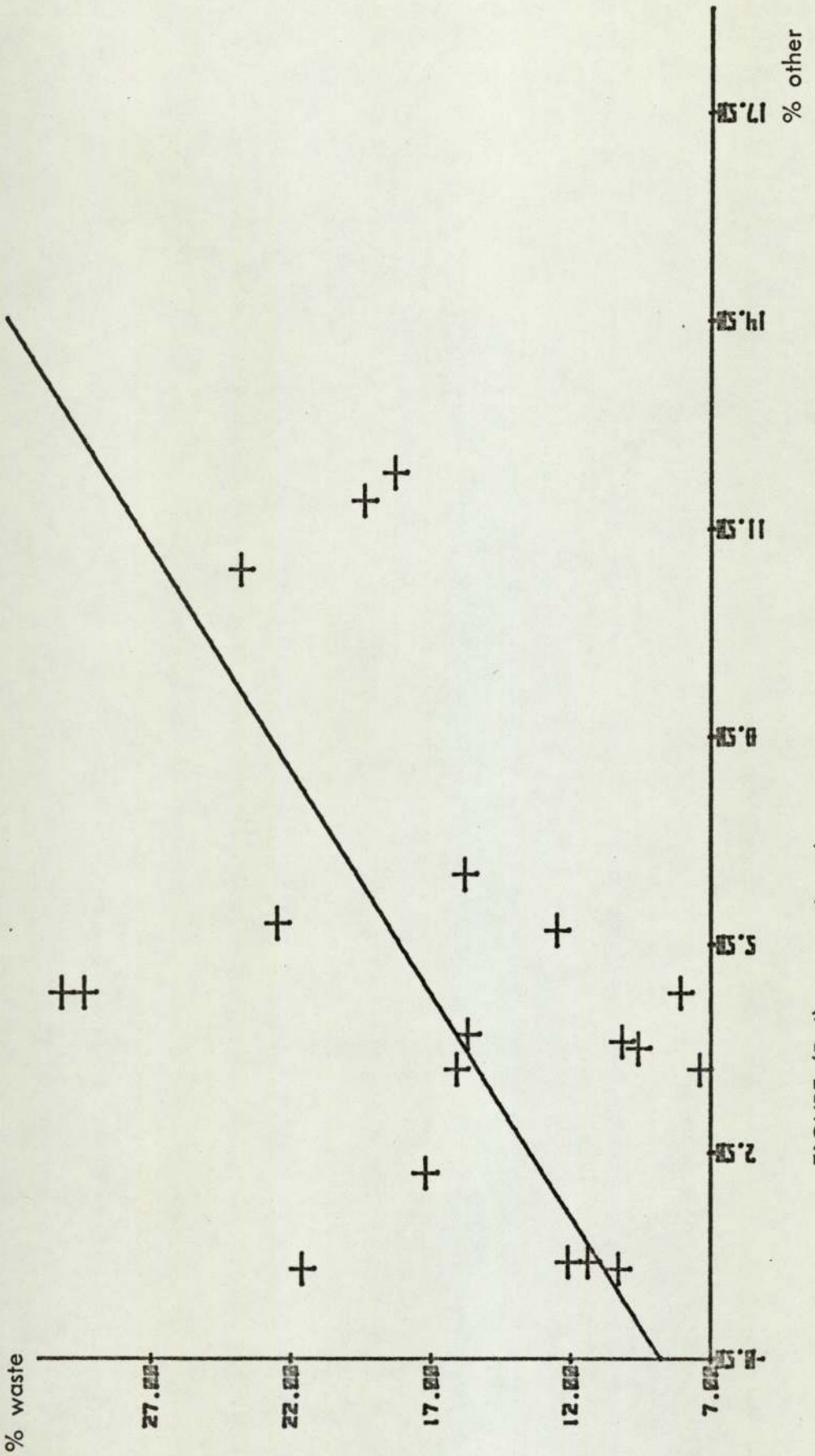


FIGURE (5.6) continued

(k) OTHER (excluding tinplate) correlation: $r = 0.68$, $100\,r^2 = 46\%$

TABLE (5.9) Direct and indirect process scrap arising per £M of engineering output.

	Direct in engineering industry £'000	Indirect		Total	Direct / Total
		In engineering industry £'000	In iron and steel industry £'000	£'000	%
22 Agricultural machinery	2.2	0.7	10.6	13.5	16
23 Machine tools	0.9	0.5	9.9	11.3	8
24 Engineers' small tools	7.3	0.4	7.1	14.8	49
25 Industrial engines	1.6	0.6	12.2	14.4	11
26 Textile machinery	0.8	0.8	7.0	8.6	9
27 Const.& mech. handling equip.	1.5	0.8	11.1	13.4	12
28 Office machinery	0.3	0.6	6.7	7.6	4
29 Other non-electrical mach.	0.9	0.4	8.9	10.2	8
30 Indust. plant and steel works	1.5	0.5	13.8	15.8	10
31 Other mechanical engineering	2.2	0.3	8.1	10.6	20
33 Electrical machinery	1.4	0.3	7.3	9.0	16
34 Insulated wires and cables	0.1	0.5	3.3	3.9	2
35 Electronics and telecom.	0.2	0.3	4.5	2.8	8
36 Other electrical goods	1.0	0.3	4.5	5.8	18
37 Cans and metal boxes	7.1	0.8	34.7	42.6	17
38 Other metal goods	4.3	0.6	11.4	16.3	26
39 Shipbuilding, etc.	1.4	0.7	8.4	10.5	13
40 Motor vehicles, etc.	3.8	1.2	12.1	17.1	22
41 Areospace equipment	0.5	0.4	6.1	7.0	7
42 Other vehicles	8.4	0.5	8.4	17.3	49

TABLE (5.10) Results for 50% reduction in iron and steel waste by engineering industries.

(a) Industry Table. Saving of Gross Output.

	£M	%
3 Coal mining	7.4	0.9
4 Other mining, quarrying	1.5	0.5
12 Mineral oil refining	3.8	0.4
13 Paint	0.4	0.2
14 Coke ovens	8.7	3.7
17 Plastic, synth. resins, etc.	0.9	0.2
18 Chemicals (15+16+18)	4.6	0.2
19 Iron and steel	172.1	7.8
20 Aluminium and alloys	1.2	0.4
21 Other non-ferrous metals	8.0	0.9
22 Agricultural machinery	0.3	0.4
23 Machine tools	0.5	0.2
24 Engineers' small tools	2.6	1.7
25 Industrial engines	-	-
26 Textile machinery	0.3	0.2
27 Const.& mech. handling equip.	1.4	0.3
28 Office machinery	-0.1	-0.1
29 Other non-electrical mach.	2.2	0.2
30 Indust. plant and steel works	2.6	0.4
31 Other mechanical engineering	4.0	0.7
32 Instrument engineering	0.4	0.1
33 Electrical machinery	1.6	0.3
34 Insulated wires and cables	0.6	0.2
35 Electronics and telecom.	1.1	0.1

TABLE (5.10) (a) continued

	£M	%
36 Other electrical goods	1.9	0.3
37 Cans and metal boxes	1.3	0.9
38 Other metal goods	10.5	0.6
39 Shipbuilding, etc.	1.0	0.2
40 Motor vehicles, etc.	15.8	0.6
41 Aerospace equipment	0.8	0.1
42 Other vehicles	2.0	1.2
52 Cement	0.3	0.3
53 Other building materials	2.5	0.4
54 Pottery and glass	-0.3	-0.1
55 Furniture, etc.	0.7	0.2
56 Timber and misc. wood manuf.	1.4	0.2
57 Paper and board	0.5	0.1
58 Paper products	1.3	0.2
60 Rubber	1.9	0.4
61 Other manufacturing	0.7	0.1
62 Construction	3.0	-
63 Gas	2.3	0.4
64 Electricity	4.8	0.3
65 Water supply	0.7	0.4
66 Road and rail transport	1.8	0.1
67 Other transport	2.1	0.1
ALL OTHER	27.9	0.1

TABLE (5.10) Continued

(b) Primary Input Table. Savings in primary inputs, £M, th. man-years.

			Scrap Generators	Iron and Steel	Other	Total
IMPORTS			10.9	9.8	9.3	30.0
CAPITAL STOCK			48.6	280.8	134.0	463.4
LABOUR	Number	Operatives	9.8	25.2	13.1	48.1
		Other	3.3	7.1	4.0	14.4
	Wages, Salaries, etc.	Operatives	9.9	27.1	13.9	50.9
		Other	4.3	8.6	5.0	17.9
		T.I.F.E.	15.7	34.7	25.6	76.0
Total Value Added			18.4	46.9	38.8	104.1

TABLE (5.11) Cost savings to industries from 50% reduction in iron and steel waste.

£'000

	SAVING ON NEW METAL			REDUCTION IN SCRAP SALES	COST SAVING
	DOMESTIC	IMPORTED	TOTAL		
22 Agricultural machinery	669	65	734	92	642
23 Machine tools	1286	48	1334	111	1223
24 Engineers' small tools	788	58	846	625	221
25 Industrial engines	2288	156	2444	112	2332
26 Textile machinery	793	44	837	68	769
27 Const.& mech. handling equip.	3851	255	4106	384	3722
28 Office machinery	265	10	275	19	256
29 Other non-electrical mach.	5214	240	5454	481	4973
30 Indust. plant and steel works					
31 Other mechanical engineering	7418	253	7671	686	6985
33 Electrical machinery	5296	314	5610	417	5193
34 Insulated wires and cables	111	8	119	11	108
35 Electronics and telecom.	976	95	1071	126	945
36 Other electrical goods	2908	236	3144	362	2782
37 Cans and metal boxes	6062	373	6435	542	5893
38 Other metal goods	22254	1961	24215	4069	20146
39 Shipbuilding, etc.	2477	212	2689	368	2321
40 Motor vehicles, etc.	48556	3543	52099	5848	46251
41 Areospace equipment	3259	90	3349	237	3112
42 Other vehicles	7691	246	7937	962	6975
TOTAL, AVERAGE	126077	8502	134579	16052	118527

TABLE (5.12) Allocation of cost saving due to 50% reduction in iron and steel waste by engineering industries.

	Price reduction % (1)	TIFE rise % (2)	Employment rise th. (3)
3 Coal mining	0.1		
4 Other mining, quarrying	0.2		
12 Mineral oil refining	0.1		
13 Paint	0.5		
14 Coke ovens	0.1		
17 Plastic, synth. resins, etc.	0.2		
18 Chemicals (15+16+18)	0.1		
19 Iron and steel	0.2		
20 Aluminium and alloys	-		
21 Other non-ferrous metals	0.2		
22 Agricultural machinery	1.6	2.6	0.6
23 Machine tools	1.1	1.3	0.9
24 Engineers' small tools	2.0	0.3	0.2
25 Industrial engines	2.8	5.9	2.0
26 Textile machinery	1.2	1.4	0.7
27 Const.& mech. handling equip.	1.8	3.0	3.1
28 Office machinery	0.9	0.7	0.2
29 Other non-electrical mach.	1.0	1.3	4.1
30 Indust. plant and steel works	1.2	1.7	2.6
31 Other mechanical engineering	1.8	2.9	5.7
32 Instrument engineering	0.2	-	-
33 Electrical machinery	1.5	2.7	4.4
34 Insulated wires and cables	0.4	0.2	0.1
35 Electronics and telecom.	0.4	0.3	0.9

TABLE (5.12) (a) Continued

	Price reduction % (1)	TIFE rise % (2)	Employment rise th. (3)
36 Other electrical goods	0.9	1.4	2.8
37 Cans and metal boxes	6.0	23.2	6.8
38 Other metal goods	2.0	4.2	18.7
39 Shipbuilding, etc.	1.0	1.1	2.0
40 Motor vehicles, etc.	3.3	7.2	34.8
41 Aerospace equipment	0.9	1.0	2.4
42 Other vehicles	5.4	8.6	5.9
52 Cement	0.2		
53 Other building materials	0.2		
54 Pottery and glass	0.1		
55 Furniture, etc.	0.2		
56 Timber and misc. wood manuf.	0.1		
57 Paper and board	0.1		
58 Paper products	0.1		
60 Rubber	0.1		
61 Other manufacturing	0.1		
62 Construction	0.3		
63 Gas	0.1		
64 Electricity	0.3		
65 Water supply	0.1		
66 Road and rail transport	0.3		
67 Other transport	0.1		
ALL OTHER	0.1		
TOTAL			98.9

TABLE (5.12) Continued

(b) Final Buyer Table. Price reduction and saving for final buyers.

	Price reduction %	Cost Saving £M
Consumers	0.2	25.5
Public Authorities	0.3	8.9
Gross Domestic Fixed Capital	0.6	37.1
Stocks	-	-
Exports	0.6	39.3
TOTAL FINAL	0.4	118.6

TABLE 5.13 Results for 10% reduction in material content of engineering and construction commodities and 50% reduction in iron and steel wasted in engineering industries.

(a) Industry Table

	Saving of Gross Output		Cost saving	Price red.	TIFE rise	Emp. rise
	£M (1)	% (2)	£M (3)	% (4)	% (5)	th. (6)
3 Coal mining	18.1	2.2		0.7		
4 Other mining, quarrying	18.7	6.3		0.8		
12 Mineral oil refining	12.4	1.3		0.2		
13 Paint	11.3	6.2		1.3		
14 Coke ovens	18.9	8.0		0.7		
17 Plastic, synth. resins, etc.	20.9	4.6		1.9		
18 Chemicals (15+16+18)	20.6	0.9		0.7		
19 Iron and steel	333.2	15.1		1.9		
20 Aluminium and alloys	25.3	8.3		4.3		
21 Other non-ferrous metals	71.8	8.1		5.4		
22 Agricultural machinery	0.3	0.4	1.8	4.2	7.4	1.6
23 Machine tools	1.0	0.5	4.5	3.6	4.7	3.4
24 Engineers' small tools	4.8	3.1	2.4	3.9	3.3	2.1
25 Industrial engines	-0.2	-0.2	4.6	5.8	11.6	3.9
26 Textile machinery	0.3	0.2	2.4	3.4	4.5	2.2
27 Const.& mech. handling equip.	2.5	0.5	10.6	4.7	8.6	8.8
28 Office machinery	-0.1	-0.1	1.2	2.9	3.4	1.1
29 Other non-electrical mach.	4.3	0.4	19.5	3.6	5.2	16.0
30 Indust. plant and steel works	4.6	0.7	16.5	4.2	7.6	11.7
31 Other mechanical engineering	7.4	1.3	18.0	4.8	7.5	14.8
32 Instrument engineering	1.0	0.2	2.8	1.5	1.5	2.5
33 Electrical machinery	2.6	0.5	13.2	4.0	6.7	11.3
34 Insulated wires and cables	2.5	0.8	14.4	4.3	23.2	12.5
35 Electronics and telecom.	2.1	0.2	7.2	1.8	2.1	7.0

TABLE (5.13) (a) Continued

	Saving of Gross Output		Cost saving	Price red.	TIFE rise	Emp rise
	£M (1)	% (2)	£M (3)	% (4)	% (5)	th. (6)
36 Other electrical goods	1.9	0.3	13.3	3.4	6.9	13.4
37 Cans and metal boxes	1.4	1.0	12.9	12.0	50.8	14.8
38 Other metal goods	10.4	0.6	67.6	5.7	14.2	62.8
39 Shipbuilding, etc.	1.9	0.2	8.3	3.3	3.8	7.1
40 Motor vehicles, etc.	15.8	0.6	89.7	6.3	14.0	67.5
41 Aerospace equipment	0.8	0.1	8.5	2.6	2.8	6.7
42 Other vehicles	3.0	1.7	9.4	7.1	11.6	7.9
52 Cement	3.1	3.1		0.6		
53 Other building materials	55.8	8.9		1.3		
54 Pottery and glass	17.0	5.0		0.6		
55 Furniture, etc.	0.4	0.1	5.2	2.6	4.5	3.8
56 Timber and misc. wood manuf.	19.0	2.8	24.9	7.0	14.9	5.2
57 Paper and board	3.2	0.7		0.5		
58 Paper products	5.0	0.8		0.4		
60 Rubber	23.6	4.9		1.0		
61 Other manufacturing	1.3	0.2	10.7	2.3	5.4	9.5
62 Construction	4.1	-	117.4	3.7	6.3	93.1
63 Gas	5.9	1.0		0.7		
64 Electricity	17.5	1.1		0.8		
65 Water supply	1.1	0.6		0.7		
66 Road and rail transport	19.0	1.0		0.7		
67 Other transport	8.3	0.5		0.3		
ALL OTHER	55.8	0.2		0.4		
TOTAL			487.0			390.7

TABLE (5.13) Continued

(b) Primary Input Table. Savings in primary inputs, £M, th. man-years.

			Iron & Steel	Other Mats. Prods.	Scrap Gens.	Other Engin.	All Other	Total
IMPORTS			20.3	44.6	43.2	39.3	10.0	157.4
CAPITAL STOCK			543.6	371.7	72.3	1.4	439.2	1428.2
LABOUR	Number	Operatives	48.8	28.7	15.6	0.4	38.7	132.2
		Other	13.7	9.5	5.5	0.1	12.4	41.2
	Wages, Salaries, etc.	Operatives	52.5	28.5	15.3	0.3	42.9	139.5
		Other	16.6	12.1	6.8	0.1	16.4	42.0
		T.I.F.E.	72.1	57.3	24.7	4.3	64.5	222.9
Total Value Added			97.4	80.3	36.9	9.7	97.7	322.0

(c) Final Buyer Table. Price reduction and saving for final buyers.

	%	£M
Consumers	0.8	132.4
Public Authorities	1.2	40.0
Gross Domestic Fixed Capital	2.2	154.1
Stocks	-	-
Exports	1.7	135.3
TOTAL FINAL	1.3	497.0

TABLE (6.1) Energy delivered to final users, 1968.

USER	COKE M TONS	GAS M THERM	COAL M TONS	OIL M TONS	ELEC. TWh.
ENGINEERING	0.47	491	2.26	4.18	18.23
OTHER INDUSTRIES	16.47	885	21.36	45.67	75.14
DOMESTIC, P.A.	5.26	2976	26.22	5.90	77.15
TOTAL	22.20	4352	49.84	55.75	170.52
TOTAL HEAT (MTh)	5740	4352	13613	24063	5820

Source: U.K. Energy Statistics[36]

TABLE (6.2) Conversions, heat equivalents and prices.

Source: U.K. Energy Statistics,[36] except where otherwise indicated.

Industrial Prices

Coke	£9.90 per ton	Census, I-O tables
Gas	6.67 pence per therm	Table 100
Coal	£5.50 per ton	"
Oil	£9.40 per ton	"
Electricity	0.644 pence per k Wh.	"

Heat Equivalent

Coke	259 therms/ton	Table 9/Table 10
Coal	273 therms/ton	"
Oil	432 therms/ton	"
Electricity	34.1 therms/M Wh.	P. 178

Value-to-therms

Coke	$\frac{£M}{9.9} \times 259 = M \text{ therms}$
Gas	$\frac{£M}{0.0667} = M \text{ therms}$
Coal	$\frac{£M}{5.5} \times 273 = M \text{ therms}$
Oil	$\frac{£M}{9.4} \times 432 = M \text{ therms}$
Electricity	$\frac{£M \times 34.1}{6.44} = M \text{ therms}$

TABLE (6.3) Distribution of energy use, 1968.

USER	USER PERCENTAGE DISTRIBUTION					TOTAL ENERGY	
	COKE	GAS	COAL	OIL	ELEC	MILLION THERMS	%
Iron & Steel	50.5	10.6	0.9	5.0	4.4	5841	10.9
Other metal	1.1	0.9	0.1	0.8	1.0	496	0.9
Cement	-	-	1.8	0.5	0.7	1044	2.0
Plastic, rubber	0.2	0.3	0.4	1.9	1.3	972	1.8
Paper, timber, board, etc.	0.2	0.1	1.6	1.4	1.1	1317	2.5
Other mat.	2.4	1.3	1.5	5.4	2.3	2973	5.6
SUB TOTAL MAT.	54.4	13.2	6.3	15.0	10.8	12643	23.7
Trans. Eq.	0.6	1.3	0.4	2.3	2.6	1259	2.4
Gen.Eng.	2.4	4.2	0.7	4.1	5.6	2454	4.6
Other Man.	0.2	0.3	0.3	1.1	1.2	630	1.2
Const.	0.3	0.4	0.1	3.6	1.0	1444	2.7
SUB TOTAL ENG.	3.5	6.2	1.5	11.1	10.4	5788	10.9
Chem.	7.5	0.8	2.8	9.6	3.5	5430	10.1
Transp.Ind.	-	0.1	0.1	7.3	3.1	2878	5.4
Other Indust.	3.3	10.7	4.7	15.8	23.5	9899	18.5
TOTAL INDUST.	68.7	31.0	15.4	58.8	51.3	36638	68.6
Consumer	18.1	63.3	12.7	6.0	39.0	14038	26.2
Public Auth.	5.6	3.6	3.0	1.7	6.2	2825	5.3
TOTAL FINAL	23.7	66.9	15.7	7.7	45.2	16863	31.5
TOTAL DOMESTIC USEFUL ENERGY	92.4	97.9	31.1	66.5	96.5	53501	100
Exp,Stocks	1.5	0.9	1.6	17.8	-		
Fuel Ind.	6.1	1.2	67.3	15.7	3.5		
TOTAL %	100	100	100	100	100		
TOTAL ORIG. UNITS	22.60 M tons	4352 M therms	167.2 M tons	82.97 M tons	170.52 T wh		
TOTAL MILLION THERMS	5741	4352	45646	36275	5820		

Source: Input-Output Tables, U.K. Energy Statistics.[36]

Industries of the aggregated Input-Output Tables are:

ENERGY:	1, 4, 5, 53, 54
MATERIALS:	7-12, 40-43, 45, 46, 49
TRANSPORT EQUIPMENT:	29-33
GENERAL ENGINEERING:	13-28, 34-39
OTHER MANUFACTURING:	44, 47, 48, 50, 51
CONSTRUCTION:	52
CHEMICALS:	6
TRANSPORT INDUSTRIES:	56-58
OTHER INDUSTRIES:	3, 55, 59, 60

FIGURE (6.1) DISTRIBUTION OF ALL DIRECT ENERGY PURCHASE IN HEAT-EQUIVALENT UNITS BY MATERIALS-PRODUCING AND ENGINEERING-TYPE INDUSTRIES IN 1968.

Based on Table (6.3)

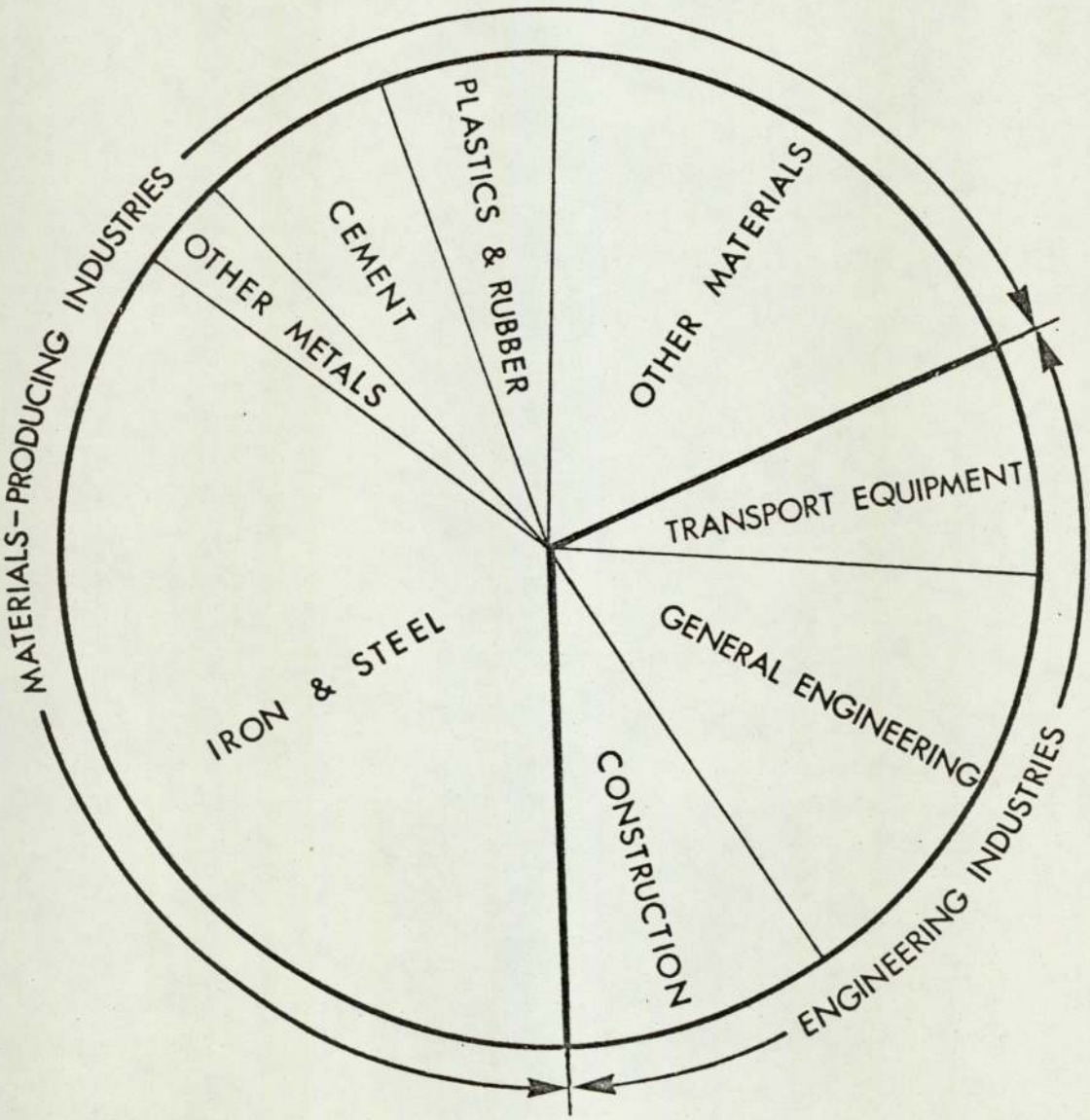


TABLE (6.4) Aggregated 4 x 4 input-output table free from all duplication.

(a) Flow Table, £M

	ENERGY	MATERIALS	ENG.& CONST.	OTHER
ENERGY	-	473.6	280.8	803.8
MATERIALS	80.9	-	3409.5	718.8
ENG.& CONST.	269.8	446.7	-	1635.0
OTHER	532.0	1166.0	1687.7	-
IMPORTS	-	24.2	24.5	149.8
GROSS OUTPUT	3425.8	5451.0	15220.7	25474.5

(b) Inverse Table, total requirements (£) per £1 of final demand.

ENERGY	1.0118	0.0997	0.0452	0.0376
MATERIALS	0.0503	1.0337	0.2376	0.0460
ENG.& CONST.	0.0953	0.1085	1.0341	0.0724
OTHER	0.1784	0.2486	0.1725	1.0237
IMPORTS	0.0014	0.0062	0.0037	0.0063

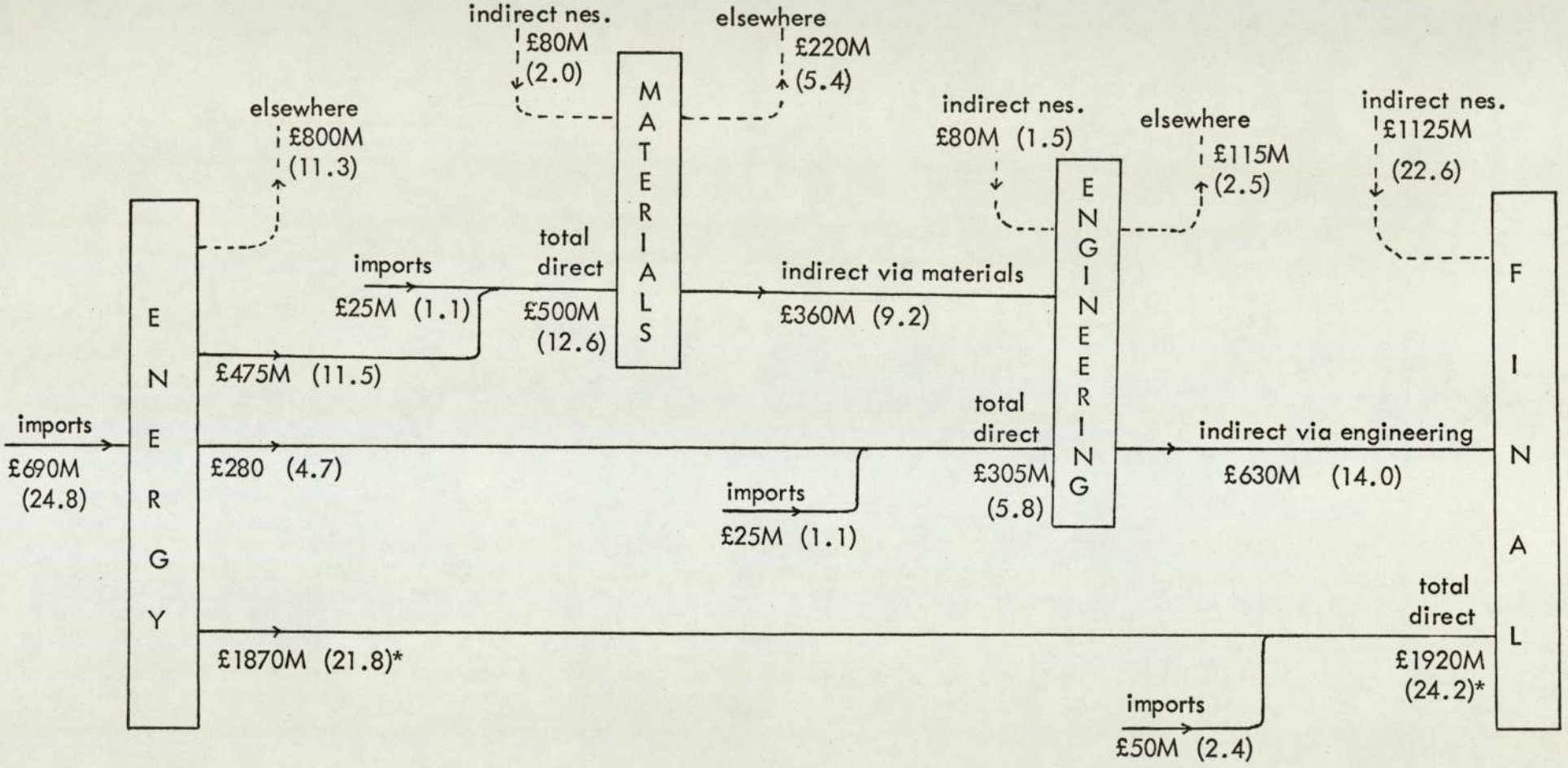


FIGURE (6.2) FLOW OF ENERGY THROUGH MATERIALS AND ENGINEERING INDUSTRIES.

£ MILLION, THOUSAND MILLION THERMS. (* includes re-export of 7313M therms, nes. = not elsewhere specified)

(footnotes overleaf)

FOOTNOTES TO FIGURE (6.2)

Energy flows in heat equivalent units are approximate because of price differences for energy in its various forms. The data given above were derived as follows:

(1) Imports of oil to users from prices on Table (6.2).

(2) Oil imports subtracted from direct energy use on Table (6.3). Note that the above figure includes a re-export of 7313M therms.

(3) Output from materials industries from prices of total direct input and then allocated pro-rata into materials and elsewhere.

(4) Indirect nes. to materials to conform to total output of materials.

(5) Indirect nes. into engineering from prices of direct and indirect input to "Other" industries.

(6) Output from engineering from prices of average total input, and allocated pro-rata.

(7) Indirect nes. by subtraction from total 53501M therms.

(8) Imports of energy to energy industries is total consumption of heat in the form of oil minus the imports directly to other industries.

TABLE (6.5) Direct and indirect use of domestic and imported energy in engineering and construction. Figures in column and row headings are gross output of that industry. All figures are £M, and are free from all duplication. nes = not elsewhere specified.

		COAL 816.3	COKE 229.0	OIL 1128.9	GAS 571.5	ELEC. 1576.6	TOTAL ENERGY 3604.3
TRANSP. EQUIP. 3187.1	Direct	3.2	1.2	23.5	7.1	34.6	69.6
	Ind-mat.	18.3	12.6	21.0	9.1	19.9	64.9
	Ind.-nes	17.3	3.8	17.2	4.8	17.5	41.1
	Total	38.8	17.6	61.7	21.1	72.0	175.7
GEN ENG. 69942.2	Direct	6.0	4.7	41.9	22.4	74.5	149.5
	Ind.-mat.	42.6	29.4	49.1	21.3	46.2	151.2
	Ind.-nes	29.7	3.4	26.0	4.3	21.5	48.5
	Total	78.3	37.5	117.0	48.0	142.3	349.2
OTHER MAN. 1580.6	Direct	2.2	0.4	11.3	1.7	15.8	31.4
	Ind-mat.	9.8	6.8	11.3	4.9	10.7	35.4
	Ind.-nes	6.6	0.9	7.5	1.4	7.0	16.2
	Total	18.6	8.1	30.2	8.0	33.5	82.4
CONST. 4954.3	Direct	1.0	0.6	38.0	2.2	13.0	54.8
	Ind.-mat.	31.1	21.4	35.8	15.5	33.7	110.4
	Ind.-nes	12.9	3.9	18.3	5.3	19.6	23.7
	Total	44.9	25.9	92.1	22.9	66.3	198.9
TOTAL ENG. & CONST. 15220.7	Direct	12.3	6.8	114.8	33.3	137.9	305.3
	Ind.-mat.	101.8	70.2	116.1	50.8	110.5	361.8
	Ind.-nes	45.4	2.1	37.4	3.8	27.5	77.1
	Total	159.5	79.1	268.2	88.0	276.0	744.3

FIGURE (6.3) ENERGY USED IN ENGINEERING AND CONSTRUCTION

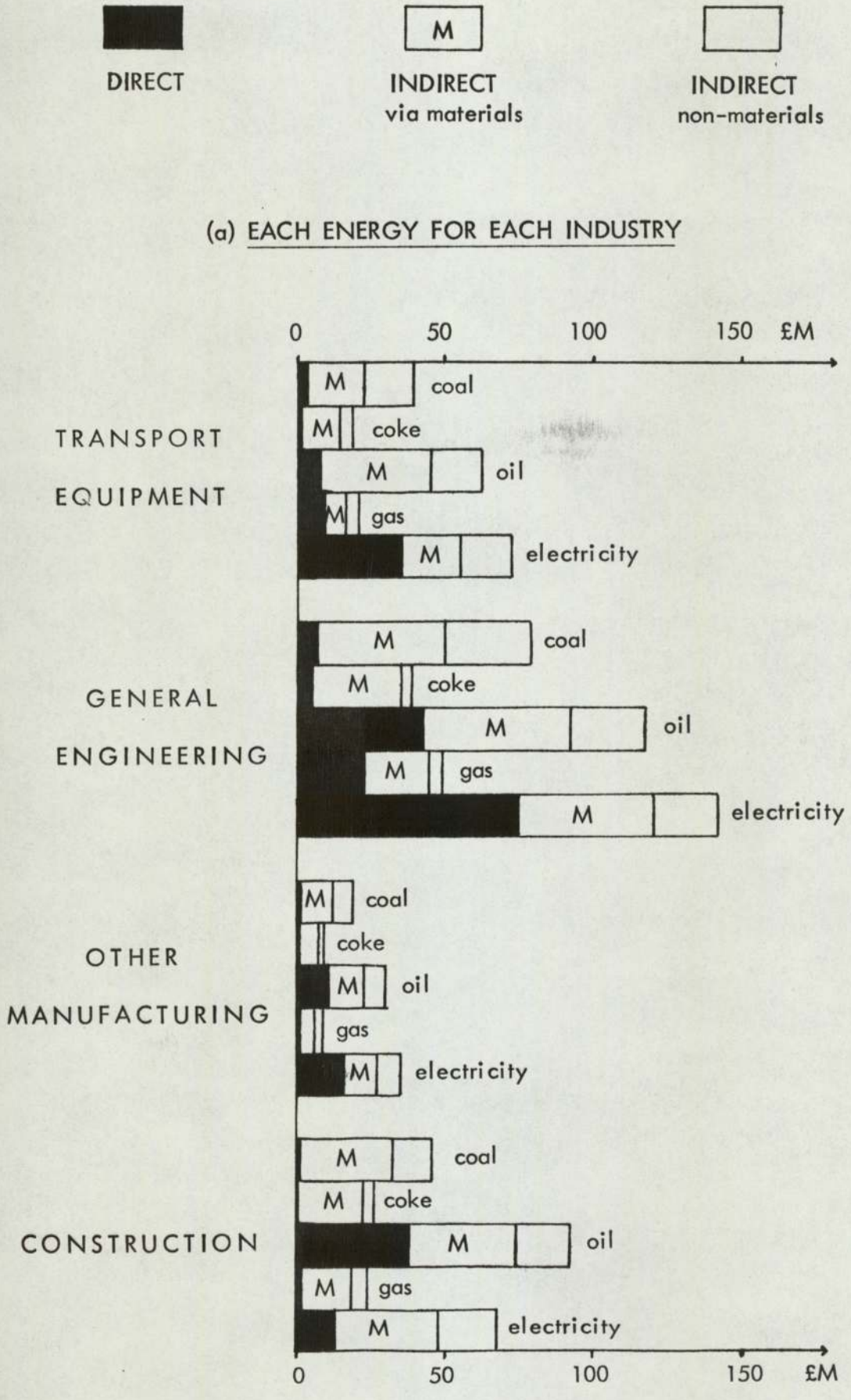
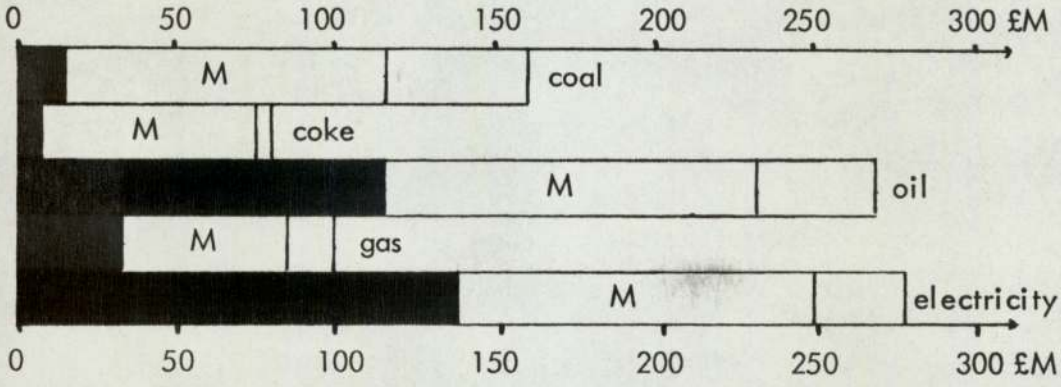


FIGURE (6.3) continued

(b) EACH ENERGY FOR ALL ENGINEERING AND CONSTRUCTION INDUSTRIES



(c) ALL ENERGY FOR EACH ENGINEERING AND CONSTRUCTION INDUSTRIES

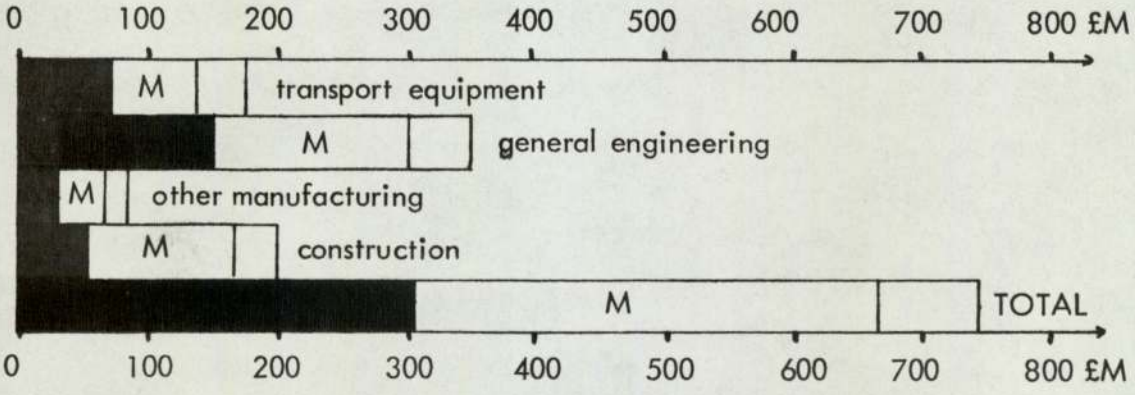


TABLE (6.6) Results of 10% material saving and 10% energy saving by engineering and construction industries.

(a) Industry Table

		MATERIAL SAVING		ENERGY SAVING	
		Output Saving %	Cost Saving £M	Output Saving %	Cost Saving £M
1	Coal mining	1.4		0.6	
2	Stone, slate, sand, etc.	7.2		-	
3	Other mining, quarrying	2.8		0.2	
4	Coke ovens, manuf. fuel	3.8		0.4	
5	Mineral oil refining	1.2		1.1	
6	Chemicals	0.8		-	
7	Paint	5.8		-	
8	Plastic, synth. resins, etc.	4.3		-	
9	Iron castings, etc.	8.9		-	
10	Other iron and steel	7.9		-	
11	Aluminium and alloys	7.5		-	
12	Other non-ferrous metals	6.9		-	
13	Agricultural machinery	0.1	1.5	-	0.2
14	Machine tools	0.2	2.8	-	0.4
15	Pumps, valves, compressors	0.4	5.5	-	0.5
16	Industrial engines	0.3	2.2	-	0.3
17	Textile machinery	0.1	1.9	-	0.3
18	Const.& mech. handling equip.	0.2	6.4	-	0.6
19	Office machinery	0.1	0.5	-	0.1
20	Other non-electrical mach.	0.3	10.3	-	1.2
21	Indust. plant and steel works	0.2	11.1	-	0.8
22	Other mechanical engineering	1.0	10.7	-	1.5
23	Instrument engineering	0.1	3.3	-	0.6
24	Electrical machinery	0.2	8.3	-	0.9
25	Insulated wires and cables	0.7	10.0	0.1	0.5
26	Electronics and telecom.	0.1	6.5	-	1.1
27	Domestic elec. appliances	0.2	5.2	0.1	0.5
28	Other electrical goods	0.3	6.1	-	0.6
29	Shipbuilding, etc.	0.1	5.6	-	1.0
30	Wheeled tractors	0.1	2.7	-	0.3

TABLE (6.6) (a) Continued

	MATERIAL SAVING		ENERGY SAVING	
	Output Saving %	Cost Saving £M	Output Saving %	Cost Saving £M
31 Motor vehicles	0.1	45.0	-	4.2
32 Areospace equipment	-	4.9	-	1.3
33 Other vehicles	0.6	2.9	-	0.4
34 Engineers' small tools	1.4	2.3	0.1	0.3
35 Cutlery and jewellery	0.1	1.8	-	0.2
36 Bolts, nuts, screws, etc.	0.7	2.4	-	0.3
37 Wire and wire manufactures	1.0	8.9	-	0.6
38 Cans and metal boxes	0.8	6.8	-	0.1
39 Other metal goods	1.1	27.5	-	3.0
40 Bricks, fireclay, etc.	7.9		-	
41 Pottery and glass	3.9		-	
42 Cement	8.3		-	
43 Other building materials	7.9		-	
44 Furniture and bedding, etc.	0.1	5.4	-	0.5
45 Timber and misc. wood manuf.	6.5		-	
46 Paper and board	4.1		-	
47 Paper and board packaging	0.7	10.0	-	0.5
48 Other paper and board prods.	0.4	5.2	-	0.4
49 Rubber	3.7		-	
50 Plastic products n.e.s.	0.6	7.9	-	1.0
51 Other manufacturing	0.1	4.2	-	0.8
52 Construction	0.1	113.5	-	5.5
53 Gas	1.0		0.6	
54 Electricity	0.8		0.9	
55 Water supply	0.5		-	
56 Railways	1.2		0.1	
57 Road transport	1.2		-	
58 Other transport	0.4		0.1	
59 Distributive trades	0.2		-	
60 ALL OTHER	0.2		-	
TOTAL		349.5		30.4

TABLE (6.6) Continued

(b) Primary Input Table Saving in primary input; £M, th. man-years.

			Material Saving	Energy Saving
IMPORTS			88.2	10.0
CAPITAL STOCK			1049.8	136.9
LABOUR	Number	Operatives	96.3	6.3
		Other	30.3	2.2
	Wages, Salaries, etc.	Operatives	101.8	6.4
		Other	38.1	2.8
		T.I.F.E.	168.9	10.7
Total Value Added			236.2	19.4

TABLE (6.7) Resultant energy saving (in original units) due to 10% material saving and 10% energy saving by engineering and construction industries.

	Materials Savings	Energy Savings
Coal M tons	2.47	1.05
Coke M tons	0.98	0.09
Oil M tons	1.10	1.00
Gas M therms	49	28
Electricity T Wh	1.58	1.83

TABLE (7.1) Matrix operations to estimate effect on the U.K. economy of changes in the use and manufacture of passenger motor vehicles.

NOTE: References in this table are to footnotes at the end of this table.

O_1 Reduce all inputs to motor vehicle industry by 67%[1]

O_2 Reduce all material inputs to motor vehicle industry by 67%[1]

Materials industries: 7-12, 41, 43, 45, 46, 49.

O_3

all industry
- reduce mineral oil x .05[2] x .95[3]
- reduce distributive margin[2]

final
- mineral oil, subtract 116.0[4] x .95[3]
- other, subtract retail margin[4]
- distributive, subtract margin[4]

O_4

all industry
- reduce mineral oil x .05[2] x .09[5]
- reduce distributive margin[2]

final
- mineral oil, subtract 116.0[4] x .09[5]
- other, subtract retail margin[4]
- distributive, subtract margin[4]

O_5

industry
- reduce motor vehicle x 0.05[6]
- reduce other, wholesale margin[7]

final
- motor vehicle, subtract (1241.0-10.0)[6]
- other, subtract retail margin[7]

O_6

industry
- reduce motor vehicle x 0.05[6] x 0.09[5]
- reduce other, wholesale margin[7]

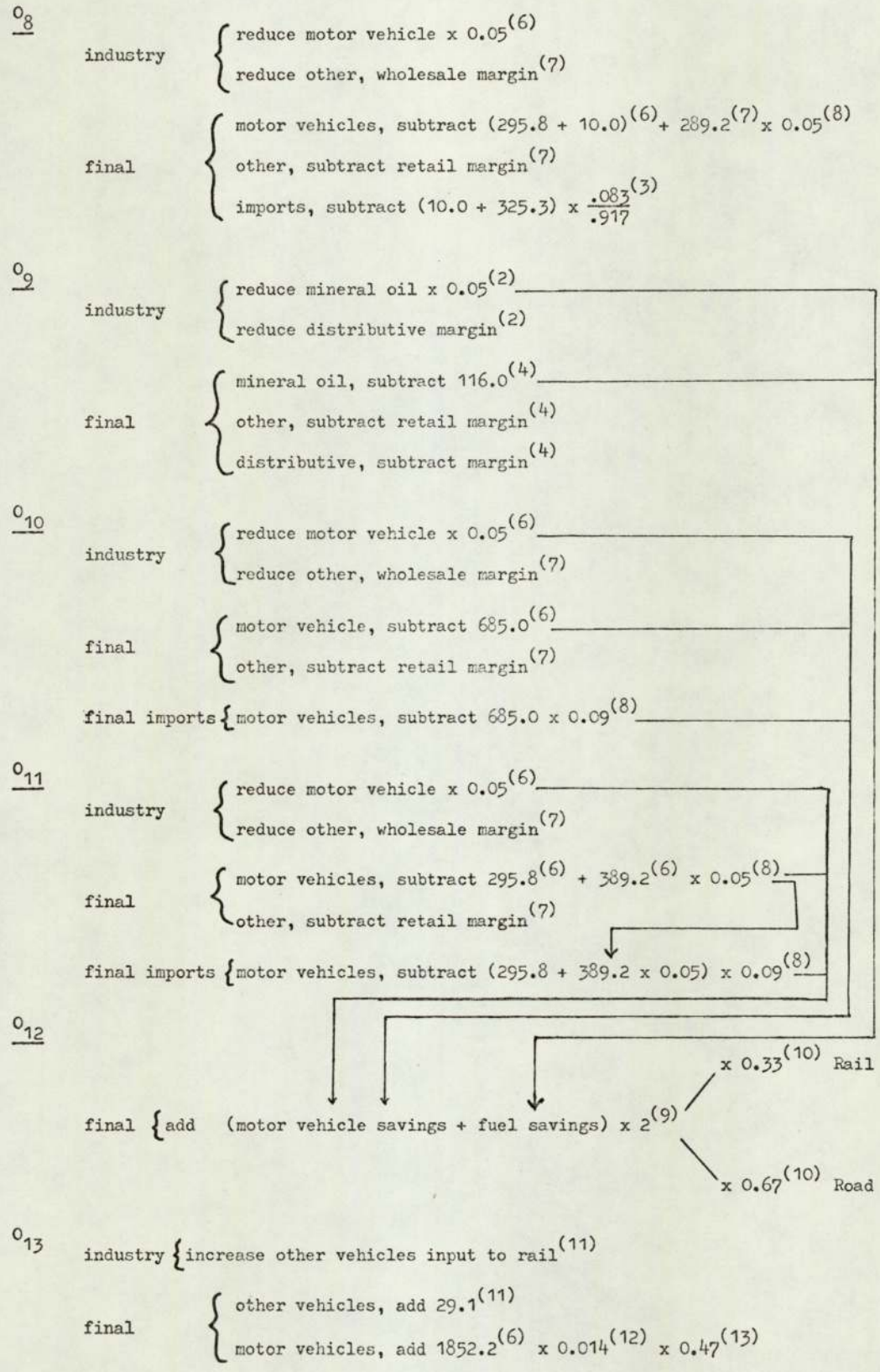
final
- motor vehicle, subtract (240.2 + 295.8)[6] x 0.09[5]
- other, subtract retail margin[7]

O_7

industry
- reduce motor vehicle x 0.05[6]
- reduce other, wholesale margin[7]

final
- motor vehicles, subtract (685.0 x 10.0)[6]
- other, subtract retail margin[7]
- imports, subtract (10.0 + 695.0) x $\frac{.05}{.95}$[3]

TABLE (7.1) Continued



FOOTNOTES AND ASSUMPTIONS OVERLEAF

TABLE (7.1) Continued

NOTES AND ASSUMPTIONS ON DATA

(1) From the disaggregation for Chapter 4 we had 37.4% of total motor vehicle industry input-output was not for passenger cars (inclusive of duplication). For the new classification which excludes wheeled Tractors we have

$$100 \times \frac{(172.9 + 6.2 + 1852.2 + 602.9) \times .374 - 172.9 - 6.2}{1852.2 + 602.9} = 33\%$$

Thus 33% of present classification is not passenger car

67% " " " " passenger car.

ASSUME (a) The proportions are the same for gross output measured free from duplication.

(b) 67% of each input is related to passenger cars.

(2) ASSUME (a) 5% of all purchases of fuel by each industry is to run its passenger cars.

Hence purchase of fuel to run cars in industry is £569 x .05 = £28.5m

(b) Wholesale distribution margin is 100% of sellers' price (consumers' distributive costs are 185%, see (4) below).

Hence a distributive service is reduced by £28.5m also

(3)

YEAR	1972	1971	1970	1969	1968	1967
% of foreign produced cars registered	23.5	19.3	14.3	10.4	8.3	8.3

Source: The Motor Industry of Great Britain[50] 1973, Table 40.

ASSUME in 1968 95% of all cars in use were produced in Great Britain

(4) ASSUME (a) 90% and 50% of consumers' and public authorities' purchase of fuel are to run passenger cars, respectively.

Hence final purchase of petrol is £112.0 x .9 x 30.4 x .5 = £116.0m

(b) the distributive margin earned by retailers is 10% and this is an additional saving.

Hence £116.0 x .1 = £11.6m of "other" industry is retail margin on petrol.

Total distribution and service costs are $\frac{213}{115}$ x 100 = 185% of sellers price (Input-Output Table 0). Thus 185 - 10 = 175% is from distributive industries, and final distribution is reduced by 116 x 1.75 = £203m.

TABLE (7.1) Continued

(5) New Registration of U.K. produced cars

U.K. Total cars in use = $\frac{1012483}{11184550} \times 100 = 9\%$

Source: The Motor Industry of Great Britain 1973, Tables 40, 44.

ASSUME 9% of all cars in use in the U.K. were produced in the U.K. in the current year.

(6)

MARKET	No. of Cars	%
HOME	1013163	56
EXPORT	802773	44
TOTAL	1815934	100

DATE 1968, U.K. production only.

Source: The Motor Industry of Great Britain[50] 1973 Table 2.

ASSUME (a) 5% of all industry purchases from motor vehicle industry is parts for cars.

Hence industry buys £199.0 x .05 = £10m parts.

(b) 56% of completed cars and parts also are produced for the home market and that 44% are exported.

(c) 44% of U.K. motor vehicle industry are parts and 56% completed vehicles. (From Table 4.2).

With these percentages and knowing the total output to be 1852.2 of which 67%[1] are cars we build up:

		PARTS, £M	COMPLETE CARS, £M	TOTAL £m	%
FINAL	EXPORT	240.2	305.8	546	44%
	DOMESTIC	295.8	389.2	685.0	56%
INDUSTRY		10.0	-	10	-
TOTAL		546.0	695.0	1241.0	100%
%		44%	56%	100%	

N.B. 1852.2 x 0.67 = 1241.0

TABLE (7.1) Continued

(7) Distributive margin on cars and parts is $\frac{86}{319} \times 100 = 27\%$ (see Input-Output Table 0) above sellers' price. This is an additional subtraction from "other" industry, and the value is $(685.0 \times 10.0)^{(6)} \times 0.27 = £187.7m$

(8) ASSUME Decrease in driving speed for 1 year causes 5% reduction in demand for cars and parts.

(9) From Input-Output Table 0 we have in £M

	Distributive margin	Tax	Sellers' Price	Total Cost
Fuel	213	401	115	729
Cars	86	152	319	557
		TOTAL	434	1286

Hence total savings are $\frac{1286}{434}$ times those of fuel and cars. As we are assuming 70% of the savings are spent on public transport (from section (7-1) (E)) we have a $0.7 \times \frac{1286}{434} = 2$ fold multiplication of increases in public transport demand

(10) ASSUME (a) 95% of consumer expenditure on road transport is for buses. Hence 5% for removal, etc., and we can build up:

	CONSUMER EXPENDITURE £M	%
RAIL	179.5	33
ROAD	.95 x 382.2 = 363.1	67
TOTAL	542.6	100

Source: Input-Output Tables 1968, Table D.

(b) Savings from petrol and cars will be spent in the above proportions.

(11) ASSUME (a) All purchases by the railways from other vehicles is all parts and repair work of carriages (£70.1m).

(b) All gross domestic capital formation from other vehicles is carriages and locomotives. (£29.1m).

TABLE (7.1) Continued

(12) $\frac{\text{Value of buses sold}}{\text{Total sales}} = \frac{£29.5m}{£2,233.4m} = 1.3\%$

Source: Census of Production 1968, Table 82/5.

ASSUME Parts for buses are an additional 0.1%.

MARKET	BUSES PRODUCED	%
HOME	14089	47
EXPORT	16074	53
TOTAL	30163	100

DATE 1972

Source: The Motor Industry of Great Britain [50] 1973, Table 3.

ASSUME In 1968 buses were produced for home and export in the same proportions as 1972.

TABLE (7.2) Operations which form part of the models to estimate the effects of changes in motor vehicle manufacturing and motor vehicle use.

OPERATIONS

Reduce to Zero

(1) all inputs of the motor vehicle industry
(2) all material inputs of the motor vehicle industry
(3) total final buyer purchases of mineral oil
(4) total final buyer purchases of motor vehicles
(5) total final buyer purchases of railway transport
(6) total final buyer purchases of road transport
(7) total final buyer purchases of other vehicles
(8) total final buyer purchases of distributive services
(9) total final buyer purchases of other

TABLE (7.3) Effect of operations of Table (7.2) evaluated at full level.

			OPERATIONS								
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IMPORTS			288.3	100.3	224.9	258.3	14.1	16.8	11.3	171.8	2048.6
CAPITAL STOCK			5842.2	1351.8	514.0	5233.1	3106.9	662.1	223.6	9891.5	26985.4
LABOUR	Number	Operatives	695.9	146.9	30.0	623.4	111.1	155.5	42.3	1672.7	4600.1
		Other	211.6	45.3	11.1	189.6	36.9	53.3	10.9	571.0	1574.4
	Wages, Salaries, etc.	Operatives	761.8	154.8	34.2	682.5	129.1	185.5	1983.5	1983.5	5426.8
		Other	276.6	56.7	16.0	247.8	46.5	67.6	13.0	724.2	1999.7
		T.I.F.E.	1135.0	234.7	53.2	1016.8	179.9	255.0	59.9	2738.9	7543.6
Total Value Added			1460.6	318.0	95.6	1308.3	249.1	347.3	69.0	4323.4	13849.9

TABLE (7.4) Coefficient levels for the operations of Table (7.2) for each model: coefficient x 10^5.

* indicates that the operation is not significant for most of the primary inputs.

\+ indicates that the operation is not significant for any of the primary inputs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A	6700								
B1		6700	8271					898	* 16
B2		6700	783					* 83	+ 2
C1				22515				806	
C2				891				* 32	
D1			13058	12793				* 17	483
D2			13058	6083				* 17	242
E1			8705	8407	-56133	-58730		946	318
E2			8705	3934	-31028	-32463		946	158
E3			8705	8333	-56133	-58730	-12012	946	318
E4			8705	3860	-31028	-32463	-12012	946	158
S1	6700	6700	30074	43722	-56098	-58601		2667	817
S2	6700	6700	22586	10915	-30993	-32334		1078	402

TABLE (7.5) Minimum coefficient levels for significance of operations of Table (7.2) on primary inputs; hence the designation of an operation as significant or not in Table (7.4).

Coefficient x 10^5

			OPERATION								
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IMPORTS			347	997	445	387	7092	5952	8850	582	49
CAPITAL STOCK			17	74	194	19	32	151	448	10	3
LABOUR	Number	Operatives	144	681	3333	160	900	643	2364	60	22
		Other	473	2208	8403	527	2710	1876	9174	175	64
	Wages, Salaries, etc.	Operatives	131	646	2924	147	775	539	2353	50	18
		Other	362	1764	6250	404	2151	1479	7692	138	50
		T.I.F.E.	88	426	1880	98	556	392	1669	37	13
Total Value Added			68	314	1046	76	401	288	1449	23	7

TABLE (7.6) Results for each model.

(a) Industry Table. Percentage change in gross output.

	A	B1	B2	C1	C2	D1	D2
1 Coal mining	0.2	0.1	0.1	0.8	-	0.5	0.2
2 Stone, slate, sand, etc.	0.2	0.1	0.1	0.6	-	0.3	0.2
3 Other mining, quarrying	0.4	0.3	0.3	1.1	-	0.8	0.4
4 Coke ovens, manuf. fuel	0.6	0.5	0.5	1.8	0.1	1.1	0.5
5 Mineral oil refining	0.2	3.1	0.9	0.9	-	5.3	5.1
6 Chemicals	0.2	0.1	0.1	0.7	-	0.5	0.3
7 Paint	0.6	0.5	0.5	1.8	0.1	1.0	0.5
8 Plastic, synth. resins, etc.	0.4	0.2	0.2	1.3	0.1	0.8	0.4
9 Iron castings, etc.	2.1	1.9	1.9	6.2	0.2	3.5	1.7
10 Other iron and steel	1.0	0.9	0.9	3.2	0.1	1.8	0.9
11 Aluminium and alloys	1.3	1.1	1.1	4.1	0.2	2.3	1.1
12 Other non-ferrous metals	0.6	0.4	0.4	1.8	0.1	1.0	0.5
13 Agricultural machinery	0.1	-	-	0.3	-	0.2	0.1
14 Machine tools	0.2	-	-	0.7	-	0.4	0.2
15 Pumps, valves, compressors	0.2	0.1	0.1	0.5	-	0.4	0.2
16 Industrial engines	0.1	-	-	0.5	-	0.3	0.1
17 Textile machinery	-	-	-	0.2	-	0.1	0.1
18 Const.& mech. handling equip.	0.1	-	-	0.3	-	0.2	0.1
19 Office machinery	-	-	-	0.2	-	0.1	0.1
20 Other non-electrical mach.	0.1	-	-	0.3	-	0.2	0.1
21 Indust. plant and steel works	0.1	-	-	0.2	-	0.1	0.1
22 Other mechanical engineering	0.5	0.1	0.1	1.6	0.1	1.0	0.5
23 Instrument engineering	0.2	-	-	0.5	-	0.3	0.2
24 Electrical machinery	0.2	-	-	0.7	-	0.4	0.2
25 Insulated wires and cables	0.3	0.1	0.1	0.9	-	0.5	0.3
26 Electronics and telecom.	-	-	-	0.2	-	0.1	-
27 Domestic elec. appliances	0.1	-	-	0.4	-	0.2	0.1
28 Other electrical goods	0.9	-	-	2.9	0.1	1.7	0.8
29 Shipbuilding, etc.	-	-	-	0.1	-	0.1	-
30 Wheeled tractors	0.2	-	-	0.7	-	0.4	0.2

TABLE (7.6) (a) Continued

	A	B1	B2	C1	C2	D1	D2
31 Motor vehicles	-	-	-	20.2	0.8	11.5	5.5
32 Areospace equipment	-	-	-	-	-	-	-
33 Other vehicles	0.2	0.1	0.1	0.7	-	0.4	0.2
34 Engineers' small tools	1.1	0.1	0.1	3.4	0.1	2.0	1.0
35 Cutlery and jewellery	-	-	-	0.2	-	0.1	0.1
36 Bolts, nuts, screws, etc.	1.9	0.1	-	5.7	0.2	3.3	1.6
37 Wire and wire manufactures	0.4	0.1	0.1	1.5	0.1	0.8	0.4
38 Cans and metal boxes	0.2	0.1	0.1	1.0	-	0.7	0.4
39 Other metal goods	0.9	0.1	0.1	2.8	0.1	1.6	0.8
40 Bricks, fireclay, etc.	0.2	0.2	0.2	0.7	-	0.4	0.2
41 Pottery and glass	0.5	0.4	0.4	1.6	0.1	0.9	0.5
42 Cement	0.1	-	-	0.2	-	0.1	0.1
43 Other building materials	0.1	-	-	0.5	-	0.3	0.1
44 Furniture and bedding, etc.	-	-	-	0.2	-	0.1	-
45 Timber and misc. wood manuf.	0.2	0.1	0.1	0.6	-	0.4	0.2
46 Paper and board	0.2	0.1	0.1	0.9	-	0.5	0.3
47 Paper and board packaging	0.2	0.1	-	1.0	-	0.6	0.3
48 Other paper and board prods.	0.2	-	-	0.7	-	0.5	0.2
49 Rubber	1.2	1.2	1.2	3.8	0.2	2.2	1.1
50 Plastic products n.e.s.	1.0	0.1	-	3.1	0.1	1.8	0.9
51 Other manufacturing	0.2	-	-	0.7	-	0.4	0.2
52 Construction	-	-	-	0.1	-	-	-
53 Gas	0.2	0.1	0.1	0.7	-	0.4	0.2
54 Electricity	0.2	0.1	0.1	0.7	-	0.5	0.2
55 Water supply	0.1	0.1	0.1	0.6	-	0.4	0.2
56 Railways	0.2	0.1	0.1	0.7	-	0.5	0.2
57 Road transport	0.2	0.1	0.1	0.6	-	0.4	0.2
58 Other transport	0.1	0.3	0.1	0.3	-	0.6	0.5
59 Distributive trades	0.1	-	-	0.3	-	0.2	0.1
60 ALL OTHER	0.1	-	-	0.9	-	0.6	0.3

TABLE (7.6) (a) Continued

	E1	E2	E3	E4	S1	S2
1 Coal mining	0.1	-	-	-	1.6	0.6
2 Stone, slate, sand, etc.	-	-	-0.1	-0.1	1.0	0.4
3 Other mining, quarrying	0.3	0.2	0.3	0.1	2.6	1.2
4 Coke ovens, manuf. fuel	0.5	0.2	0.4	0.1	4.0	1.7
5 Mineral oil refining	2.7	2.9	2.7	2.9	12.1	9.1
6 Chemicals	0.1	0.1	0.1	0.1	1.4	0.6
7 Paint	0.1	-	0.1	-	3.6	1.5
8 Plastic, synth. resins, etc.	0.3	0.1	0.3	0.1	2.7	1.0
9 Iron castings, etc.	2.0	0.9	1.9	0.8	14.2	6.4
10 Other iron and steel	0.7	0.3	0.6	0.2	6.9	3.0
11 Aluminium and alloys	1.3	0.6	1.2	0.5	9.2	4.0
12 Other non-ferrous metals	0.4	0.2	0.4	0.1	3.8	1.6
13 Agricultural machinery	0.1	-	0.1	-	0.7	0.2
14 Machine tools	0.2	0.1	0.2	0.1	1.5	0.6
15 Pumps, valves, compressors	0.1	0.1	0.1	0.1	1.2	0.5
16 Industrial engines	-0.6	-0.4	-0.9	-0.6	0.2	-
17 Textile machinery	-	-	-	-	0.3	0.1
18 Const.& mech. handling equip.	0.1	-	0.1	-	0.6	0.2
19 Office machinery	-0.1	-	-0.1	-	0.3	0.1
20 Other non-electrical mach.	0.1	-	0.1	-	0.7	0.2
21 Indust. plant and steel works	-	-	-	-	0.4	0.2
22 Other mechanical engineering	0.2	0.1	0.1	-0.1	3.2	1.2
23 Instrument engineering	0.1	0.1	0.1	0.1	1.1	0.4
24 Electrical machinery	-0.1	-0.1	-0.2	-0.1	1.2	0.4
25 Insulated wires and cables	-	-	-	-	1.7	0.6
26 Electronics and telecom.	-	-	-	-	0.3	0.1
27 Domestic elec. appliances	0.1	-	0.1	-0.2	0.7	0.2
28 Other electrical goods	-0.1	-0.1	-0.2	-	5.2	1.7
29 Shipbuilding, etc.	-	-	-	0.1	0.2	0.1
30 Wheeled tractors	0.2	0.1	0.2	0.1	1.4	0.5

TABLE (7.6) (a) Continued

		E1	E2	E3	E4	S1	S2
31	Motor vehicles	7.3	3.4	7.2	3.3	39.0	9.7
32	Areospace equipment	-	-	-	-	0.1	-
33	Other vehicles	-9.6	-5.3	-16.6	-11.9	-8.4	-4.9
34	Engineers' small tools	1.0	0.5	0.9	0.4	7.1	2.7
35	Cutlery and jewellery	0.1	-	0.1	-	0.5	0.2
36	Bolts, nuts, screws, etc.	1.8	0.8	1.7	0.7	12.0	4.4
37	Wire and wire manufactures	-0.4	-0.2	-0.4	-0.3	2.2	0.7
38	Cans and metal boxes	0.3	0.2	0.3	0.2	2.2	0.8
39	Other metal goods	0.8	0.4	0.8	0.3	5.8	2.2
40	Bricks, fireclay, etc.	-	-	-	-	1.3	0.5
41	Pottery and glass	0.4	0.2	0.4	0.2	3.1	0.8
42	Cement	-0.2	-0.1	-0.2	-0.1	0.2	-
43	Other building materials	-0.2	-0.1	-0.2	-0.1	0.6	0.1
44	Furniture and bedding, etc.	-	-	-	-	0.3	0.1
45	Timber and misc. wood manuf.	0.1	-	-	-	1.1	0.3
46	Paper and board	0.2	0.1	0.2	0.1	1.8	0.6
47	Paper and board packaging	0.2	0.1	0.2	0.1	2.0	0.7
48	Other paper and board prods.	-0.2	-0.1	-0.2	-0.1	1.1	0.3
49	Rubber	0.1	-0.1	-	-0.1	4.5	3.2
50	Plastic products n.e.s.	1.0	0.5	0.9	0.4	6.6	2.4
51	Other manufacturing	0.1	0.1	0.1	-	1.3	0.5
52	Construction	-	-	-	-	0.1	-
53	Gas	0.2	0.1	0.1	0.1	1.5	0.6
54	Electricity	-0.1	-0.1	-0.1	-0.1	1.3	0.4
55	Water supply	-	-	-	-	1.1	0.4
56	Railways	-22.6	-12.5	-22.6	-12.5	-21.2	-11.9
57	Road transport	-19.3	-10.7	-19.4	-10.7	-18.1	-10.2
58	Other transport	0.3	0.2	0.2	0.2	1.5	0.9
59	Distributive trades	0.1	-	0.1	-	0.6	0.2
60	ALL OTHER	0.3	0.1	0.2	0.1	1.8	0.5

TABLE (7.6) continued

(b) Primary Input Table Change in primary input requirements, £M, th. man-years.

			A	B1	B2	C1	C2	D1	D2
IMPORTS			19.4	26.1	11.0	74.7	3.0	109.4	80.4
CAPITAL STOCK			392.8	227.3	103.8	1396.1	55.3	868.5	452.7
LABOUR	Number	Operatives	46.8	26.8	10.9	177.5	7.0	106.2	53.3
		Other	14.2	9.0	3.5	55.4	2.2	33.5	17.0
	Wages, Salaries, etc.	Operatives	51.2	20.5	11.8	197.4	7.8	118.3	59.5
		Other	18.6	11.0	4.4	71.9	2.8	43.6	22.1
		T.I.F.E.	76.3	43.8	17.4	289.8	11.5	173.9	87.6
Total Value Added			98.2	66.9	24.7	385.2	15.3	234.9	120.1

			E1	E2	E3	E4	S1	S2
IMPORTS			43.4	30.4	4.1	28.7	263.1	142.5
CAPITAL STOCK			-1460.7	-784.5	-1496.1	-817.6	1137.5	161.0
LABOUR	Number	Operatives	-68.8	-35.5	-75.1	-41.3	266.7	90.5
		Other	-29.0	-12.7	-26.6	-14.3	80.5	11.0
	Wages, Salaries, etc.	Operatives	-85.9	-44.0	-92.4	-50.1	286.6	95.4
		Other	-30.6	-15.5	-32.6	-17.4	106.4	29.7
		T.I.F.E.	-111.7	-57.1	-120.8	-65.7	436.8	124.2
Total Value Added			-150.5	-73.3	-161.1	-83.3	588.8	169.3

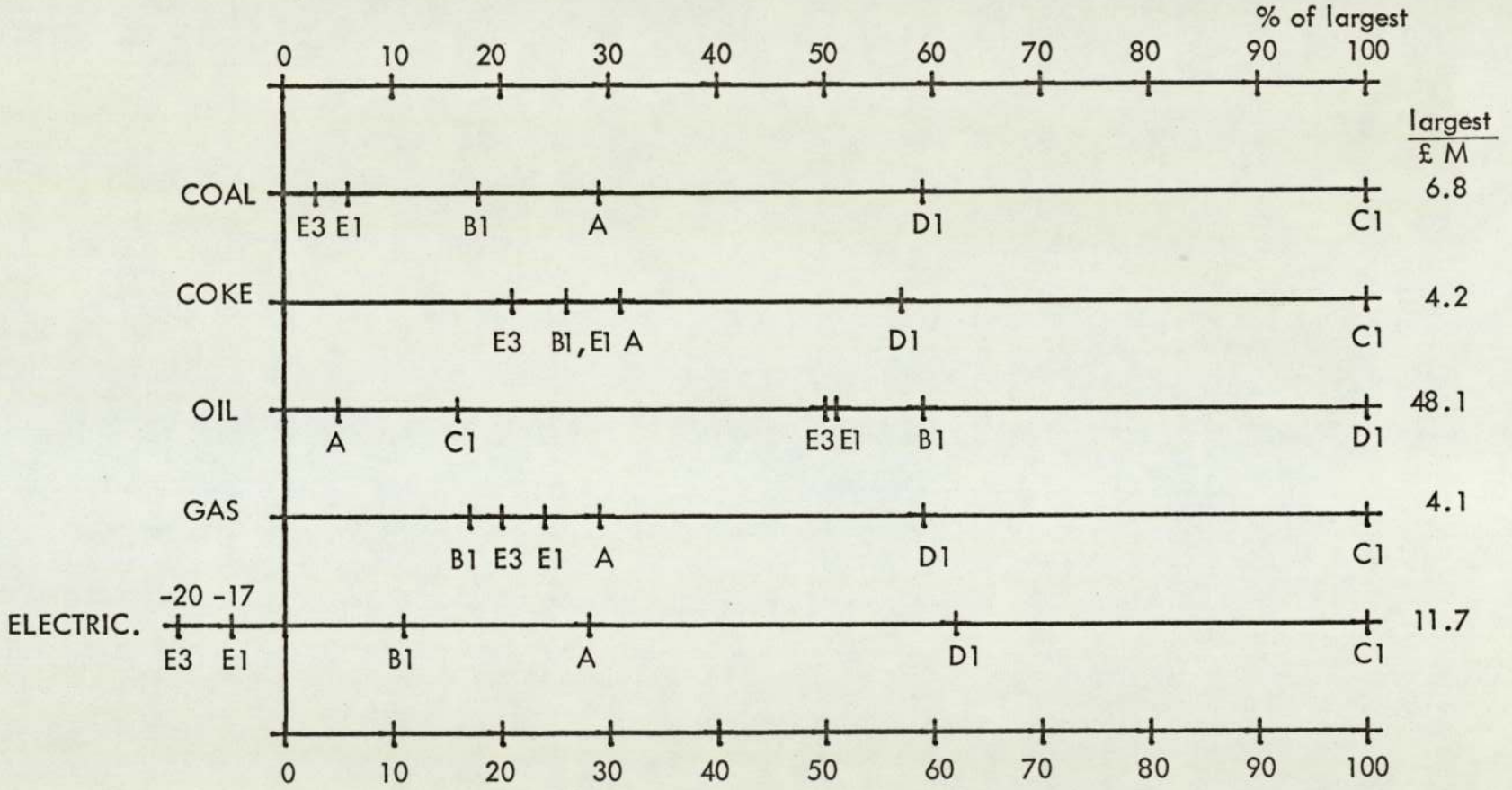


FIGURE (7.1) COMPARISON OF MODELS FOR CAR MANUFACTURE AND SUBSTITUTION.

(a) LONG TERM MODELS

(i) ENERGY

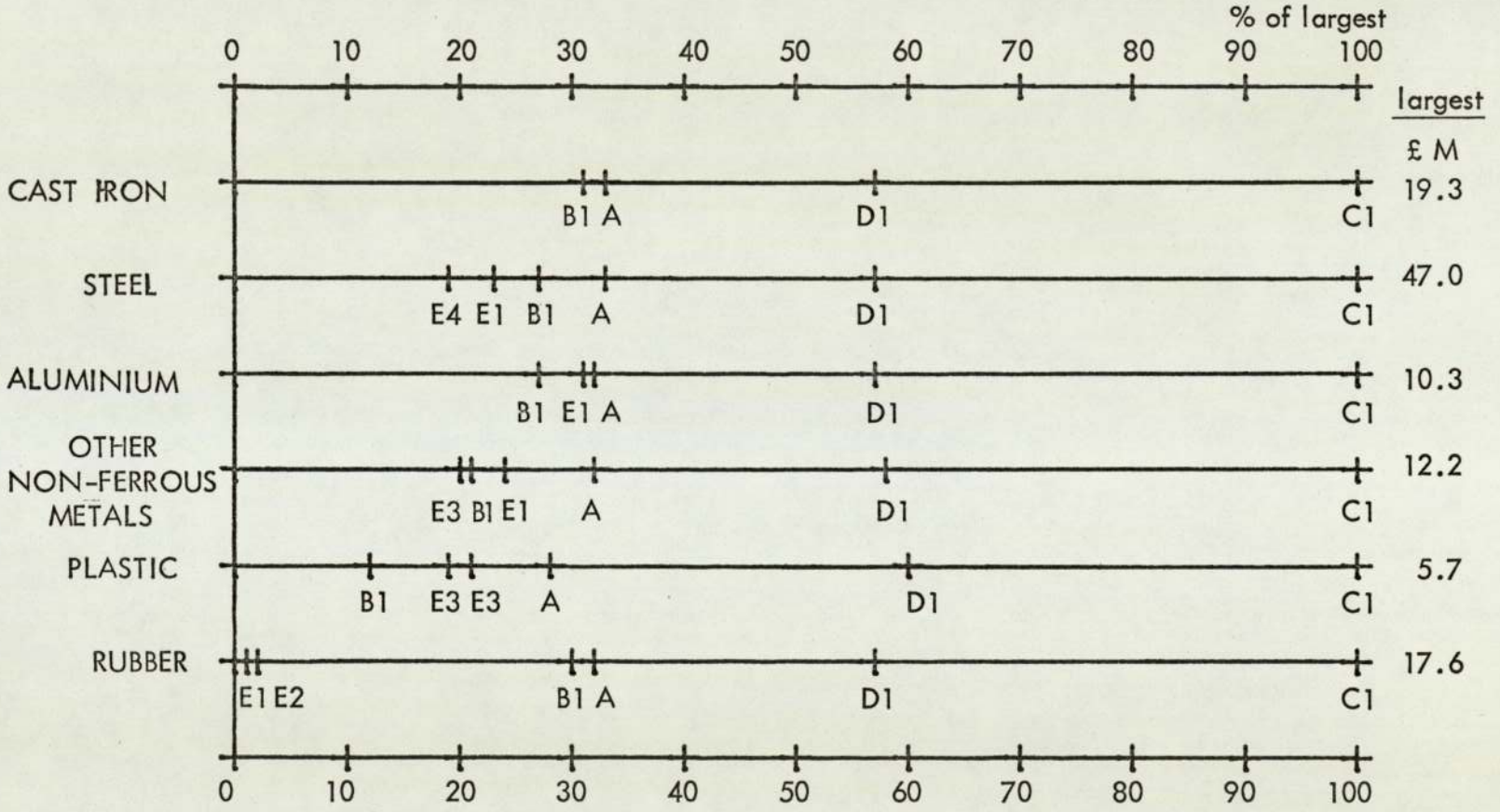


FIGURE (7.1) (a) continued

(ii) MATERIALS

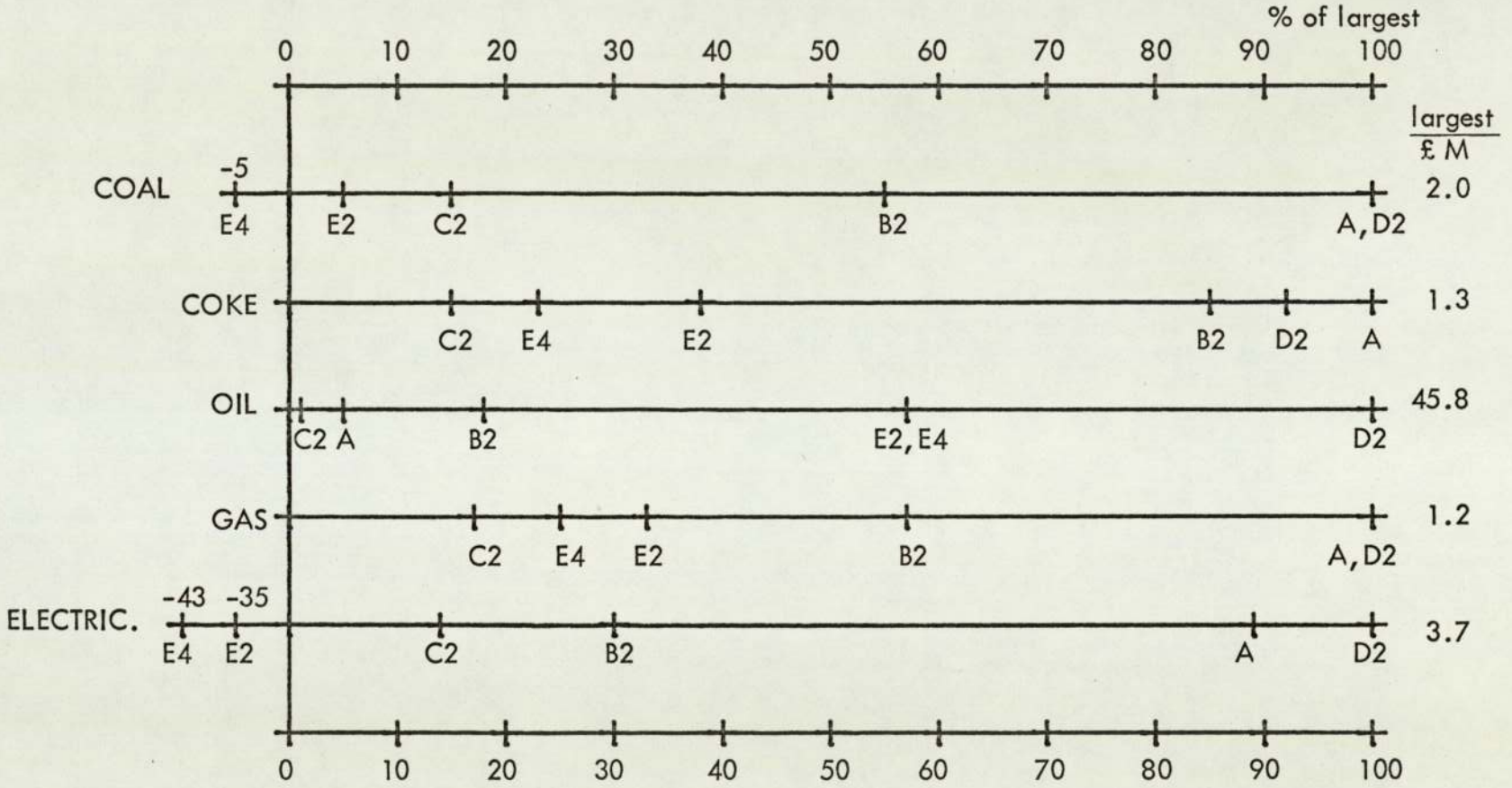


FIGURE (7.1) continued

(b) SHORT TERM MODELS

(i) ENERGY

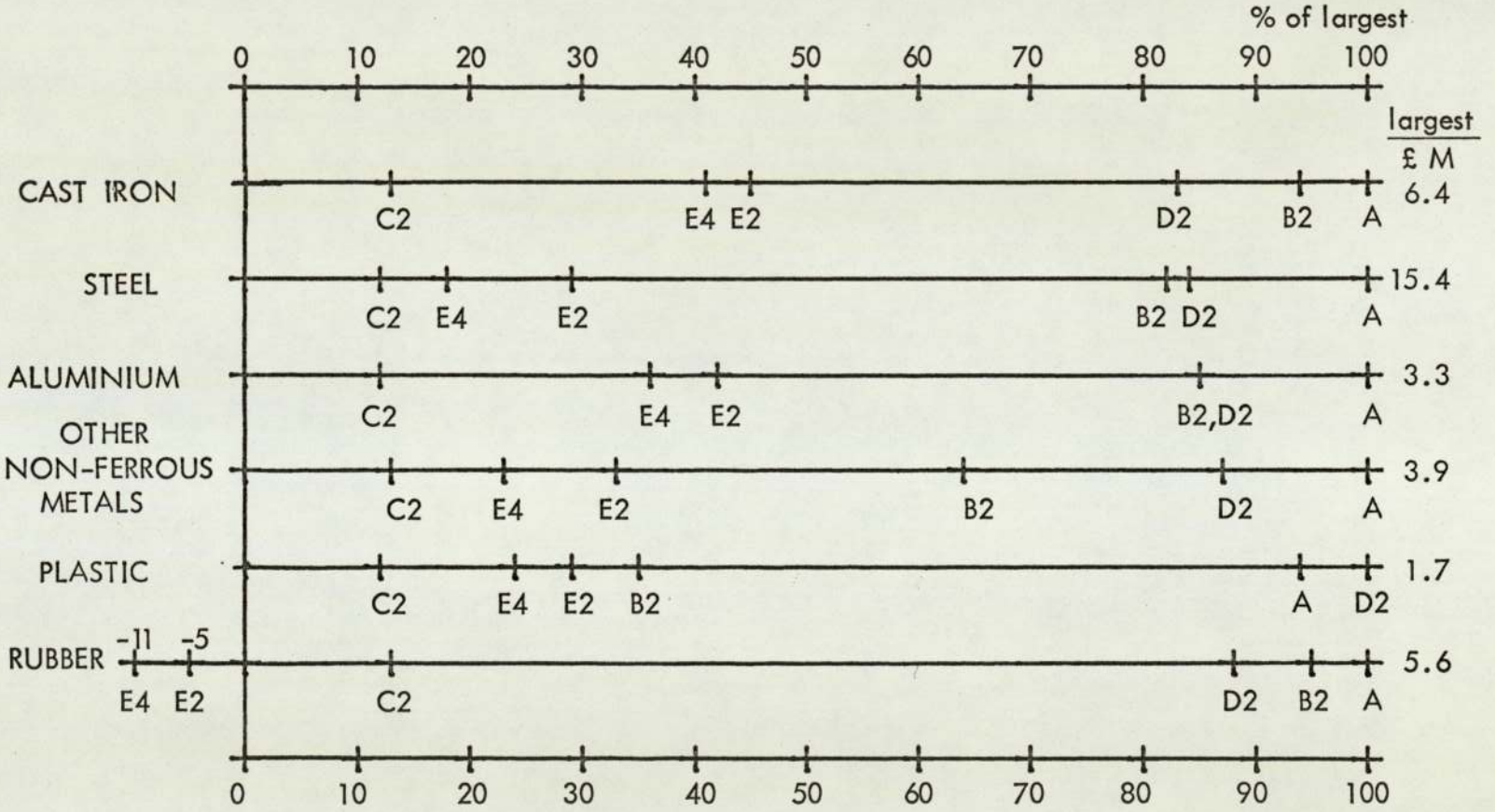


FIGURE (7.1) (b) continued

(ii) MATERIALS

FIGURE (7.2) CHANGED REQUIREMENT OF PRIMARY INPUTS DUE TO CHANGES IN THE MANUFACTURE AND USE OF MOTOR CARS.

(a) LONG TERM MODELS

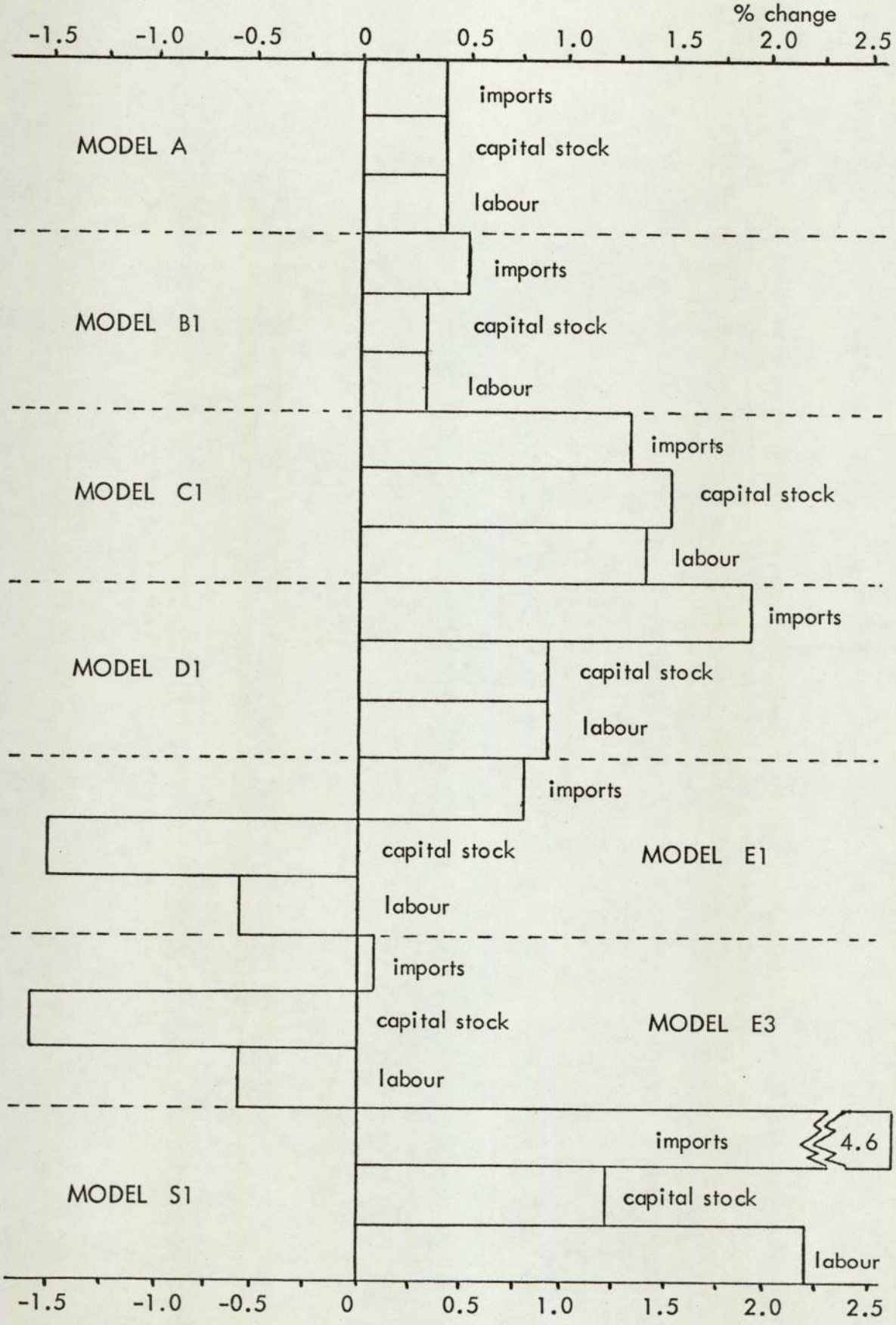


FIGURE (7.2) continued

(b) SHORT TERM MODELS

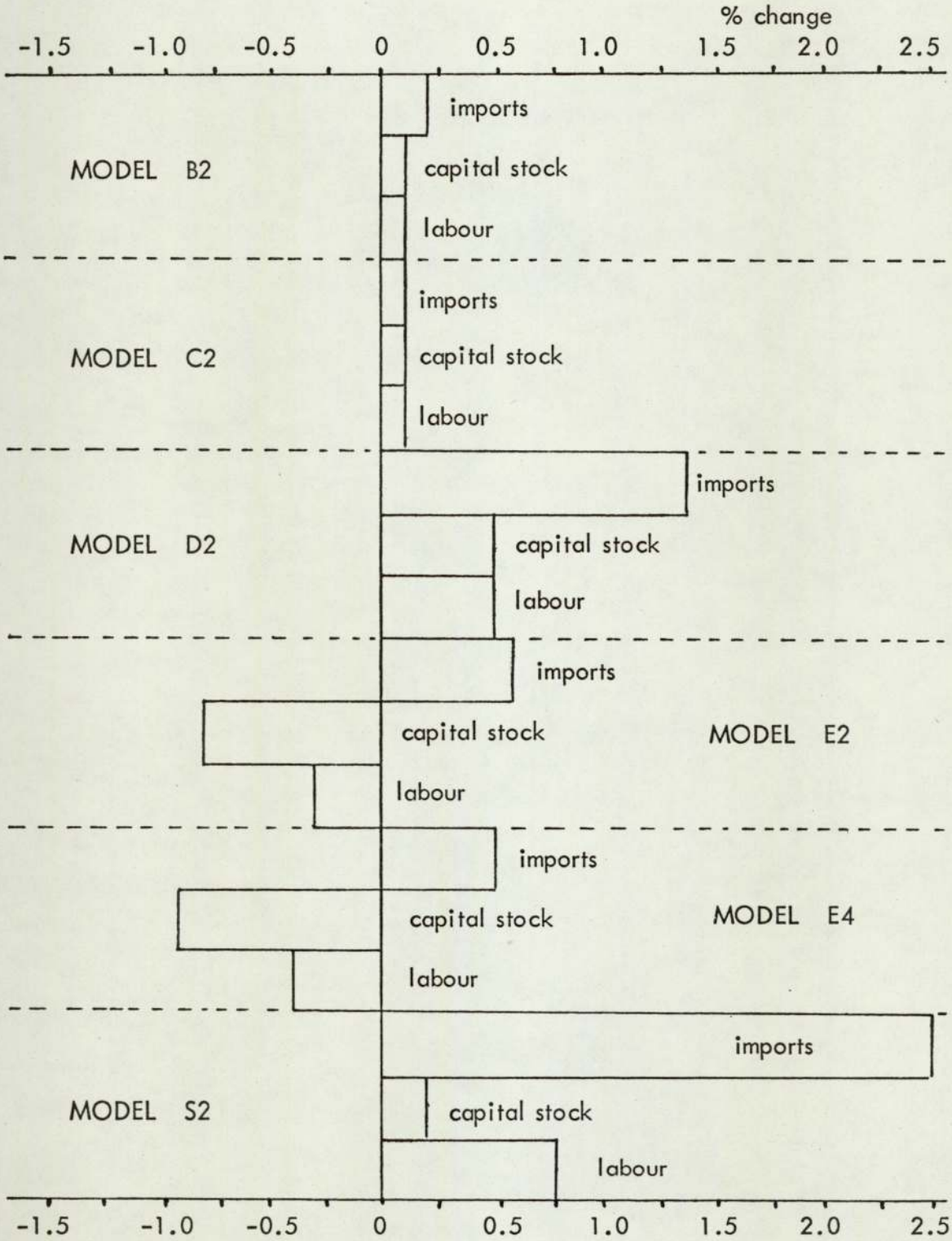


FIGURE (8.1) REPRESENTATION OF CALCULATIONS FOR TECHNICAL CHANGES IN MANUFACTURING INDUSTRIES RELATING TO ONE DOMESTICALLY PRODUCED AND IMPORTED MATERIAL

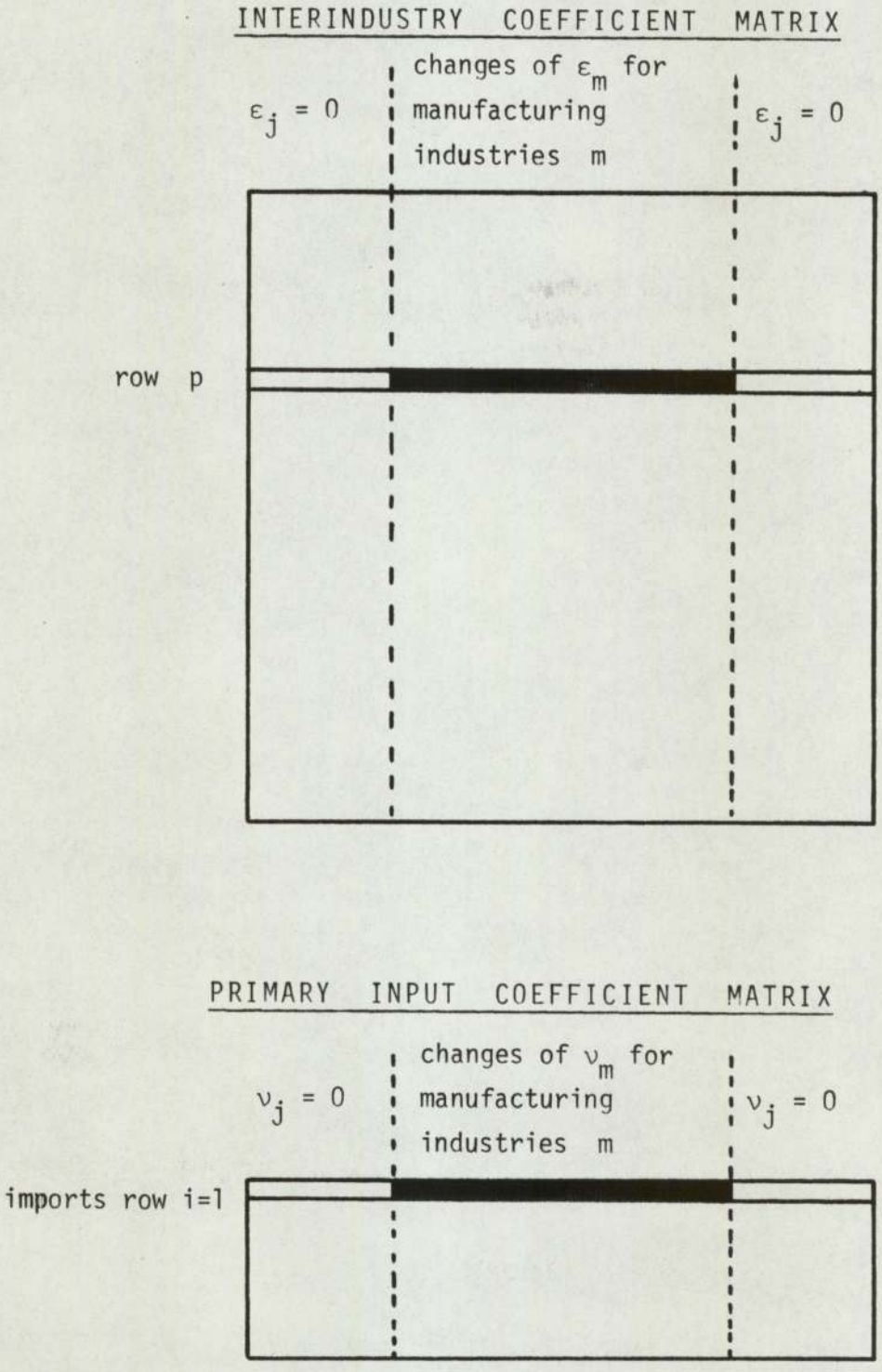


TABLE (9.1) Total requirements per £1 output of U.K. produced engineering materials (£ or 10^{-3} man-years),

	CAST IRON	STEEL	ALUMINIUM	OTHER NON-FERROUS METALS	PLASTIC	RUBBER
COAL	0.0634	0.0532	0.0103	0.0086	0.0156	0.0136
COKE	0.0631	0.0585	0.0031	0.0036	0.0038	0.0020
OIL	0.0183	0.0394	0.0173	0.0098	0.0475	0.0160
GAS	0.0302	0.0377	0.0103	0.0056	0.0041	0.0028
ELEC.	0.0382	0.0461	0.0302	0.0179	0.0347	0.0274
IMPORTS	0.1063	0.1900	0.4205	0.4515	0.2545	0.2215
CAPITAL STOCK	2.8550	3.9720	2.5096	1.3510	3.2839	2.0285
MANPOWER	0.5238	0.4347	0.3393	0.2339	0.3112	0.4226

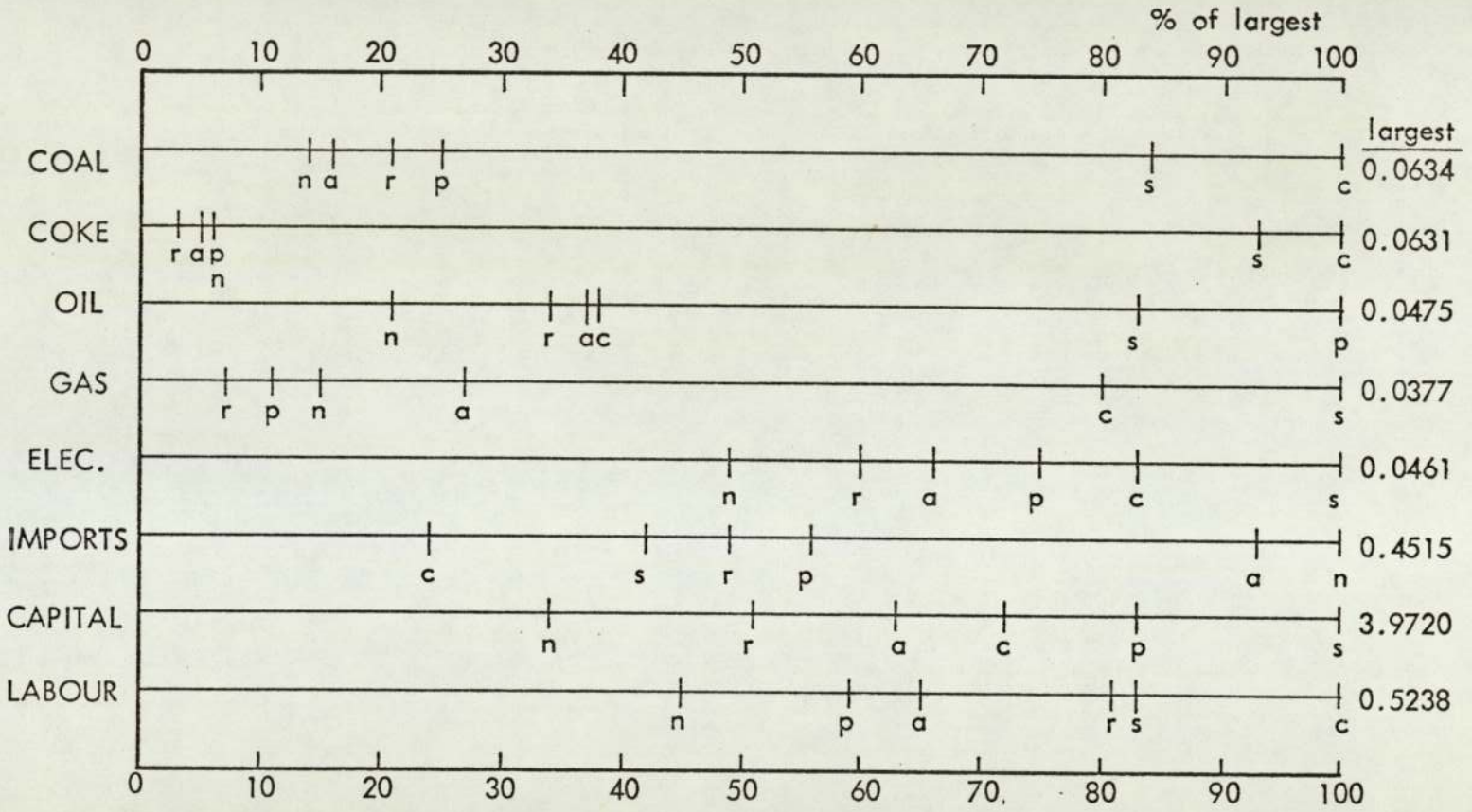


FIGURE (9.1) COMPARISON OF TOTAL RESOURCE INTENSITY OF ENGINEERING MATERIALS

£ of resources (10^{-3} man-years) required per £ of material: cast iron (c), steel (s), aluminium (a), other non-ferrous metals (n), plastic (p), rubber (r).

TABLE (9.2) Data to estimate use of resources via materials by manufacturing industries.

N.B. Column 1 records total direct purchase of material from domestic sources by U.K. manufacturing industries, column 4 direct plus indirect.

	DATA			REDUCTION IN MATERIAL, $\lvert\Delta t_p\rvert$	
	$\sum_m d_{p,m}\, t_m$	$\sum_m d_{p,m}\delta_{m,p}$	$\delta_{p,p}$	£M	%
CAST IRON	211.2	0.00187	1.00438	211.7	68.2
STEEL	1095.6	0.01656	1.02222	1101.7	74.9
ALUMINIUM	168.0	0.00154	1.00249	168.2	66.9
OTHER NON-FERROUS METALS	401.9	0.01128	1.01278	402.5	58.7
PLASTIC	134.4	0.00238	1.00681	135.0	31.5
RUBBER	147.2	0.00055	1.00263	147.5	32.3

TABLE (9.3) Percent of gross output of industries and industrial use of primary input used by U.K. manufacturing industries via materials.

(a) Industry Table

		Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1	Coal mining	1.6	7.2	0.2	0.4	0.3	0.2
2	Stone, slate, sand, etc.	1.4	6.0	0.1	0.2	0.1	0.1
3	Other mining, quarrying	2.0	17.0	0.2	3.0	0.3	0.1
4	Coke ovens, manuf. fuel	5.8	28.1	0.2	0.6	0.2	0.1
5	Mineral oil refining	0.4	4.8	0.3	0.4	0.7	0.3
6	Chemicals	0.2	1.6	0.2	0.3	1.8	0.6
7	Paint	0.7	1.3	0.4	0.1	0.1	0.1
8	Plastic, synth. resins, etc.	0.3	1.2	0.2	0.3	31.5	2.1
9	Iron castings, etc.	68.2	18.6	0.1	0.4	0.1	0.1
10	Other iron and steel	0.6	74.9	0.2	0.5	0.1	0.2
11	Aluminium and alloys	0.5	2.2	66.9	2.8	0.2	0.2
12	Other non-ferrous metals	0.7	5.4	1.1	58.7	0.2	0.2
13	Agricultural machinery	-	0.4	-	-	-	-
14	Machine tools	0.3	1.0	0.1	0.2	-	-
15	Pumps, valves, compressors	0.3	1.8	0.1	0.6	0.2	0.1
16	Industrial engines	0.2	1.2	0.1	0.3	0.1	0.1
17	Textile machinery	0.1	0.3	-	0.1	-	-
18	Const.& mech. handling equip.	0.1	0.9	-	0.1	-	-
19	Office machinery	-	0.3	-	0.2	0.1	0.1
20	Other non-electrical mach.	0.2	1.0	-	0.2	0.1	0.1
21	Indust. plant and steel works	0.3	0.8	-	0.1	0.1	-
22	Other mechanical engineering	0.8	4.7	0.2	0.9	0.3	0.2
23	Instrument engineering	0.4	0.4	-	0.1	-	-
24	Electrical machinery	0.2	0.8	0.1	0.4	-	-
25	Insulated wires and cables	0.2	1.5	0.2	3.9	0.1	0.1
26	Electronics and telecom.	-	0.1	-	0.2	-	-
27	Domestic elec. appliances	0.1	0.6	0.1	0.3	-	-
28	Other electrical goods	0.2	0.7	0.1	0.5	-	0.1
29	Shipbuilding, etc.	-	0.2	-	0.2	-	-
30	Wheeled tractors	0.1	0.3	-	0.1	-	-

TABLE (9.3) (a) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	0.1	0.5	-	0.2	-	-
32 Areospace equipment	-	0.1	0.1	-	-	-
33 Other vehicles	0.6	3.2	0.1	0.5	0.1	0.1
34 Engineers' small tools	1.0	6.1	0.6	0.8	0.3	0.4
35 Cutlery and jewellery	-	0.2	-	0.1	-	-
36 Bolts, nuts, screws, etc.	0.4	2.4	0.1	1.5	0.1	0.1
37 Wire and wire manufactures	0.3	1.4	0.1	1.1	0.1	1.3
38 Cans and metal boxes	0.3	1.7	0.1	0.4	0.3	0.2
39 Other metal goods	0.8	4.8	0.5	1.1	0.2	0.4
40 Bricks, fireclay, etc.	1.0	11.6	0.1	0.2	-	-
41 Pottery and glass	0.1	0.5	-	0.1	0.3	0.1
42 Cement	0.1	1.0	-	0.1	0.1	-
43 Other building materials	0.1	2.3	0.1	0.1	0.1	0.1
44 Furniture and bedding, etc.	-	0.1	-	-	-	-
45 Timber and misc. wood manuf.	0.1	0.7	0.2	0.2	0.1	0.1
46 Paper and board	0.1	0.9	0.5	0.3	0.6	0.3
47 Paper and board packaging	0.2	1.3	0.2	0.4	0.6	0.4
48 Other paper and board prods.	0.3	1.2	0.2	0.3	0.2	0.2
49 Rubber	0.4	1.9	0.1	0.3	0.2	32.3
50 Plastic products n.e.s.	0.3	2.1	0.4	0.4	0.4	0.2
51 Other manufacturing	0.1	0.3	-	0.1	0.1	0.1
52 Construction	-	0.2	-	-	-	-
53 Gas	1.1	7.3	0.3	0.4	0.1	0.1
54 Electricity	0.5	3.2	0.3	0.5	0.3	0.3
55 Water supply	0.3	1.9	0.1	0.4	0.7	0.3
56 Railways	1.1	6.0	0.2	0.7	0.2	0.2
57 Road transport	0.7	3.2	0.2	0.6	0.3	0.3
58 Other transport	0.1	1.3	0.1	0.5	0.1	0.1
59 Distributive trades	0.1	1.0	0.1	0.6	-	0.1
60 ALL OTHER	0.1	0.6	0.1	0.1	0.1	0.1

TABLE (9.3) Continued

(b) Primary Input Table

			Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
IMPORTS			0.4	5.2	1.4	5.1	1.1	0.8
CAPITAL STOCK			0.7	5.0	0.5	0.6	0.5	0.3
LABOUR	Number	Operatives	0.7	2.9	0.3	0.6	0.2	0.4
		Other	0.5	2.6	0.3	0.6	0.3	0.4
	Wages, Salaries, etc.	Operatives	0.7	2.8	0.3	0.5	0.2	0.3
		Other	0.5	2.6	0.3	0.6	0.4	0.4
		T.I.F.E.	0.6	2.8	0.3	0.5	0.3	0.4
Total Value Added			0.6	2.6	0.3	0.6	0.3	0.4

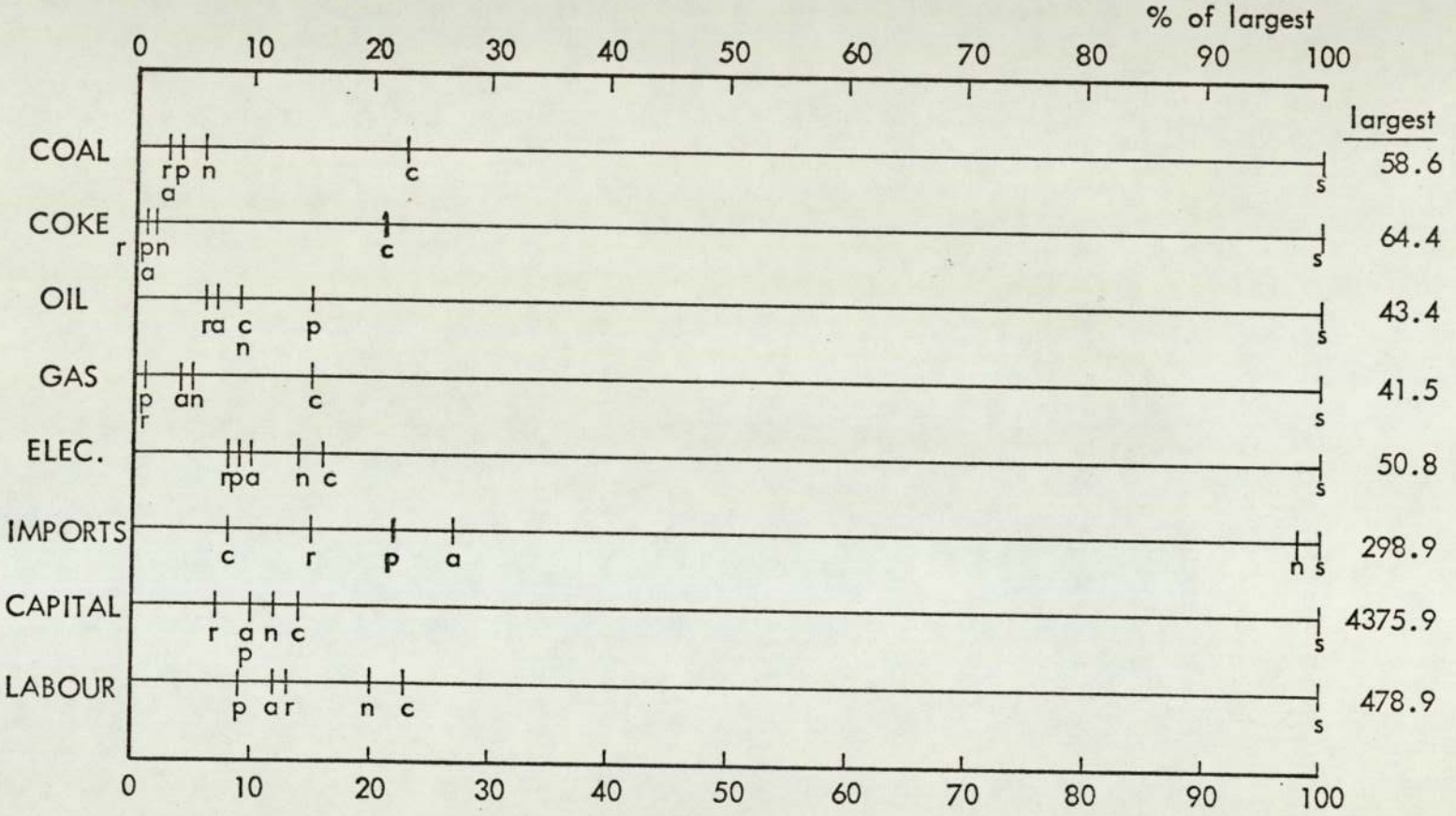


FIGURE (9.2) COMPARISON OF RESOURCES REQUIRED TO MANUFACTURE MATERIALS FOR ENGINEERING AND CONSTRUCTION INDUSTRIES. £M, th. man-years; cast iron (c), steel (s), aluminium (a), other non-ferrous metals (n), plastic (p), rubber (r).

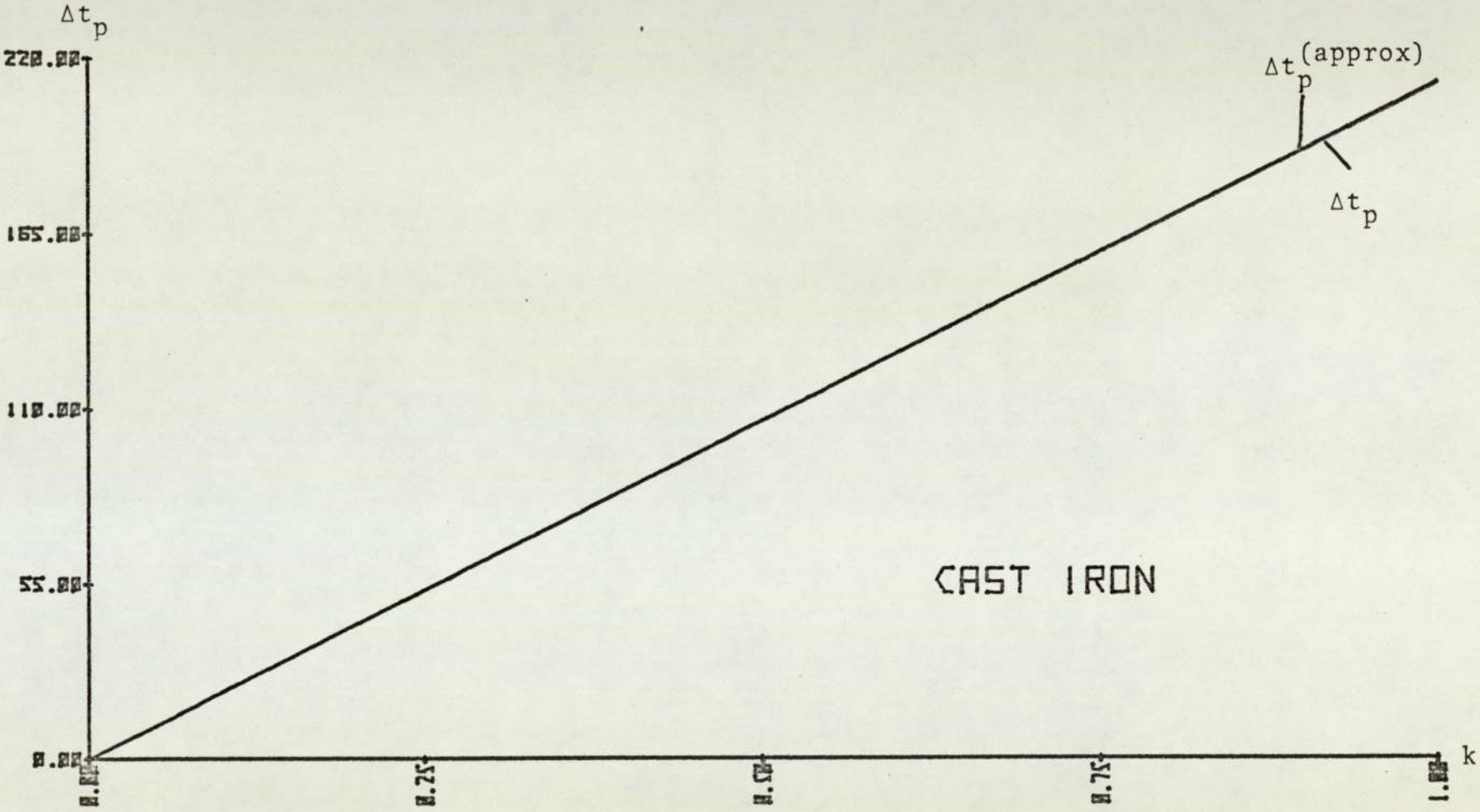


FIGURE (9.3) VARIATION OF TOTAL MATERIAL SAVED (Δt_p and linear approximation, £M) WITH PROPORTION (k from 0 to 100%) MATERIAL SAVED DIRECTLY IN ENGINEERING AND CONSTRUCTION INDUSTRIES.

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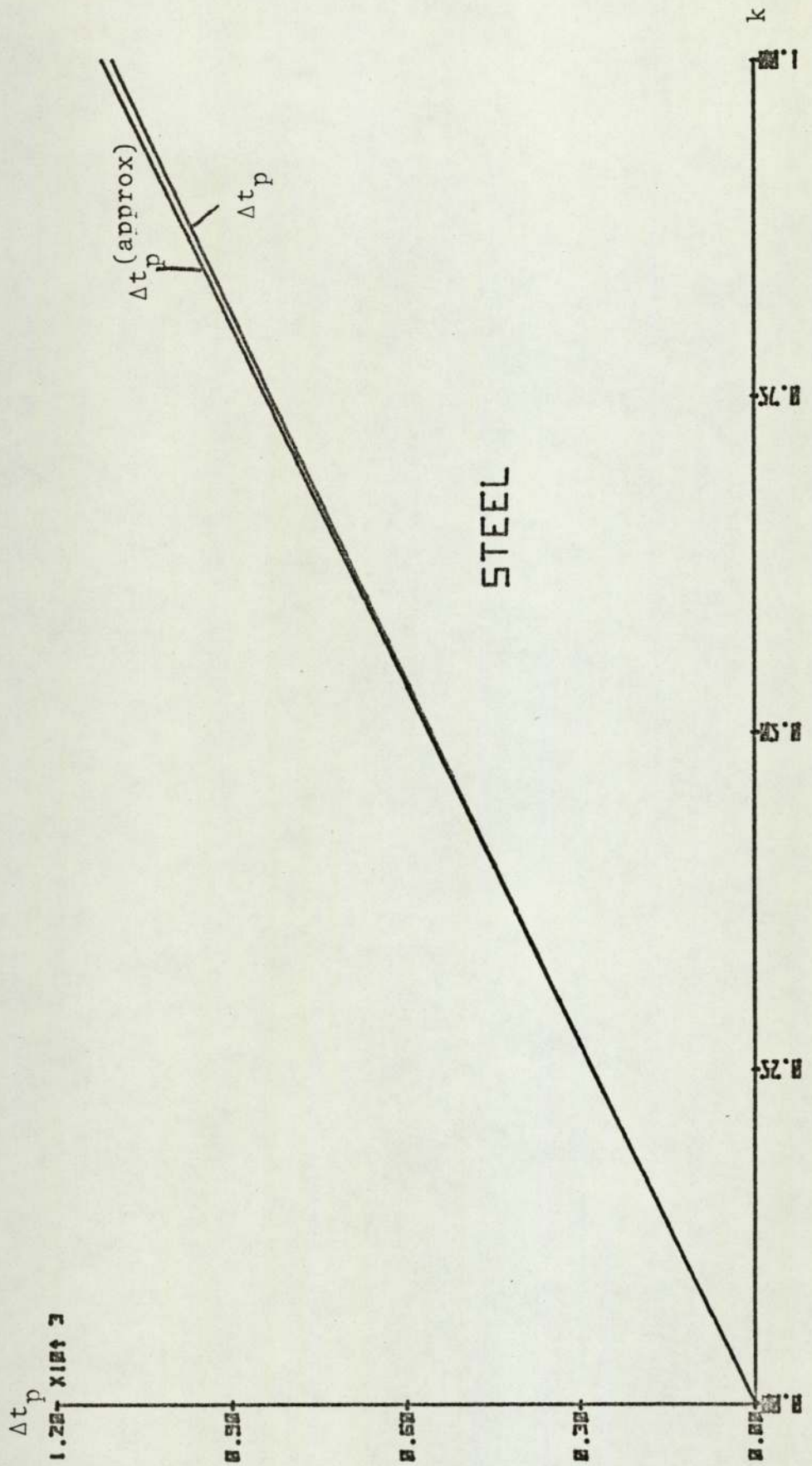

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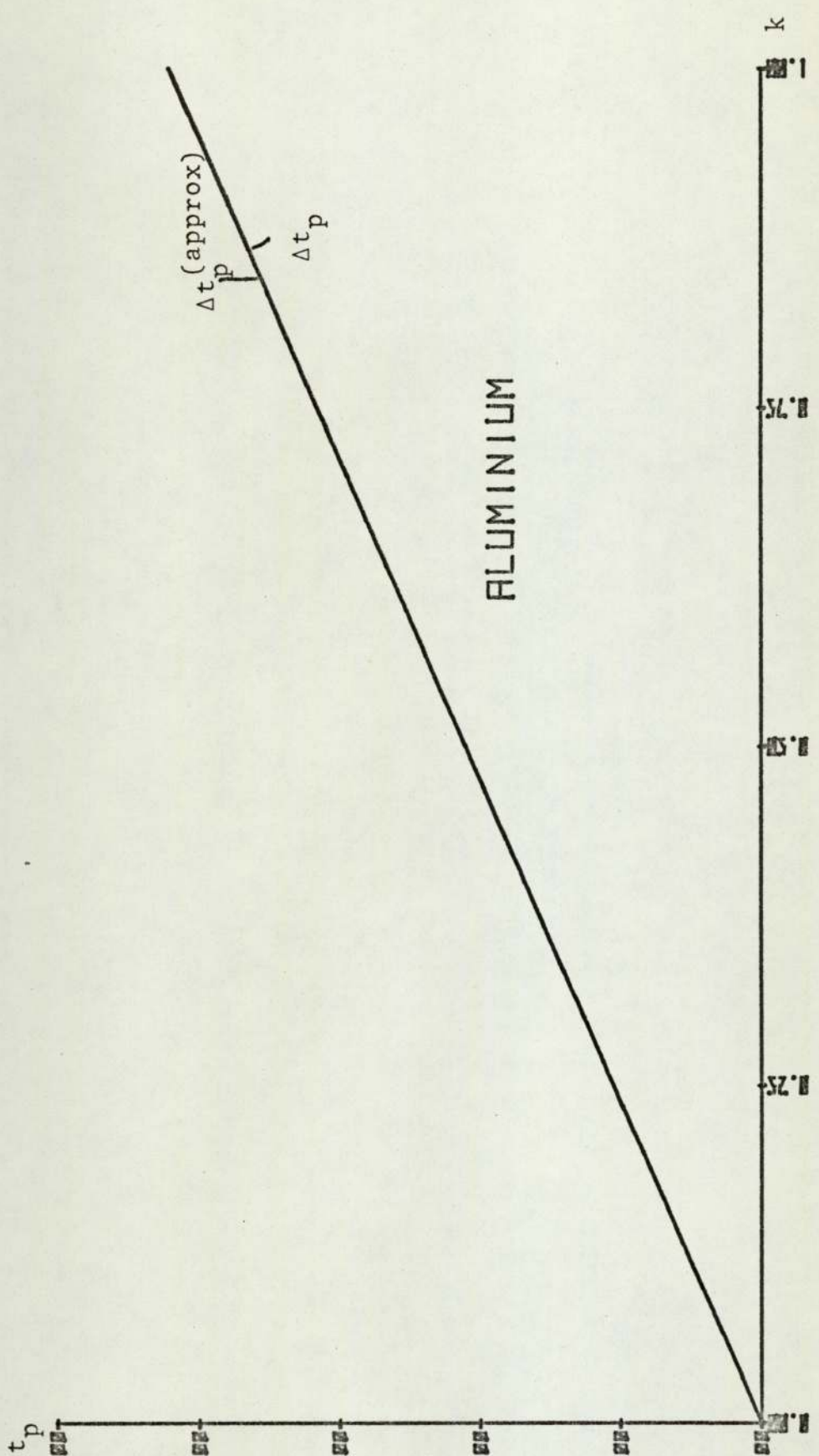

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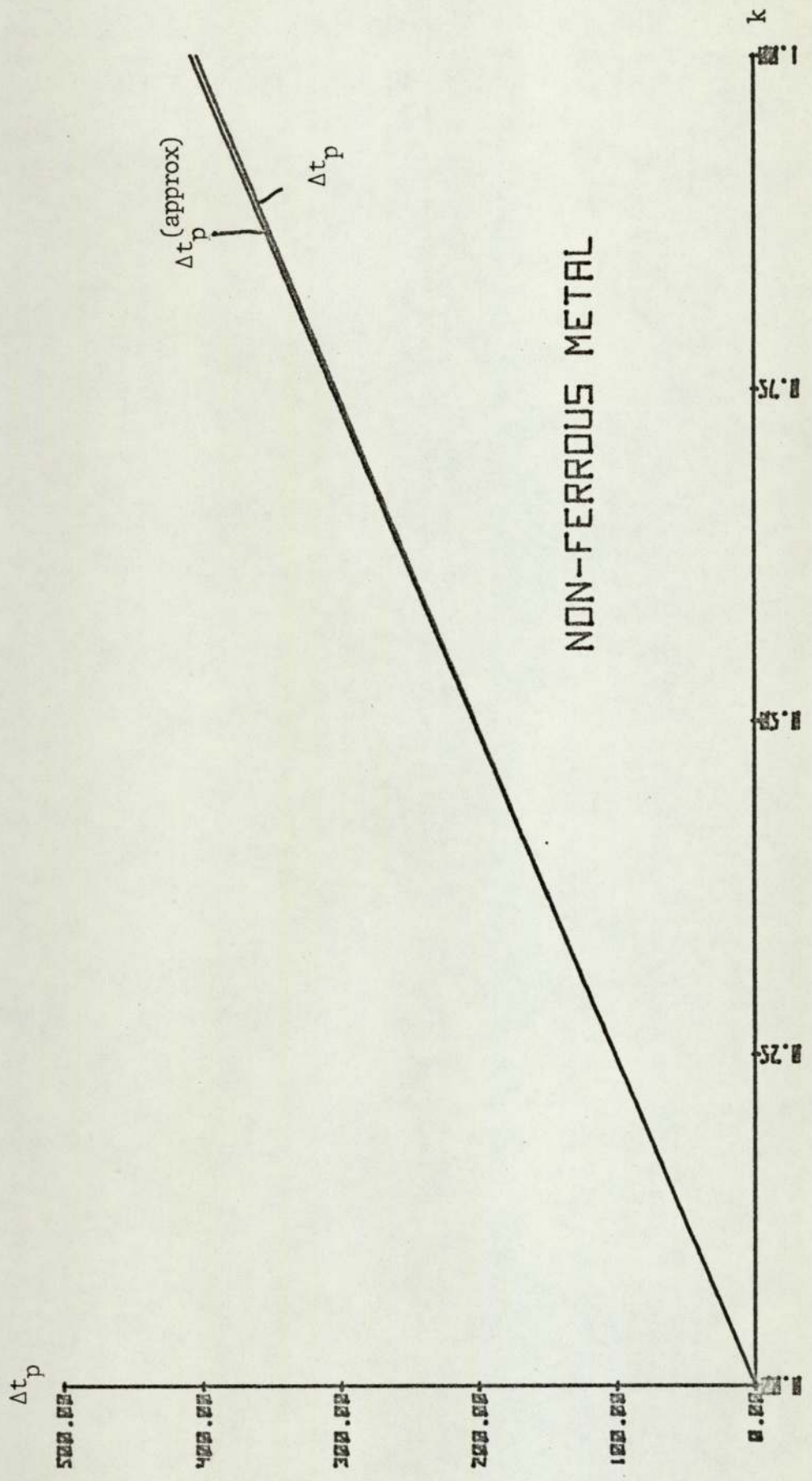

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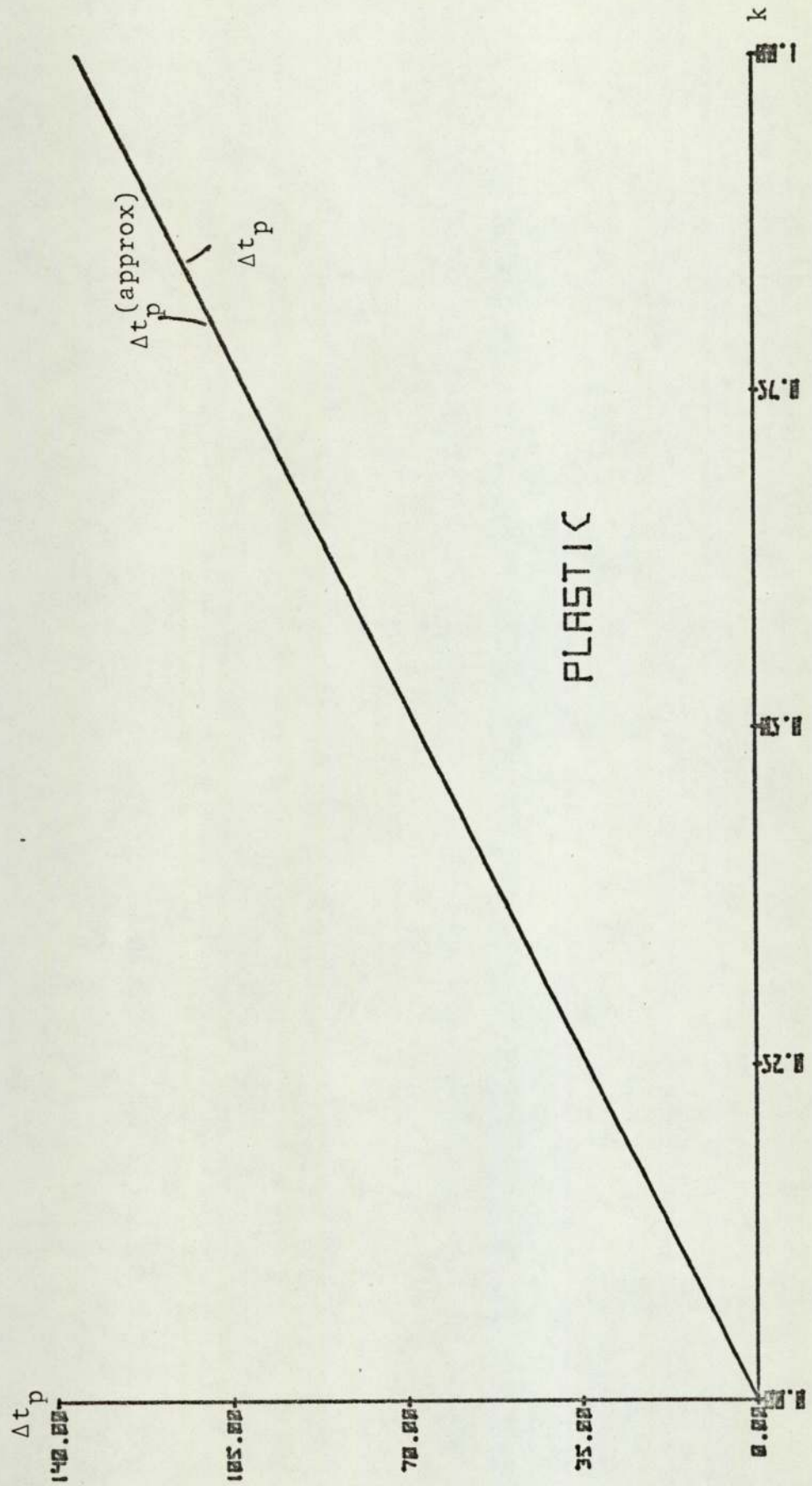

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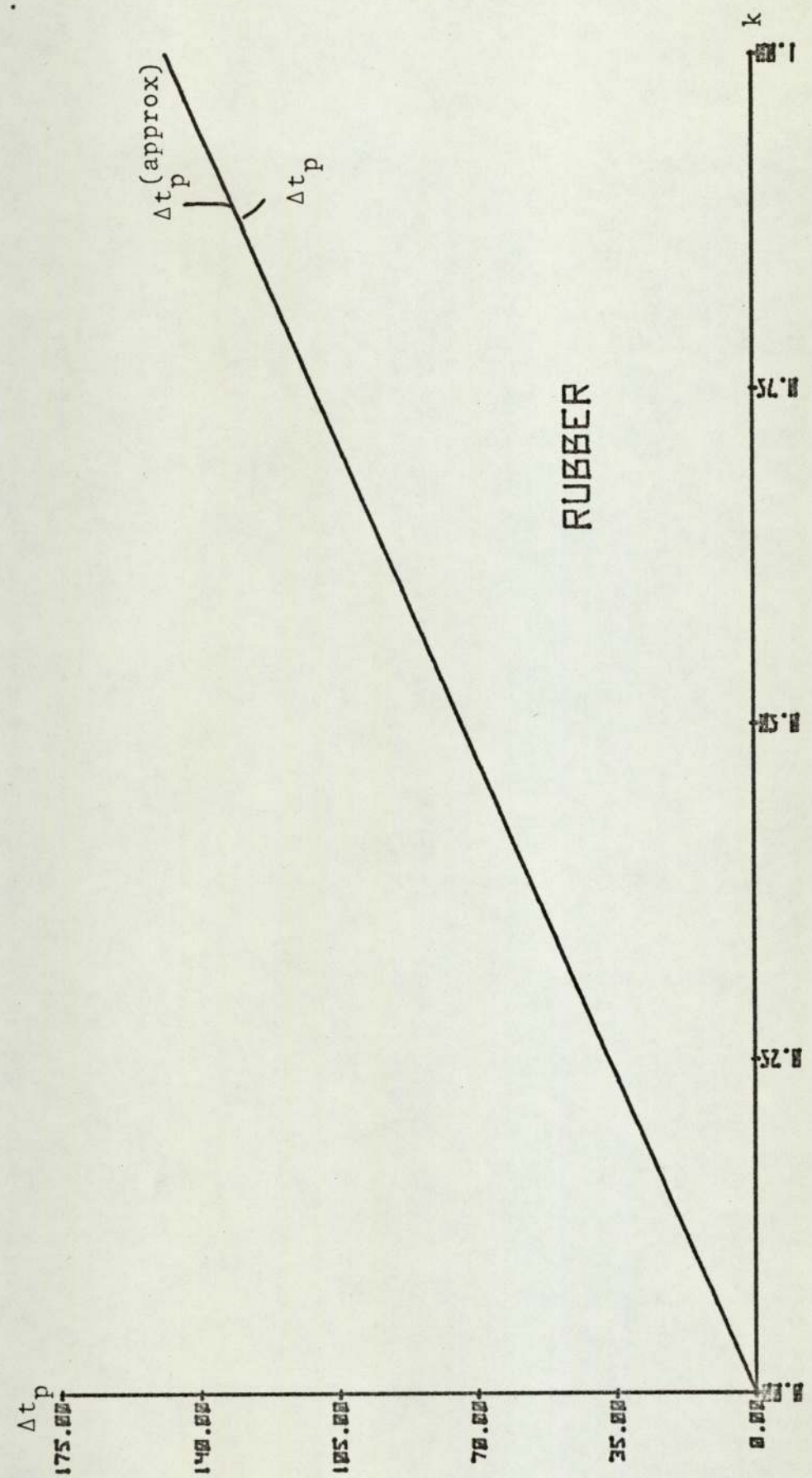


FIGURE (9.3) continued

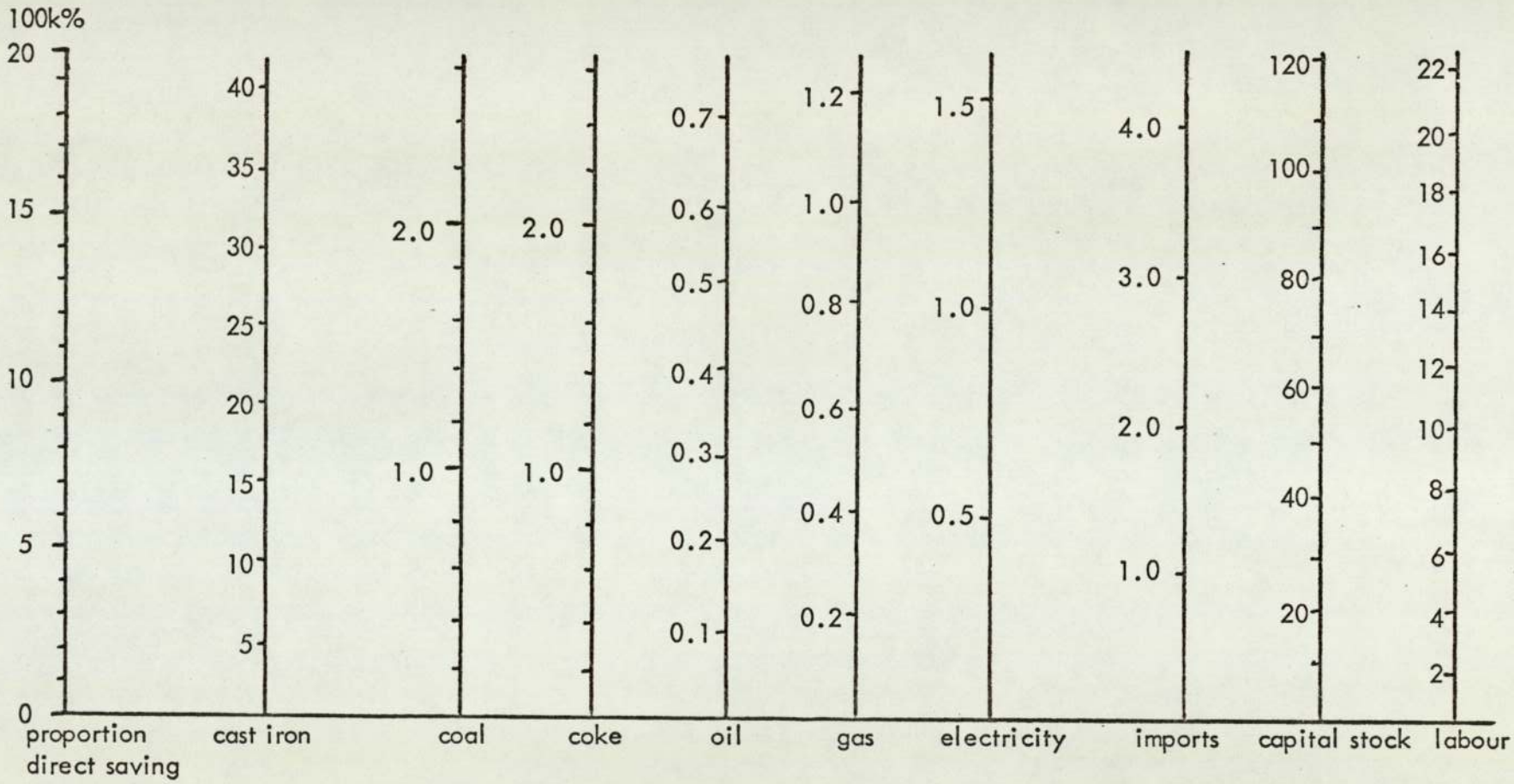


FIGURE (9.4) TOTAL MATERIAL AND RESOURCE SAVING RESULTING FROM 100k% DIRECT SAVING OF U.K. MATERIAL BY ENGINEERING AND CONSTRUCTION INDUSTRIES.

(a) CAST IRON (£M, thousand man-years)

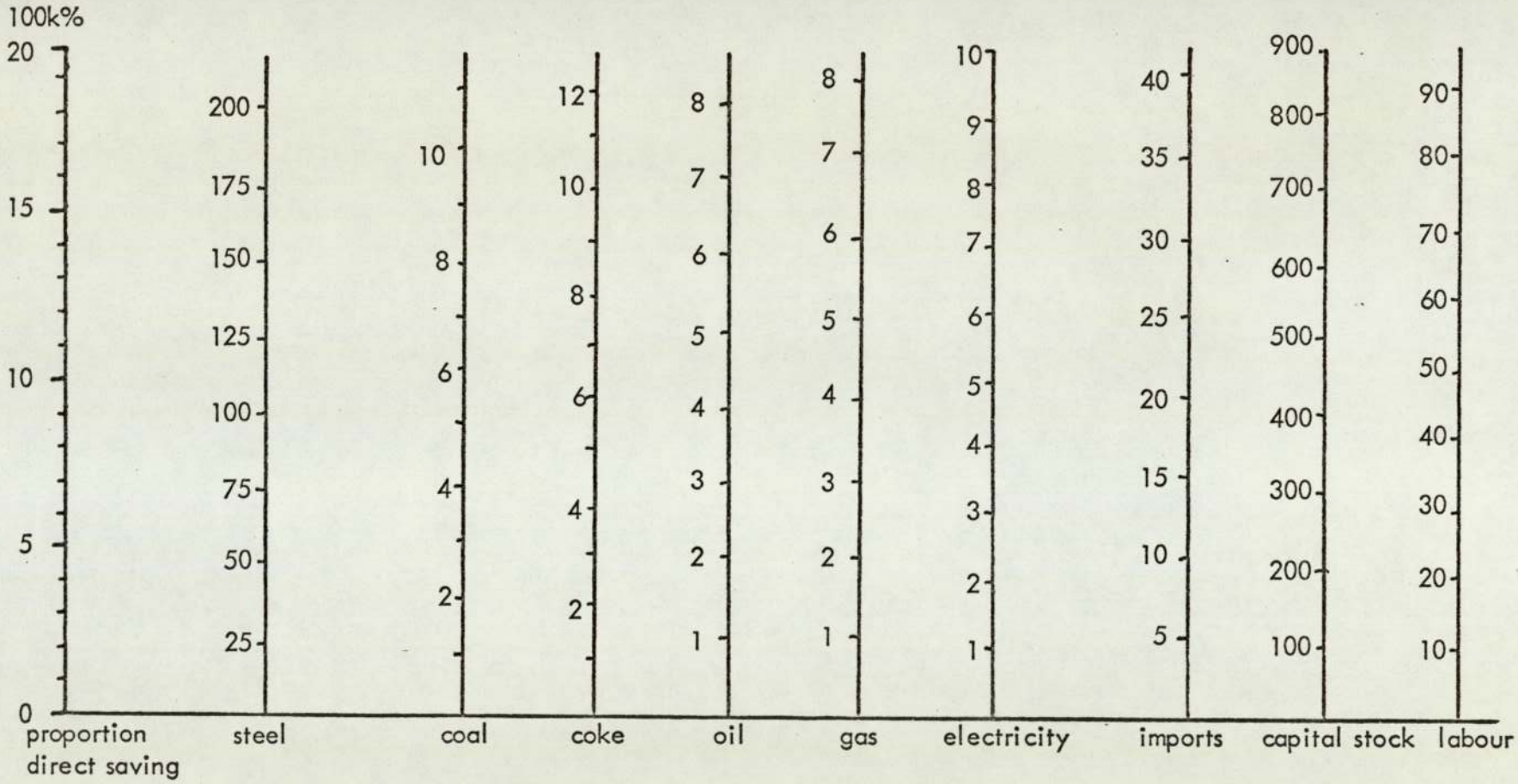


FIGURE (9.4) continued

(b) STEEL (£M, thousand man-years)

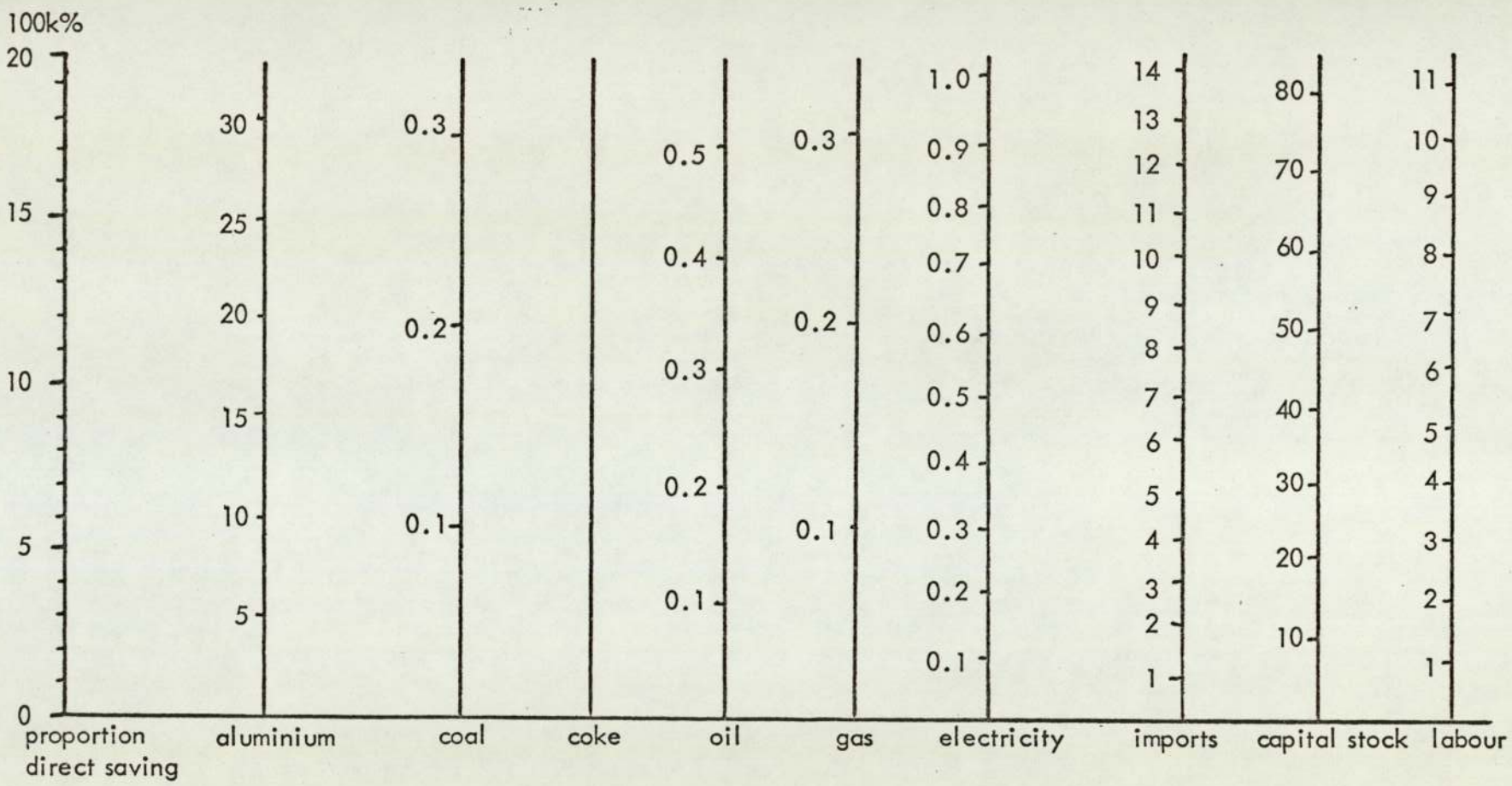


FIGURE (9.4) continued

(c) ALUMINIUM (£M, thousand man-years)

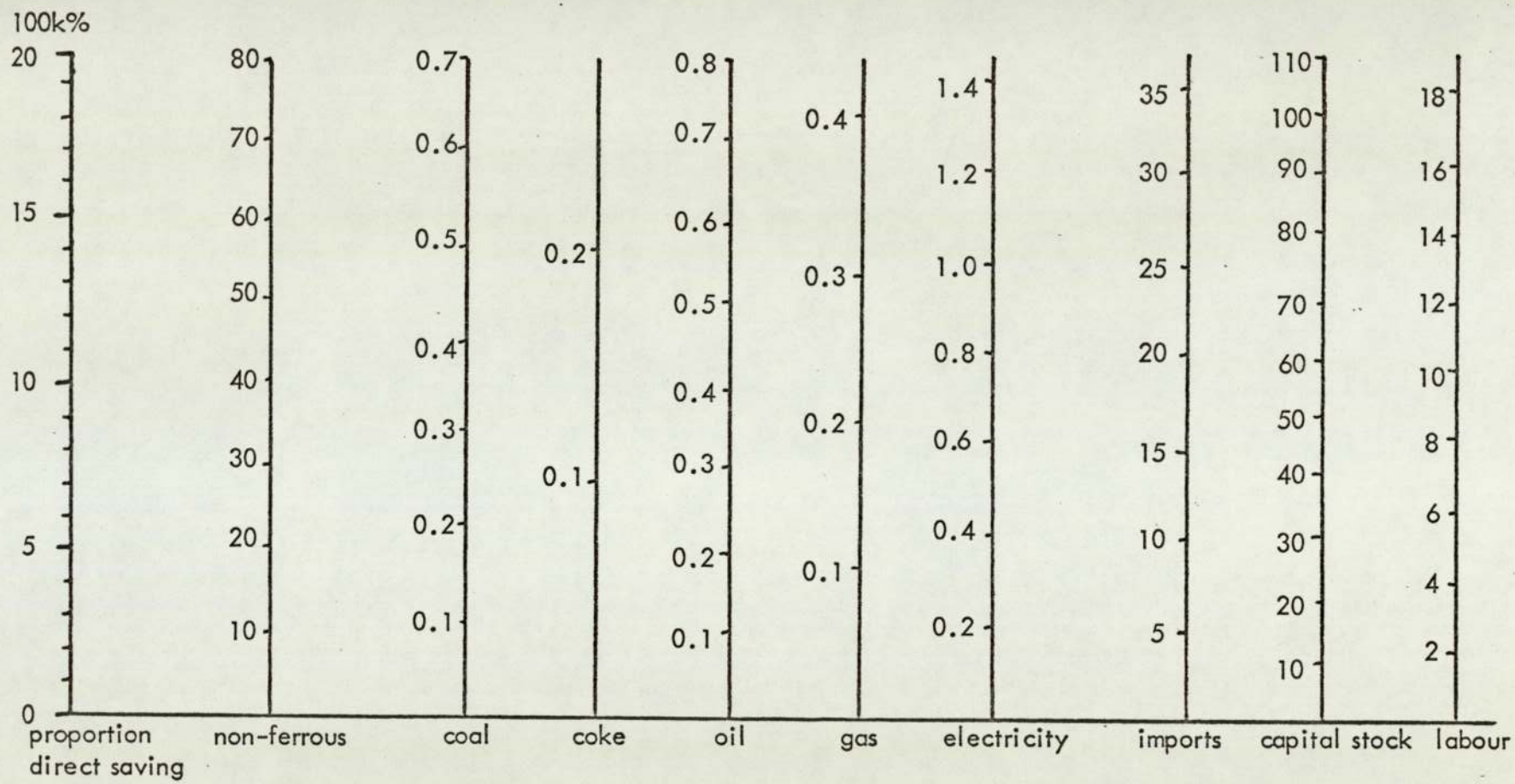


FIGURE (9.4) continued

(d) OTHER NON-FERROUS METALS (£M, thousand man-years)

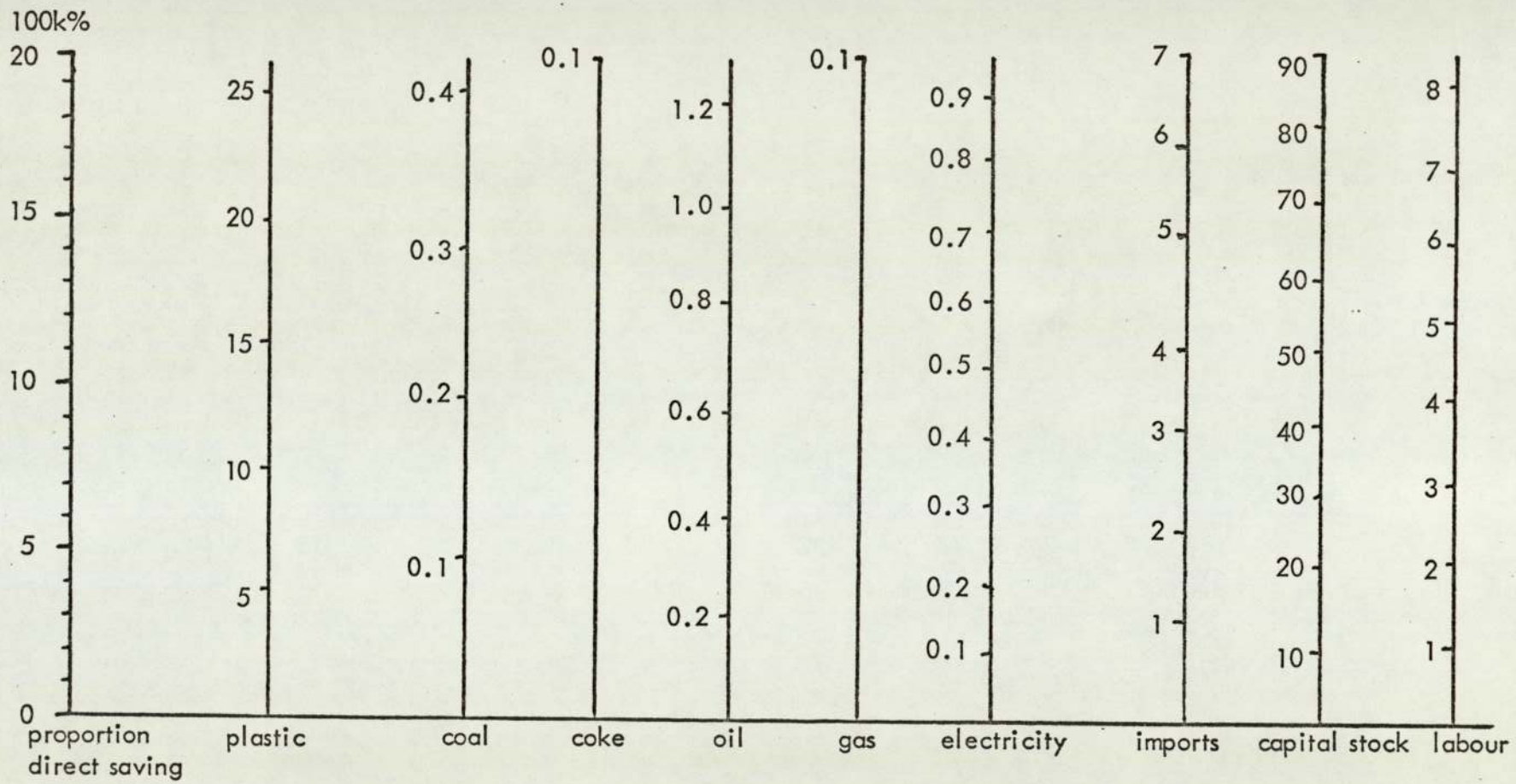


FIGURE (9.4) continued

(e) PLASTIC (£M, thousand man-years)

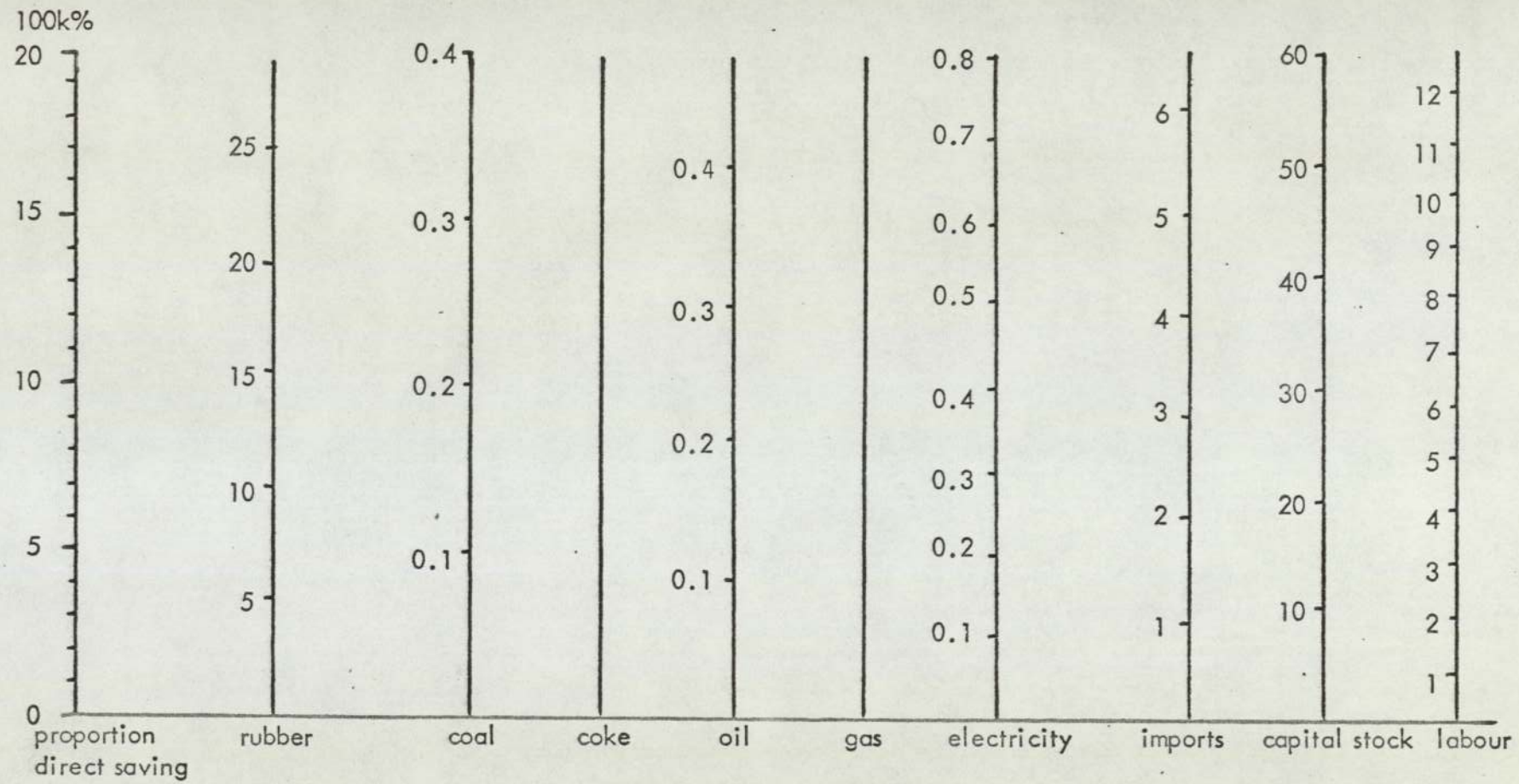


FIGURE (9.4) continued

(f) RUBBER (£M, tjousand man-years)

TABLE (9.4) Materials component of prices (U.K. produced).
Data for estimation, $\left(\sum_m d_{p,m} \delta_{m,i} \right) \times 10^5$
ALSO
Component, percent x 10^3

		Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1	Coal mining	172	1322	189	673	95	87
2	Stone, slate, sand, etc.	191	1315	173	491	88	106
3	Other mining, quarrying	54	564	84	223	100	34
4	Coke ovens, manuf. fuel	174	1416	196	625	114	100
5	Mineral oil refining	53	558	70	199	58	33
6	Chemicals	80	1065	130	346	466	63
7	Paint	68	2971	194	339	246	60
8	Plastic, synth. resins, etc.	76	818	114	313	238	52
9	Iron castings, etc.	186	1606	246	631	137	128
10	Other iron and steel	183	1656	257	679	187	125
11	Aluminium and alloys	77	892	154	418	199	62
12	Other non-ferrous metals	126	1227	268	1128	205	110
13	Agricultural machinery	1874	16111	857	1834	339	1558
14	Machine tools	4534	8541	923	2618	254	445
15	Pumps, valves, compressors	2608	9771	1519	7459	370	1471
16	Industrial engines	4012	10014	1730	5947	198	569
17	Textile machinery	2742	8618	1423	2241	355	638
18	Const.& mech. handling equip.	1909	13051	737	2004	242	1340
19	Office machinery	715	6467	1710	2557	692	444
20	Other non-electrical mach.	2109	10543	1735	2618	425	747
21	Indust. plant and steel works	1099	13653	839	1713	181	254
22	Other mechanical engineering	1530	10171	1755	6203	407	591
23	Instrument engineering	103	3345	1268	2720	815	814
24	Electrical machinery	1774	10091	1247	4929	800	302
25	Insulated wires and cables	276	5812	3222	21894	3353	680
26	Electronics and telecom.	205	3260	1184	3083	1454	377
27	Domestic elec. appliances	773	9720	3140	3810	2266	1564
28	Other electrical goods	282	5278	1658	6450	1807	1498
29	Shipbuilding, etc.	687	9765	653	2714	285	331
30	Wheeled tractors	9169	7868	1608	1722	324	3778

TABLE (9.4) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	4506	12093	2565	2601	827	4281
32 Areospace equipment	167	4984	2210	2073	497	802
33 Other vehicles	1348	13529	1693	3029	389	1688
34 Engineers' small tools	749	11273	516	3209	115	255
35 Cutlery and jewellery	80	2740	360	6384	137	95
36 Bolts, nuts, screws, etc.	190	18794	891	6757	415	366
37 Wire and wire manufactures	177	30896	3498	10645	724	236
38 Cans and metal boxes	196	48391	1881	1536	714	235
39 Other metal goods	547	17078	3060	6611	595	791
40 Bricks, fireclay, etc.	120	978	149	391	155	80
41 Pottery and glass	91	970	147	411	147	63
42 Cement	151	1423	219	568	200	99
43 Other building materials	114	1505	212	603	159	83
44 Furniture and bedding, etc.	99	1649	438	522	1216	933
45 Timber and misc. wood manuf.	47	661	92	259	125	46
46 Paper and board	69	775	108	308	104	42
47 Paper and board packaging	58	531	77	214	138	38
48 Other paper and board prods.	56	556	82	218	134	38
49 Rubber	73	1290	180	504	157	55
50 Plastic products n.e.s.	88	1382	300	585	21696	558
51 Other manufacturing	76	2083	437	1725	6116	799
52 Construction	890	4134	234	1339	290	266
53 Gas	128	1086	138	409	82	71
54 Electricity	93	835	176	742	137	68
55 Water supply	89	561	89	297	236	57
56 Railways	268	2568	350	834	132	283
57 Road transport	81	400	79	173	71	90
58 Other transport	28	301	44	107	29	24
59 Distributive trades	35	443	57	152	141	40
60 ALL OTHER	59	652	87	241	134	54

TABLE (9.5) Materials component of prices (direct imports by manufacturing industries).

Data for estimation, $\left(\sum_j \delta_{m,j} \Delta\theta_m\right) \times 10^5$

ALSQ

Component, percent x 10^3

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1 Coal mining	1	106	10	239	22	7
2 Stone, slate, sand, etc.	1	102	9	91	20	.9
3 Other mining, quarrying	-	40	5	46	24	2
4 Coke ovens, manuf. fuel	1	108	11	197	27	0
5 Mineral oil refining	-	39	4	46	14	3
6 Chemicals	-	76	7	91	112	4
7 Paint	-	205	10	65	56	4
8 Plastic, synth. resins, etc.	-	59	6	76	57	4
9 Iron castings, etc.	1	115	14	140	32	10
10 Other iron and steel	1	118	14	158	45	9
11 Aluminium and alloys	-	64	8	125	47	4
12 Other non-ferrous metals	1	92	15	650	49	9
13 Agricultural machinery	2	1067	28	360	51	137
14 Machine tools	2	570	71	482	49	17
15 Pumps, valves, compressors	1	665	92	565	89	118
16 Industrial engines	2	624	110	806	46	18
17 Textile machinery	2	594	90	262	54	15
18 Const.& mech. handling equip.	1	909	50	382	46	125
19 Office machinery	4	497	139	631	215	17
20 Other non-electrical mach.	1	719	92	457	99	70
21 Indust. plant and steel works	1	946	43	408	49	25
22 Other mechanical engineering	18	691	100	802	91	60
23 Instrument engineering	-	262	82	278	182	74
24 Electrical machinery	1	681	63	1611	195	30
25 Insulated wires and cables	1	588	181	17557	804	64
26 Electronics and telecom.	1	233	66	829	340	21
27 Domestic elec. appliances	1	696	168	2426	522	120
28 Other electrical goods	1	433	77	2788	425	143
29 Shipbuilding, etc.	1	677	38	401	68	35
30 Wheeled tractors	1	492	106	306	74	384

TABLE (9.5) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	1	815	145	492	188	396
32 Areospace equipment	-	347	132	446	107	79
33 Other vehicles	2	941	87	750	123	140
34 Engineers' small tools	-	770	7	116	27	5
35 Cutlery and jewellery	1	196	6	891	21	3
36 Bolts, nuts, screws, etc.	1	1387	32	748	56	7
37 Wire and wire manufactures	1	3528	208	4006	154	7
38 Cans and metal boxes	1	3289	87	117	118	6
39 Other metal goods	11	1182	171	966	137	26
40 Bricks, fireclay, etc.	1	71	8	88	37	6
41 Pottery and glass	-	72	8	89	35	4
42 Cement	1	102	12	144	48	7
43 Other building materials	-	134	12	188	38	6
44 Furniture and bedding, etc.	1	125	123	109	298	62
45 Timber and misc. wood manuf.	-	49	5	53	29	3
46 Paper and board	-	66	6	93	25	3
47 Paper and board packaging	-	41	4	60	33	3
48 Other paper and board prods.	-	42	4	55	32	3
49 Rubber	-	114	10	149	37	4
50 Plastic products n.e.s.	1	114	10	102	5230	35
51 Other manufacturing	-	146	8	463	1443	68
52 Construction	4	551	12	225	66	25
53 Gas	1	92	8	100	19	5
54 Electricity	-	66	10	455	32	6
55 Water supply	-	41	5	66	57	5
56 Railways	-	190	18	294	35	24
57 Road transport	-	32	4	60	17	8
58 Other transport	-	22	3	28	7	2
59 Distributive trades	-	34	3	56	33	3
60 ALL OTHER	-	49	5	91	32	4

TABLE (9.6) Materials component of prices (U.K. produced plus imports), percent.

(a) Industry Table

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1 Coal mining	0.2	1.5	0.2	0.9	0.2	0.1
2 Stone, slate, sand, etc.	0.2	1.5	0.2	0.6	0.2	0.1
3 Other mining, quarrying	0.1	0.6	0.1	0.3	0.2	-
4 Coke ovens, manuf. fuel	0.2	1.6	0.2	0.8	0.2	0.1
5 Mineral oil refining	0.1	0.6	0.1	0.2	0.1	-
6 Chemicals	0.1	1.1	0.1	0.4	1.0	0.1
7 Paint	0.1	3.1	0.2	0.4	0.5	0.1
8 Plastic, synth. resins, etc.	0.1	0.9	0.1	0.4	0.5	0.1
9 Iron castings, etc.	0.2	1.7	0.3	0.8	0.3	0.1
10 Other iron and steel	0.2	1.8	0.3	0.8	0.4	0.1
11 Aluminium and alloys	0.1	1.0	0.2	0.5	0.4	0.1
12 Other non-ferrous metals	0.1	1.3	0.3	1.8	0.3	0.1
13 Agricultural machinery	1.9	16.9	0.9	2.2	0.5	1.7
14 Machine tools	4.5	9.0	1.0	3.1	0.4	0.5
15 Pumps, valves, compressors	2.6	10.3	1.6	7.9	0.6	1.6
16 Industrial engines	4.0	10.5	1.8	6.7	0.3	0.6
17 Textile machinery	2.7	9.1	1.5	2.5	0.5	0.7
18 Const.& mech. handling equip.	1.9	13.7	0.8	2.4	0.4	1.5
19 Office machinery	0.7	6.9	1.8	3.2	1.3	0.5
20 Other non-electrical mach.	2.1	11.1	1.8	3.0	0.7	0.8
21 Indust. plant and steel works	1.2	14.6	0.9	2.2	0.3	0.3
22 Other mechanical engineering	1.6	10.7	1.9	6.9	0.6	0.7
23 Instrument engineering	0.1	3.6	1.4	3.0	1.2	0.9
24 Electrical machinery	1.8	10.6	1.3	6.5	1.1	0.3
25 Insulated wires and cables	0.3	6.3	3.4	39.1	4.3	0.7
26 Electronics and telecom.	0.2	3.5	1.3	3.9	2.3	0.4
27 Domestic elec. appliances	0.8	10.3	3.3	6.2	3.3	1.7
28 Other electrical goods	0.3	5.6	1.7	9.1	2.6	1.7
29 Shipbuilding, etc.	0.7	10.3	0.7	3.1	0.4	0.4
30 Wheeled tractors	9.2	8.2	1.7	2.0	0.6	4.2

TABLE (9.6) (a) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	4.5	12.7	2.7	3.1	1.6	4.7
32 Areospace equipment	0.2	5.3	2.3	2.5	0.8	0.9
33 Other vehicles	1.4	14.3	1.8	3.7	0.6	1.8
34 Engineers' small tools	0.8	11.9	0.5	3.3	0.2	0.3
35 Cutlery and jewellery	0.1	2.9	0.4	7.2	0.2	0.1
36 Bolts, nuts, screws, etc.	0.2	19.9	0.9	7.4	0.6	0.4
37 Wire and wire manufactures	0.2	33.9	3.7	14.5	1.0	0.2
38 Cans and metal boxes	0.2	50.8	2.0	1.6	1.0	0.2
39 Other metal goods	0.9	18.0	3.2	7.5	1.0	0.8
40 Bricks, fireclay, etc.	0.1	1.1	0.2	0.5	0.3	0.1
41 Pottery and glass	0.1	1.0	0.2	0.5	0.3	0.1
42 Cement	0.2	1.5	0.2	0.7	0.4	0.1
43 Other building materials	0.1	1.6	0.2	0.8	0.3	0.1
44 Furniture and bedding, etc.	0.1	1.8	0.6	0.7	2.0	1.0
45 Timber and misc. wood manuf.	-	0.7	0.1	0.3	0.3	0.1
46 Paper and board	0.1	0.8	0.1	0.4	0.2	-
47 Paper and board packaging	0.1	0.6	0.1	0.3	0.3	-
48 Other paper and board prods.	0.1	0.6	0.1	0.3	0.3	-
49 Rubber	0.1	1.4	0.2	0.6	0.3	0.1
50 Plastic products n.e.s.	0.1	1.7	0.4	0.8	48.5	1.1
51 Other manufacturing	0.1	3.2	0.7	3.5	13.6	1.6
52 Construction	1.6	7.1	0.3	2.3	0.6	0.5
53 Gas	0.2	1.3	0.1	0.5	0.2	0.1
54 Electricity	0.1	0.9	0.2	1.2	0.2	0.1
55 Water supply	0.1	0.6	0.1	0.4	0.5	0.1
56 Railways	0.3	2.7	0.4	1.1	0.2	0.3
57 Road transport	0.1	0.4	0.1	0.2	0.1	0.1
58 Other transport	-	0.3	-	0.1	0.1	-
59 Distributive trades	-	0.5	0.1	0.2	0.3	-
60 ALL OTHER	0.1	0.7	0.1	0.3	0.3	0.1

TABLE (9.6) Continued

(b) Final Buyer Table

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
Consumers	0.2	1.4	0.2	0.6	0.5	0.2
Public Authorities	0.4	3.1	0.6	1.5	0.7	0.4
Gross Domestic Fixed Capital	1.6	7.6	0.8	2.9	0.8	0.8
Stocks	-0.5	-5.8	-1.9	-5.8	0.5	-0.6
Exports	0.9	4.2	0.8	2.0	0.9	0.7
TOTAL FINAL	0.6	3.4	0.5	1.4	0.7	0.5

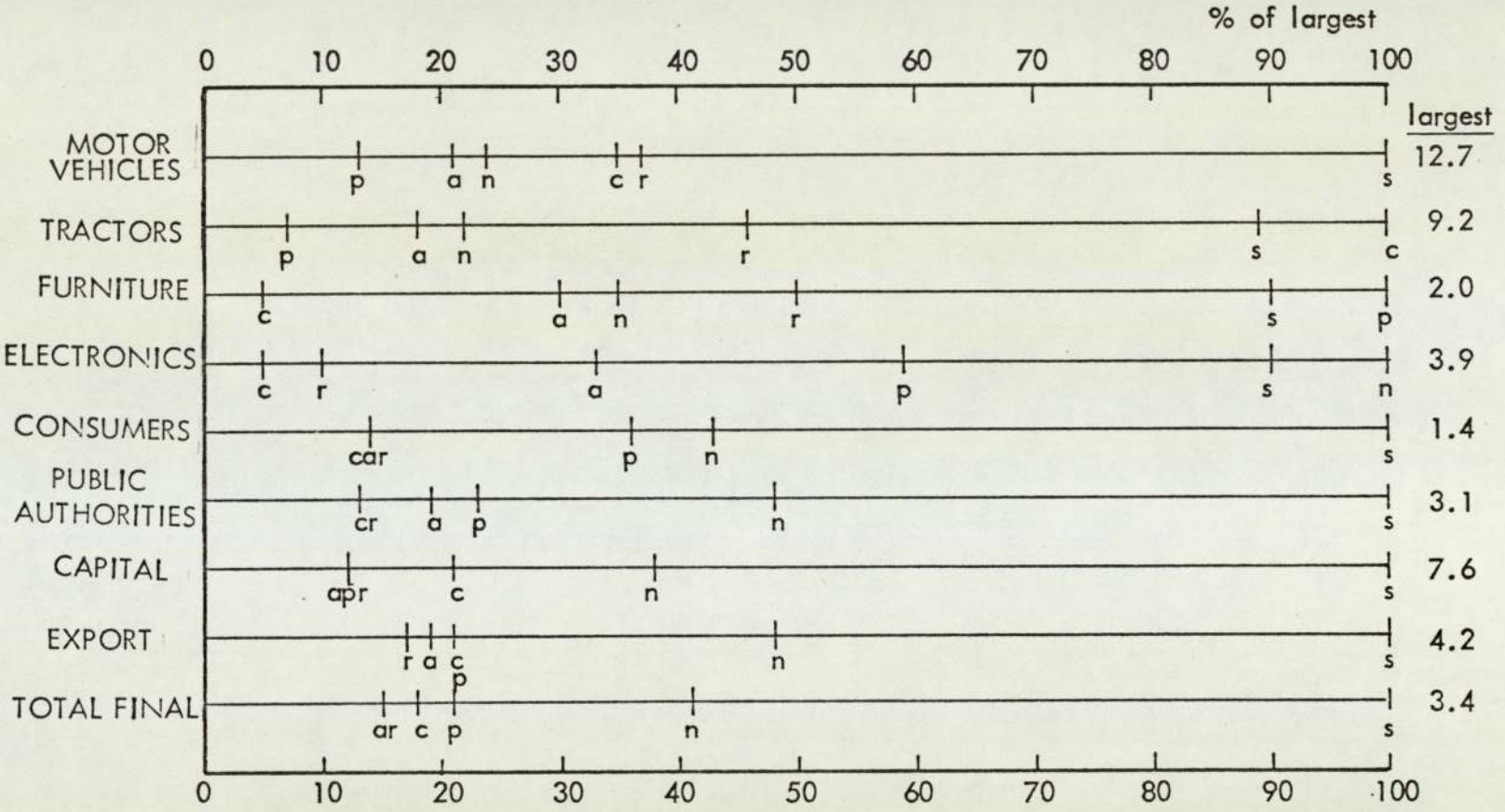


FIGURE (9.5) COMPARISON OF MATERIALS COMPONENT OF PRICES. Direct plus that indirect material initially directly used in an engineering and construction industry as percent of price, for some selected products and for all final goods: cast iron (c), steel (s), aluminium (a), other non-ferrous metals (n), plastic (p), rubber (r).

TABLE (9.7) Price rises induced by increase in coal mining income and oil imports. (see footnotes for details)

(a) Industry Table

Data for estimation, $\left(\sum_j \delta_{j,i} \Delta \theta^*_j\right) \times 10^5$

ALSO

Price rise of 100% increase, percent x 10^3

		Coal mining income	Oil imports
1	Coal mining	63656	927
2	Stone, slate, sand, etc.	939	6353
3	Other mining, quarrying	1201	2361
4	Coke ovens, manuf. fuel	38812	1892
5	Mineral oil refining	241	74107
6	Chemicals	1609	7111
7	Paint	617	3814
8	Plastic, synth. resins, etc.	984	5248
9	Iron castings, etc.	4003	1869
10	Other iron and steel	3415	3976
11	Aluminium and alloys	651	1749
12	Other non-ferrous metals	547	1009
13	Agricultural machinery	1021	1769
14	Machine tools	805	1296
15	Pumps, valves, compressors	901	1239
16	Industrial engines	905	1595
17	Textile machinery	836	1225
18	Const.& mech. handling equip.	808	1417
19	Office machinery	550	1165
20	Other non-electrical mach.	785	1366
21	Indust. plant and steel works	799	1348
22	Other mechanical engineering	936	1589
23	Instrument engineering	418	951
24	Electrical machinery	840	1357
25	Insulated wires and cables	734	1334
26	Electronics and telecom.	443	984
27	Domestic elec. appliances	785	1658
28	Other electrical goods	640	1413
29	Shipbuilding, etc.	696	1165
30	Wheeled tractors	1014	1497

TABLE (9.7) (a) Continued

		Coal mining income	Oil imports
31	Motor vehicles	1017	1842
32	Areospace equipment	548	1178
33	Other vehicles	1079	1706
34	Engineers' small tools	698	1124
35	Cutlery and jewellery	302	563
36	Bolts, nuts, screws, etc.	1148	1847
37	Wire and wire manufactures	1607	2170
38	Cans and metal boxes	1884	2539
39	Other metal goods	1058	1910
40	Bricks, fireclay, etc.	3281	4962
41	Pottery and glass	1083	4037
42	Cement	9195	5269
43	Other building materials	1791	4833
44	Furniture and bedding, etc.	418	1289
45	Timber and misc. wood manuf.	337	947
46	Paper and board	2213	2723
47	Paper and board packaging	825	1716
48	Other paper and board prods.	753	1488
49	Rubber	858	1748
50	Plastic products n.e.s.	757	2228
51	Other manufacturing	703	2028
52	Construction	637	1741
53	Gas	7208	10665
54	Electricity	13016	2701
55	Water supply	1261	698
56	Railways	923	2153
57	Road transport	121	2341
58	Other transport	165	1472
59	Distributive trades	388	777
60	ALL OTHER	422	1166

TABLE (9.7) Continued

(b) Final Buyer Table Percent price rise by 100% increase.

	Coal mining income	Oil imports
Consumers	1.7	1.9
Public Authorities	1.7	2.3
Gross Domestic Fixed Capital	1.0	1.6
Stocks	4.9	4.1
Exports	0.9	3.5
TOTAL FINAL	1.3	2.3

FOOTNOTES TO TABLE (9.7)

$\Delta\theta_j^*$ is taken as:

(a) Coal Mining Income: TIFE

(b) Oil Price Rises: all imports of refined oil in the UK (row 5 of Table C) plus imports of crude oil (row 3 of Table C) to UK oil refining, chemical and plastic materials industries.

TABLE (9.8). Percent x k^t price increases in coal mining income and oil imports which can be overcome by 100 k^t% saving of material by manufacturing industries.

(i) Coal Mining Income

(a) Industry Table

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1 Coal mining	-	2	-	1	-	-
2 Stone, slate, sand, etc.	20	151	19	62	12	12
3 Other mining, quarrying	5	50	7	22	10	3
4 Coke ovens, manuf. fuel	-	4	1	2	-	-
5 Mineral oil refining	22	247	31	102	30	15
6 Chemicals	5	71	9	27	36	4
7 Paint	11	515	33	66	49	10
8 Plastic, synth. resins, etc.	8	89	12	40	30	6
9 Iron castings, etc.	5	43	6	19	4	3
10 Other iron and steel	5	52	8	25	7	4
11 Aluminium and alloys	12	147	25	83	38	10
12 Other non-ferrous metals	23	241	52	25	46	22
13 Agricultural machinery	184	1682	87	215	38	166
14 Machine tools	564	1132	123	385	38	57
15 Pumps, valves, compressors	290	1158	179	890	51	176
16 Industrial engines	443	1175	203	745	27	65
17 Textile machinery	328	1102	181	299	49	78
18 Const.& mech. handling equip.	237	1728	97	295	36	181
19 Office machinery	130	1265	336	579	165	84
20 Other non-electrical mach.	269	1434	233	392	67	104
21 Indust. plant and steel works	135	1827	110	266	29	35
22 Other mechanical engineering	165	1160	198	748	53	70
23 Instrument engineering	25	862	323	717	238	212
24 Electrical machinery	211	1282	156	779	119	40
25 Insulated wires and cables	38	872	464	5377	567	101
26 Electronics and telecom.	47	788	282	883	405	90
27 Domestic elec. appliances	99	1327	422	795	355	215
28 Other electrical goods	44	892	471	1444	349	257
29 Shipbuilding, etc.	99	1500	99	448	51	53
30 Wheeled tractors	905	825	169	200	39	411

TABLE (9.8) (i) (a) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	443	1269	266	304	100	460
32 Areospace equipment	31	972	427	459	110	161
33 Other vehicles	125	1341	165	350	47	169
34 Engineers' small tools	107	1726	75	476	20	37
35 Cutlery and jewellery	27	972	121	2410	52	32
36 Bolts, nuts, screws, etc.	17	1758	80	654	41	33
37 Wire and wire manufactures	11	2143	231	912	55	15
38 Cans and metal boxes	10	2743	104	88	44	13
39 Other metal goods	81	1726	305	716	69	77
40 Bricks, fireclay, etc.	4	32	5	15	6	3
41 Pottery and glass	8	96	14	46	17	6
42 Cement	2	17	3	8	3	1
43 Other building materials	6	92	12	44	11	5
44 Furniture and bedding, etc.	24	424	132	151	362	238
45 Timber and misc. wood manuf.	14	211	29	93	46	15
46 Paper and board	3	38	5	18	6	2
47 Paper and board packaging	7	69	10	33	21	5
48 Other paper and board prods.	7	79	11	36	22	5
49 Rubber	9	164	22	76	23	7
50 Plastic products n.e.s.	12	198	41	91	3556	78
51 Other manufacturing	11	317	63	311	1075	123
52 Construction	140	735	39	245	56	46
53 Gas	2	16	2	7	1	1
54 Electricity	1	7	1	9	1	1
55 Water supply	7	48	7	29	23	5
56 Railways	29	299	40	122	18	33
57 Road transport	67	357	69	193	73	81
58 Other transport	17	196	28	82	22	16
59 Distributive trades	9	123	16	54	45	11
60 ALL OTHER	14	166	22	78	39	14

TABLE (9.8) (i) Continued

(b) Final Buyer Table

	Cast iron	Steel	aluminium	other non-ferrous	plastic	rubber
Consumers	12	82	12	35	29	12
Public Authorities	24	182	35	88	41	24
Gross Domestic Fixed Capital	160	760	80	290	80	80
Stocks	10	118	39	118	10	12
Exports	100	467	89	222	100	78
TOTAL FINAL	46	262	38	108	54	38

TABLE (9.8) Continued

(ii) Oil Imports

(a) Industry Table

		Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1	Coal mining	19	154	22	98	13	10
2	Stone, slate, sand, etc.	3	22	3	9	2	2
3	Other mining, quarrying	2	26	4	12	5	2
4	Coke ovens, manuf. fuel	9	80	11	44	8	6
5	Mineral oil refining	-	1	-	-	-	-
6	Chemicals	1	16	2	6	8	1
7	Paint	2	83	5	10	8	2
8	Plastic, synth. resins, etc.	1	17	2	7	6	1
9	Iron castings, etc.	10	92	14	41	9	8
10	Other iron and steel	5	45	7	21	6	3
11	Aluminium and alloys	4	55	9	31	14	4
12	Other non-ferrous metals	12	131	28	177	25	12
13	Agricultural machinery	106	972	50	124	22	96
14	Machine tools	350	704	77	239	23	36
15	Pumps, valves, compressors	211	843	130	648	37	128
16	Industrial engines	252	667	115	423	15	37
17	Textile machinery	224	751	123	204	33	53
18	Const.& mech. handling equip.	135	984	56	168	20	103
19	Office machinery	62	598	159	274	78	40
20	Other non-electrical mach.	155	825	134	225	38	60
21	Indust. plant and steel works	82	1083	65	157	17	21
22	Other mechanical engineering	98	684	117	441	31	41
23	Instrument engineering	11	380	142	316	105	94
24	Electrical machinery	131	793	96	481	73	24
25	Insulated wires and cables	21	479	255	2956	311	56
26	Electronics and telecom.	21	355	127	397	182	41
27	Domestic elec. appliances	47	628	199	376	168	102
28	Other electrical goods	20	404	123	654	158	116
29	Shipbuilding, etc.	59	896	59	267	30	32
30	Wheeled tractors	613	559	114	135	27	278

TABLE (9.8) (ii) (a) Continued

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
31 Motor vehicles	245	701	147	168	55	254
32 Areospace equipment	14	452	199	214	51	75
33 Other vehicles	79	848	104	221	30	107
34 Engineers' small tools	67	1071	46	295	13	23
35 Cutlery and jewellery	14	522	65	1295	28	17
36 Bolts, nuts, screws, etc.	10	1094	50	407	26	20
37 Wire and wire manufactures	8	1586	171	675	41	11
38 Cans and metal boxes	8	2036	78	65	33	10
39 Other metal goods	11	955	169	396	38	43
40 Bricks, fireclay, etc.	2	21	3	10	4	2
41 Pottery and glass	2	26	4	12	5	2
42 Cement	3	29	4	14	5	2
43 Other building materials	2	34	4	16	4	2
44 Furniture and bedding, etc.	8	138	43	49	117	77
45 Timber and misc. wood manuf.	5	75	10	33	16	5
46 Paper and board	3	31	4	15	5	2
47 Paper and board packaging	3	33	5	16	10	3
48 Other paper and board prods.	4	40	6	18	11	3
49 Rubber	4	80	11	37	11	3
50 Plastic products n.e.s.	4	67	14	31	1208	27
51 Other manufacturing	4	110	22	108	372	43
52 Construction	51	269	14	90	21	17
53 Gas	1	11	1	5	1	1
54 Electricity	3	33	7	44	6	3
55 Water supply	13	86	14	52	42	9
56 Railways	12	128	17	52	8	14
57 Road transport	4	18	4	10	4	4
58 Other transport	2	22	3	9	2	2
59 Distributive trades	4	62	8	27	22	6
60 ALL OTHER	5	60	8	28	14	5

TABLE (9.8) (ii) Continued

(b) Final Buyer Table

	Cast iron	Steel	aluminium	other non-ferrous	plastic	rubber
Consumers	10	74	10	32	26	10
Public Authorities	17	135	26	65	31	17
Gross Domestic Fixed Capital	100	475	50	181	50	50
Stocks	-8	-89	-29	-89	+8	-9
Exports	26	120	23	57	26	20
TOTAL FINAL	26	148	22	61	31	22

TABLE (9.9) Regional distribution of employment as percent of total in each industry. (See footnotes)

		Census cover %	(1) North	(2) Yorks. Humb.	(3) East Mid.	(4) East Ang.	(5) South East
1	Coal mining	(1) -	15.0	26.0	22.3	-	0.9
2	Stone, slate, sand, etc.	(2) -	5.5	8.7	6.0	2.6	33.7
3	Other mining, quarrying	(3) -	18.2	9.1	9.1	-	2.3
4	Coke ovens, manuf. fuel	58.4	-	56.0	-	-	-
5	Mineral oil refining	73.9	0.5	-	-	-	40.9
6	Chemicals	100.0	10.2	8.1	5.3	2.0	30.0
7	Paint	92.6	7.6	8.0	-	-	43.6
8	Plastic, synth. resins, etc.	96.0	19.2	-	2.0	-	19.2
9	Iron castings, etc.	100.0	5.8	9.5	23.0	0.3	10.7
10	Other iron and steel	99.6	13.2	25.8	6.0	-	2.0
11	Aluminium and alloys	92.0	3.4	-	2.3	0.4	28.0
12	Other non-ferrous metals	99.5	1.9	12.7	0.8	1.1	16.9
13	Agricultural machinery	99.9	2.1	8.3	4.3	24.6	18.8
14	Machine tools	99.9	4.6	12.6	8.9	2.3	22.8
15	Pumps, valves, compressors	97.1	3.0	9.3	7.0	4.6	23.1
16	Industrial engines	54.5	-	0.7	-	-	30.5
17	Textile machinery	79.8	-	20.4	24.9	-	-
18	Const.& mech. handling equip.	94.5	9.8	10.4	14.0	3.1	23.3
19	Office machinery	92.9	-	-	-	-	50.7
20	Other non-electrical mach.	95.6	2.3	12.6	6.4	2.4	31.1
21	Indust. plant and steel works	99.9	10.3	8.1	5.0	0.7	24.8
22	Other mechanical engineering	92.4	6.4	11.6	7.5	1.2	35.2
23	Instrument engineering	100.0	2.3	3.0	2.9	3.5	52.6
24	Electrical machinery	86.2	-	9.7	7.1	-	21.9
25	Insulated wires and cables	91.2	-	0.4	-	-	42.3
26	Electronics and telecom.	58.6	3.4	3.1	3.2	1.2	64.0
27	Domestic elec. appliances	98.6	4.8	5.2	-	7.8	29.1
28	Other electrical goods	71.5	6.7	3.6	5.3	-	20.3
29	Shipbuilding, etc.	94.8	20.5	3.7	0.2	1.7	24.2
30	Wheeled tractors	(4) -	-	3.3	2.4	-	29.8

TABLE (9.9) Continued

	Census cover %	(1) North	(2) Yorks. Humb.	(3) East Mid.	(4) East Ang.	(5) South East
31 Motor vehicles	97.2	-	3.3	2.4	-	29.8
32 Areospace equipment	83.1	0.4	-	-	-	32.5
33 Other vehicles	(4) -	-	3.3	2.4	-	29.8
34 Engineers' small tools	99.9	0.8	24.3	4.5	0.2	26.4
35 Cutlery and jewellery	92.8	-	32.2	1.3	0.3	39.8
36 Bolts, nuts, screws, etc.	100.0	0.4	4.5	4.3	-	11.1
37 Wire and wire manufactures	97.9	4.9	24.4	5.3	-	13.0
38 Cans and metal boxes	59.9	-	18.4	-	-	40.1
39 Other metal goods	99.5	1.9	10.1	4.3	0.5	25.5
40 Bricks, fireclay, etc.	87.1	-	15.8	12.5	-	22.4
41 Pottery and glass	94.3	4.7	11.2	2.2	0.4	12.1
42 Cement	(5) 52.3	2.6	4.1	2.9	1.2	61.5
43 Other building materials	96.9	6.2	7.1	10.3	2.9	29.7
44 Furniture and bedding, etc.	100.0	3.7	8.9	4.8	3.0	46.5
45 Timber and misc. wood manuf.	100.0	5.2	9.6	7.2	4.1	35.2
46 Paper and board	98.6	2.8	4.9	1.1	-	35.2
47 Paper and board packaging	98.7	4.7	6.9	7.0	1.6	26.2
48 Other paper and board prods.	94.7	4.1	8.6	1.1	-	45.7
49 Rubber	100.0	1.8	2.6	6.2	0.9	20.1
50 Plastic products n.e.s.	100.0	4.2	5.6	6.8	3.0	44.6
51 Other manufacturing	92.1	1.0	5.1	3.5	2.7	45.2
52 Construction	(2) -	5.5	8.7	6.0	2.6	33.7
53 Gas	(1) -	4.8	6.2	12.4	6.3	29.9
54 Electricity	(2) -	5.5	8.7	6.0	2.6	33.7
55 Water supply	(6) -	10.0	7.1	12.6	3.4	26.0
56 Railways	(2) -	5.5	8.7	6.0	2.6	33.7
57 Road transport	(2) -	5.5	8.7	6.0	2.6	33.7
58 Other transport	(2) -	5.5	8.7	6.0	2.6	33.7
59 Distributive trades	(2) -	5.5	8.7	6.0	2.6	33.7
60 ALL OTHER	(2) -	5.5	8.7	6.0	2.6	33.7

TABLE (9.9) Continued

		(6) South West	(7) West Mid.	(8) North West	(9) Wales	(10) Scot.	(11) North Ireland
1	Coal mining	-	12.2	5.1	9.4	8.2	0.9
2	Stone, slate, sand, etc.	1.7	9.8	12.5	4.2	9.1	2.2
3	Other mining, quarrying	4.6	4.6	4.6	33.4	14.2	-
4	Coke ovens, manuf. fuel	-	-	2.1	42.0	-	-
5	Mineral oil refining	1.6	-	38.6	16.8	1.6	-
6	Chemicals	2.2	4.1	26.9	3.4	7.1	0.8
7	Paint	3.0	11.1	20.3	0.9	5.1	0.4
8	Plastic, synth. resins, etc.	6.9	8.4	28.7	8.1	7.5	-
9	Iron castings, etc.	1.3	30.1	7.1	3.9	8.1	0.2
10	Other iron and steel	0.4	16.5	4.5	22.9	8.7	-
11	Aluminium and alloys	0.8	39.1	8.8	17.2	-	-
12	Other non-ferrous metals	4.2	43.8	11.8	4.5	2.3	-
13	Agricultural machinery	7.6	14.7	1.2	3.8	13.6	0.9
14	Machine tools	2.8	32.6	7.3	1.3	4.5	0.2
15	Pumps, valves, compressors	13.3	14.7	11.6	-	13.4	-
16	Industrial engines	-	25.7	43.1	-	-	-
17	Textile machinery	0.4	2.6	45.6	-	6.0	-
18	Const.& mech. handling equip.	7.4	11.0	9.4	0.6	10.3	0.7
19	Office machinery	3.0	4.7	0.3	-	41.2	-
20	Other non-electrical mach.	4.1	8.6	18.8	2.6	10.5	0.7
21	Indust. plant and steel works	1.8	17.9	10.9	3.0	17.0	0.4
22	Other mechanical engineering	6.4	15.3	9.3	2.5	4.3	0.4
23	Instrument engineering	6.6	4.3	12.3	2.0	9.3	1.2
24	Electrical machinery	7.0	26.5	20.2	2.6	4.5	0.6
25	Insulated wires and cables	-	1.0	49.1	4.8	2.3	-
26	Electronics and telecom.	6.1	0.3	6.8	5.3	6.3	0.2
27	Domestic elec. appliances	6.1	10.6	19.1	7.7	9.6	-
28	Other electrical goods	1.8	35.8	17.3	3.4	5.7	-
29	Shipbuilding, etc.	10.1	-	17.3	1.2	21.2	-
30	Wheeled tractors	2.9	37.0	16.8	3.9	3.7	0.2

TABLE (9.9) Continued

	(6) South West	(7) West Mid.	(8) North West	(9) Wales	(10) Scot.	(11) North Ireland
31 Motor vehicles	2.9	37.0	16.8	3.9	3.7	0.2
32 Areospace equipment	24.7	7.2	19.7	2.4	8.5	4.6
33 Other vehicles	2.9	37.0	16.8	3.9	3.7	0.2
34 Engineers' small tools	5.2	26.5	7.1	0.9	3.7	0.3
35 Cutlery and jewellery	1.6	23.8	1.0	-	-	-
36 Bolts, nuts, screws, etc.	0.4	63.3	6.2	3.6	6.2	-
37 Wire and wire manufactures	-	13.6	21.6	5.1	11.7	0.4
38 Cans and metal boxes	-	10.2	25.4	-	6.0	-
39 Other metal goods	2.7	37.1	9.7	3.5	4.3	0.3
40 Bricks, fireclay, etc.	2.4	16.2	10.1	6.0	13.0	1.6
41 Pottery and glass	0.5	43.5	20.0	2.3	2.4	0.5
42 Cement	2.7	4.7	6.0	9.0	4.3	1.0
43 Other building materials	7.1	6.4	15.1	3.4	8.8	3.0
44 Furniture and bedding, etc.	4.7	6.5	11.8	2.5	5.7	1.9
45 Timber and misc. wood manuf.	6.2	7.9	11.0	3.0	9.0	1.7
46 Paper and board	9.1	2.7	20.7	4.3	19.2	-
47 Paper and board packaging	10.9	6.0	24.1	1.8	8.6	2.1
48 Other paper and board prods.	3.8	7.9	19.9	1.4	7.0	0.6
49 Rubber	6.7	25.3	23.5	3.4	6.5	3.0
50 Plastic products n.e.s.	4.4	12.6	11.6	4.0	2.3	0.9
51 Other manufacturing	2.8	9.7	16.1	7.4	6.5	0.1
52 Construction	5.7	9.8	12.5	4.2	9.1	2.2
53 Gas	3.3	14.0	13.6	3.3	5.7	0.6
54 Electricity	5.7	9.8	12.5	4.2	9.1	2.2
55 Water supply	12.0	1.8	7.8	9.2	9.2	0.9
56 Railways	5.7	9.8	12.5	4.2	9.1	2.2
57 Road transport	5.7	9.8	12.5	4.2	9.1	2.2
58 Other transport	5.7	9.8	12.5	4.2	9.1	2.2
59 Distributive trades	5.7	9.8	12.5	4.2	9.1	2.2
60 ALL OTHER	5.7	9.8	12.5	4.2	9.1	2.2

FOOTNOTES TO TABLE (9.9)

All data obtained from Census of Production[27], Report 157, Table 27, except the following:

(1) UK Energy Statistics[36]

(2) Assumed to be distributed as the total civilian workforce, Table (9.10).

(3) Estimated from UK Mineral Statistics[68]

(4) Only a very small part of the total employment in these industries is covered by Census. Assumed to be distributed as industry 31, motor vehicles.

(5) Only 52.3% coverage by Census (45.3% SE, 7.0% W). Remainder assumed as (2) above.

(6) Water Resources Board[69]

In those industries for which the Census covered less than 100% of the total employment, the distribution given in the Census was increased pro rata so as to sum to 100%.

TABLE (9.10) Total regional employment.

Source: Abstract of Regional Statistics[70], Employment and Productivity Gazette[34]

	I-O Industrial		Other Civil		Unemploy.		TOTAL
	th	%	th	%	th	%	th
1 North	931.6	71.1	323.4	24.7	55.9	4.3	1310.9
2 Yorks. & Humb.	1524.8	74.4	477.2	23.3	48.3	2.4	2050.3
3 East Midland	1026.4	72.2	371.6	26.1	24.2	1.7	1422.2
4 East Anglia	362.5	58.3	244.5	39.3	15.0	2.4	622.0
5 South East	5347.2	67.1	2508.8	31.5	114.0	1.4	7970.0
6 South West	910.3	67.9	401.7	30.0	28.3	2.1	1340.3
7 West Midland	2085.8	90.1	185.2	8.0	44.1	1.9	2315.1
8 North West	2239.4	75.5	659.6	22.2	66.6	2.2	2965.6
9 Wales	761.7	77.3	188.3	19.1	35.4	3.6	985.4
10 Scotland	1452.4	67.2	633.6	29.3	74.6	3.5	2160.6
11 N. Ireland	284.8	54.2	204.2	38.9	36.0	6.9	525.0
TOTAL	16926.7	71.5	6198.3	26.2	542.4	2.3	23667.4

TABLE (9.11) Direct, indirect, and total regional distribution of employment in materials manufacturing: percent of total.

	CAST IRON			STEEL			ALUMINIUM		
	DIR.	IND.	TOTAL	DIR	IND.	TOTAL	DIR.	IND.	TOTAL
1 North	5.8	6.6	6.1	13.2	5.9	9.5	3.4	5.4	4.0
2 Yorkshire and Humberside	9.5	13.2	10.9	25.8	12.0	18.7	-	10.3	3.3
3 East Midland	23.0	8.2	17.3	6.0	9.1	7.6	2.3	6.3	3.6
4 East Anglia	0.3	1.7	0.8	-	1.7	0.9	0.4	1.9	0.9
5 South East	10.7	25.0	16.2	2.0	25.4	14.0	28.0	29.0	28.3
6 South West	1.3	4.0	2.3	0.4	4.0	2.3	0.8	4.9	2.1
7 West Midland	30.7	14.3	24.0	16.5	15.5	16.0	39.1	15.2	31.5
8 North West	7.1	11.4	8.8	4.5	11.6	8.1	8.8	13.0	10.1
9 Wales	3.9	6.6	4.9	27.9	5.6	14.0	17.2	4.8	13.2
10 Scotland	8.1	7.8	8.0	8.7	7.8	8.2	-	7.8	2.5
11 Northern Ireland	0.2	1.3	0.6	-	1.3	0.7	-	1.4	0.5
TOTAL (th)	100.2	62.5	162.7	313.2	326.2	639.4	58.0	27.2	85.2

	OTHER NON-FERROUS			PLASTIC			RUBBER		
	DIR.	IND.	TOTAL	DIR.	IND.	TOTAL	DIR.	IND.	TOTAL
1 North	1.9	5.4	3.8	19.2	6.7	12.0	1.8	6.8	3.6
2 Yorkshire and Humberside	12.7	9.3	10.8	-	9.5	5.5	2.6	9.8	5.2
3 East Midland	0.8	6.0	3.7	2.0	6.3	4.5	6.2	6.2	6.2
4 East Anglia	1.1	1.8	1.5	-	2.0	1.1	0.9	1.9	1.3
5 South East	16.9	30.0	24.0	19.2	29.9	25.3	20.1	29.2	23.4
6 South West	4.2	4.6	4.4	6.9	4.5	5.5	6.7	4.8	6.0
7 West Midland	43.8	14.7	27.9	8.4	10.9	9.8	25.3	12.0	20.5
8 North West	11.8	13.9	12.9	28.7	16.3	21.6	23.5	14.7	20.3
9 Wales	4.5	5.3	5.0	8.1	4.5	6.0	3.4	4.9	3.9
10 Scotland	2.3	7.7	5.3	7.5	8.0	7.8	6.5	8.3	7.1
11 Northern Ireland	-	1.4	0.7	-	1.4	0.8	3.0	1.5	2.4
TOTAL (th)	72.7	87.6	160.3	56.7	76.4	133.1	123.5	69.7	193.2

FIGURE (9.6) REGIONAL DISTRIBUTION OF EMPLOYMENT IN STEEL MANUFACTURING, 1968

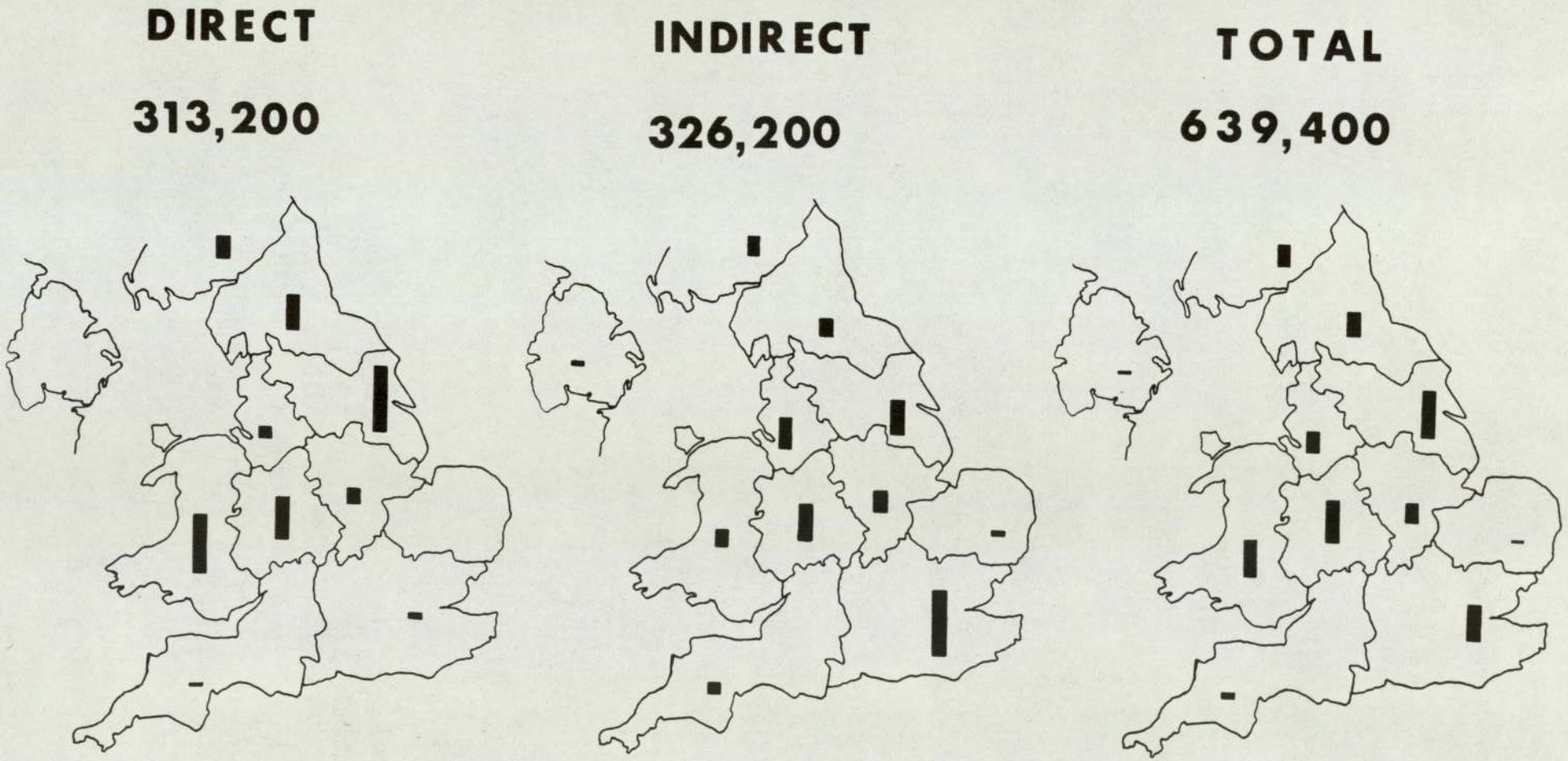


FIGURE (9.7) REGIONAL INTENSITY OF EMPLOYMENT IN MATERIALS MANUFACTURING. Direct (black bar) plus indirect (white bar) employment in materials manufacturing as percent of total regional employment, 1968. The percent labelled on each diagram is the average for the UK, and acts as a scale.

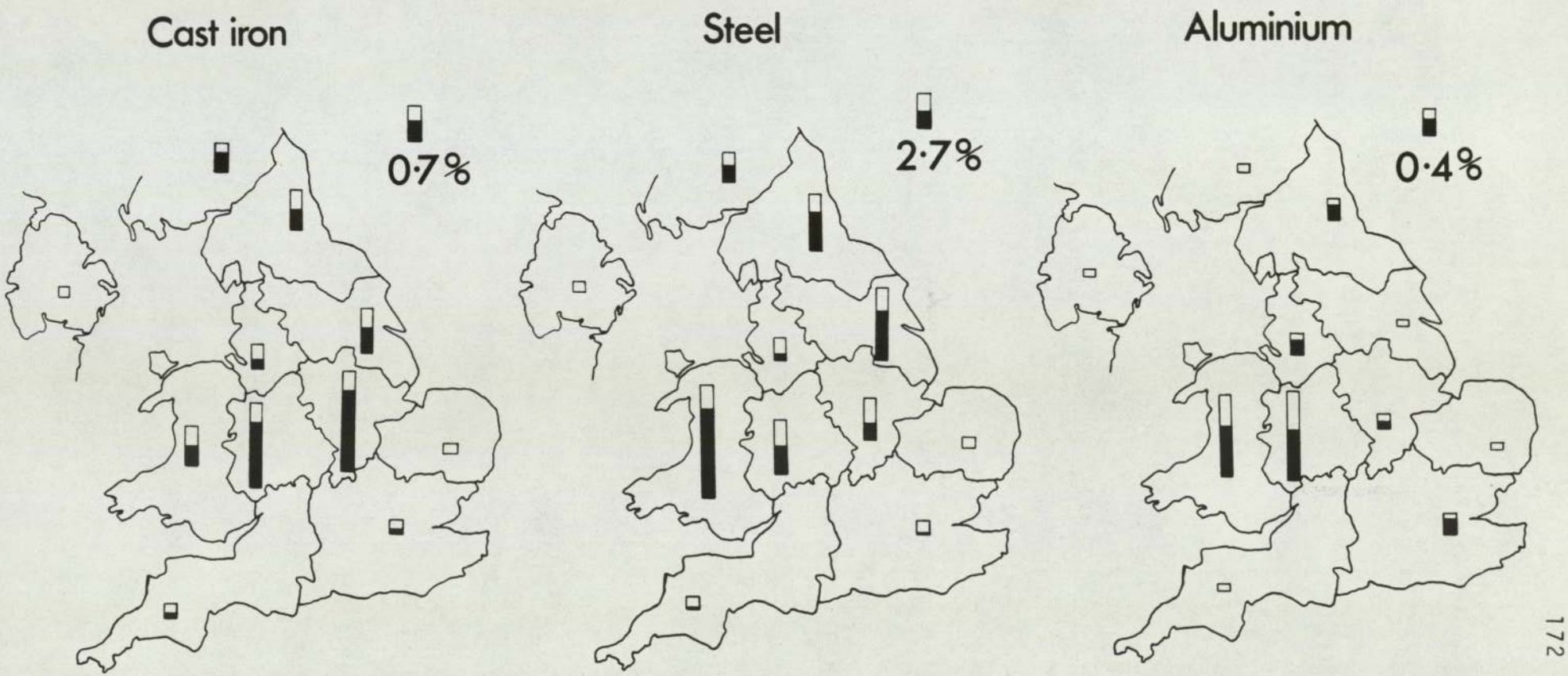


FIGURE (9.7) Continued

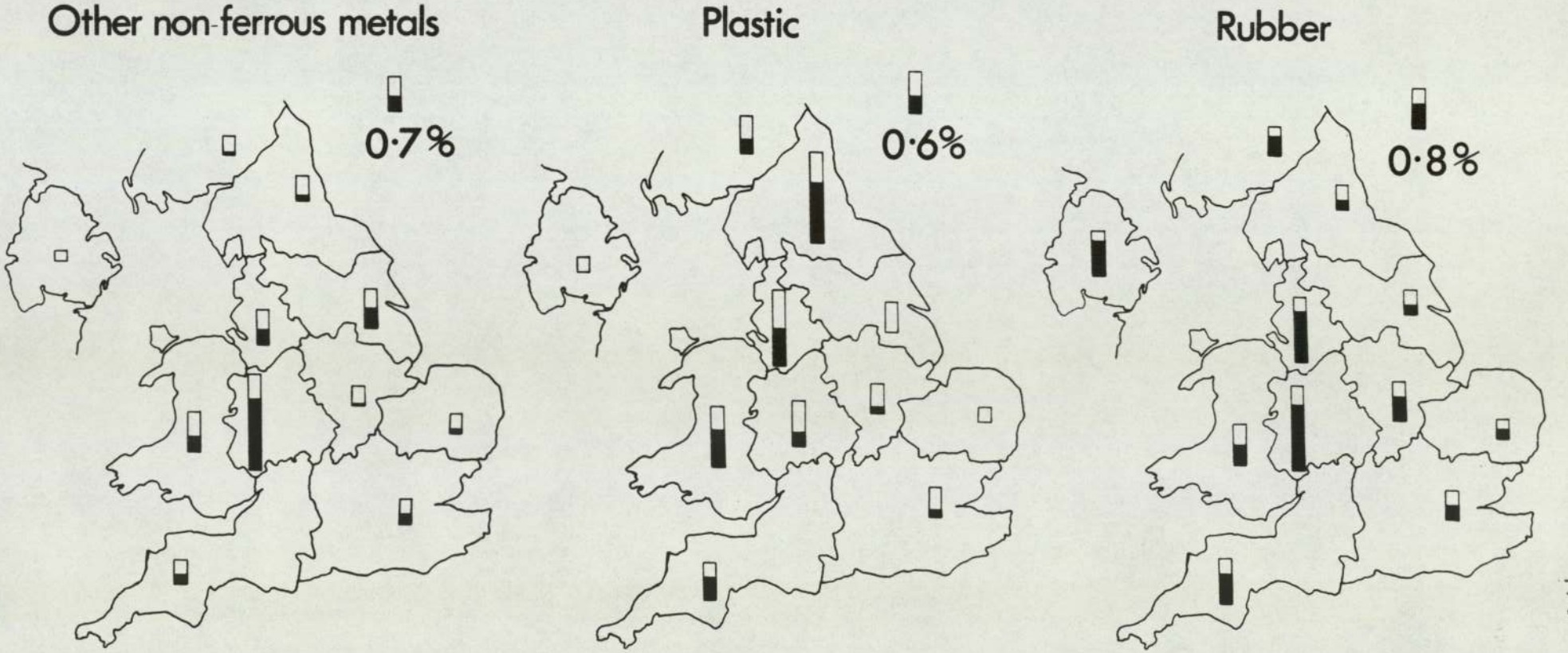


TABLE (9.12) Regional employment in materials production for U.K. manufacturing industries.

(a) thousands

	Cast iron	Steel	Aluminium	Other non-ferrous	Plastic	Rubber
1 North	6.8	45.4	2.3	3.6	5.1	2.3
2 Yorkshire and Humberside	11.9	89.6	1.7	10.0	2.1	3.0
3 East Midland	19.3	36.5	2.1	3.5	1.9	3.9
4 East Anglia	0.8	4.1	0.4	1.3	0.4	0.7
5 South East	17.7	66.7	16.0	22.4	10.5	14.3
6 South West	2.8	11.1	1.5	4.4	2.6	4.0
7 West Midland	26.9	76.7	18.2	26.5	4.4	13.0
8 North West	9.7	39.0	5.8	12.2	9.1	12.6
9 Wales	5.6	67.5	7.6	4.8	2.6	2.6
10 Scotland	9.0	39.6	1.5	5.1	3.4	4.6
11 Northern Ireland	0.5	3.0	0.1	0.6	0.2	1.4
TOTAL	111.0	479.1	57.2	94.4	42.3	62.4

(b) Percent of total civilian workforce within each region.

	Cast iron	Steel	Aluminium	Other non ferrous	Plastic	Rubber
1 North	0.5	3.5	0.2	0.3	0.4	0.2
2 Yorkshire and Humberside	0.6	4.4	0.1	0.5	0.1	0.1
3 East Midland	1.4	2.6	0.1	0.2	0.1	0.3
4 East Anglia	0.1	0.7	0.1	0.2	0.1	0.1
5 South East	0.2	0.8	0.2	0.3	0.1	0.2
6 South West	0.2	0.8	0.1	0.3	0.2	0.3
7 West Midland	1.2	3.3	0.8	1.1	0.2	0.6
8 North West	0.3	1.3	0.2	0.4	0.3	0.4
9 Wales	0.6	6.8	0.8	0.5	0.3	0.3
10 Scotland	0.4	1.8	0.1	0.2	0.2	0.2
11 Northern Ireland	0.1	0.6	-	0.1	-	0.3
TOTAL	0.5	2.0	0.2	0.4	0.2	0.3

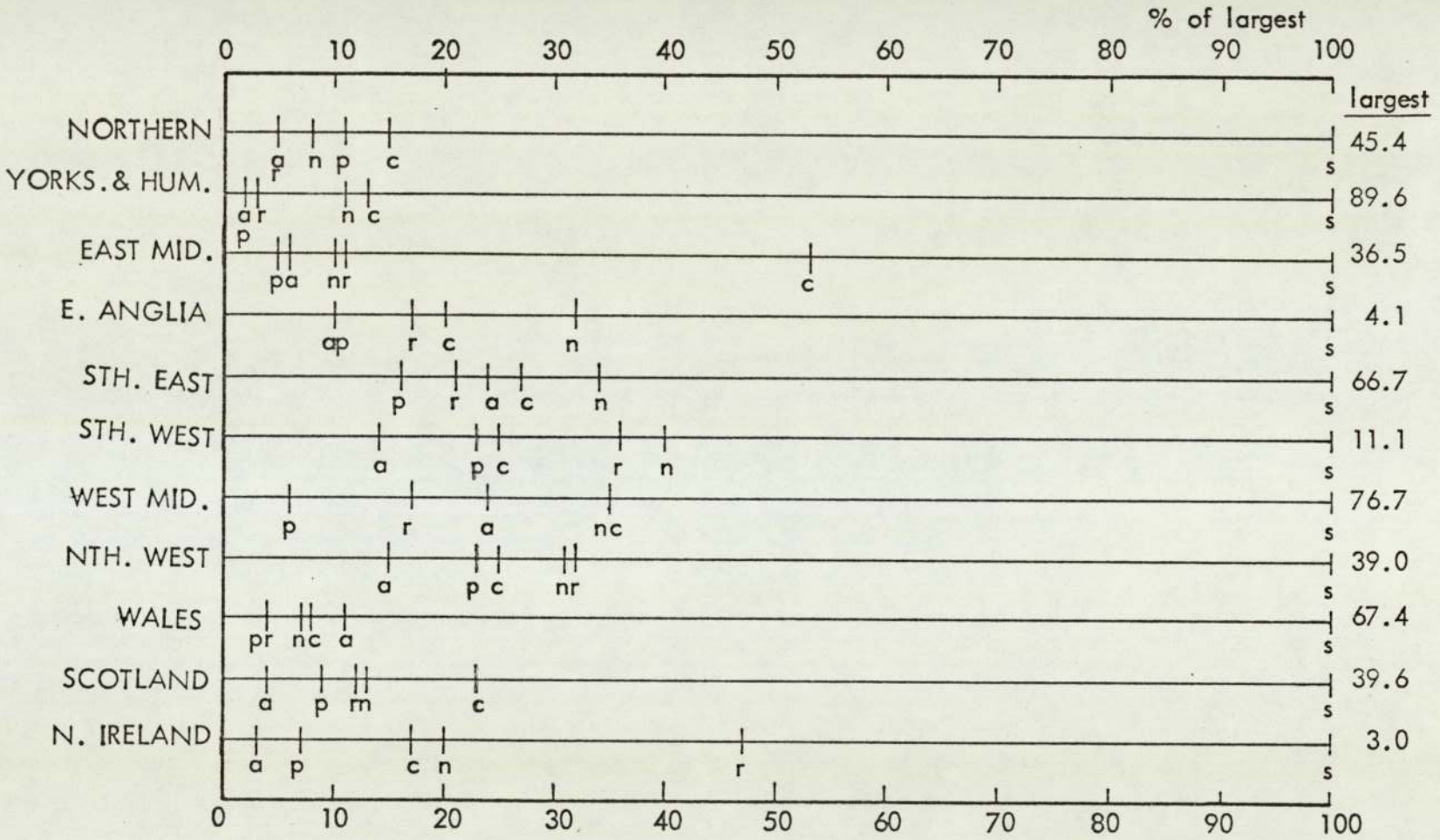


FIGURE (9.8) WITHIN REGION COMPARISON OF EMPLOYMENT IN MANUFACTURE OF MATERIALS FOR UK ENGINEERING AND CONSTRUCTION INDUSTRIES. th. man-years: cast iron (c), steel (s), aluminium (a), other non-ferrous metals (n), plastic (p), rubber (r).

TABLE (9.13) Results for 10% saving of all engineering materials by U.K. manufacturing industries.

(a) Industry Table

		Gross Output reduction		Cost saving	Price reduct.	TIFE rise	Employment rise
		£M	%	£M	%	%	th.
1	Coal mining	8.2	1.0		0.3		
2	Stone, slate, sand, etc.	1.5	0.8		0.3		
3	Other mining, quarrying	1.1	2.3		0.1		
4	Coke ovens, manuf. fuel	8.1	3.6		0.3		
5	Mineral oil refining	6.3	0.7		0.1		
6	Chemicals	8.8	0.5		0.2		
7	Paint	0.5	0.3		0.4		
8	Plastic, synth. resins, etc.	15.3	3.6		0.2		
9	Iron castings, etc.	27.2	8.8		0.3		
10	Other iron and steel	113.9	7.7		0.3		
11	Aluminium and alloys	18.3	7.3		0.2		
12	Other non-ferrous metals	45.9	6.7		0.4		
13	Agricultural machinery	-	-	1.5	2.4	6.4	1.3
14	Machine tools	0.4	0.2	2.8	1.8	3.4	2.3
15	Pumps, valves, compressors	0.9	0.3	5.5	2.5	5.9	4.7
16	Industrial engines	0.2	0.2	2.1	2.4	5.5	1.8
17	Textile machinery	0.1	0.1	1.7	1.7	3.2	1.5
18	Const.& mech. handling equip.	0.6	0.1	6.6	2.1	5.3	5.3
19	Office machinery	0.1	0.1	0.5	1.4	1.5	0.4
20	Other non-electrical mach.	1.1	0.2	10.2	2.0	4.0	8.5
21	Indust. plant and steel works	1.0	0.1	10.8	1.9	5.3	7.9
22	Other mechanical engineering	4.1	0.7	10.8	2.2	5.5	9.4
23	Instrument engineering	0.4	0.1	2.9	1.0	1.6	2.6
24	Electrical machinery	0.8	0.2	8.0	2.2	4.4	7.0
25	Insulated wires and cables	2.1	0.6	15.5	5.4	24.8	13.0
26	Electronics and telecom.	0.4	-	5.1	1.1	1.5	4.9
27	Domestic elec. appliances	0.3	0.1	5.2	2.5	6.7	5.0
28	Other electrical goods	0.6	0.2	5.4	2.1	4.9	5.6
29	Shipbuilding, etc.	0.2	-	5.3	1.6	2.4	4.5
30	Wheeled tractors	0.1	-	2.7	2.6	7.4	1.9

TABLE (9.13) (a) Continued

	Gross Output reduction		Cost saving	Price reduct.	TIFE rise	Employment rise
	£M	%	£M	%	%	th.
31 Motor vehicles	1.7	0.1	42.6	2.9	7.2	32.5
32 Areospace equipment	0.1	-	4.9	1.2	1.6	3.7
33 Other vehicles	0.8	0.5	2.8	2.4	4.3	2.6
34 Engineers' small tools	1.4	0.9	2.3	1.7	4.0	2.0
35 Cutlery and jewellery	0.1	-	1.9	1.1	5.3	1.8
36 Bolts, nuts, screws, etc.	0.5	0.5	2.5	3.0	6.7	2.5
37 Wire and wire manufactures	0.9	0.4	10.3	5.4	23.3	9.3
38 Cans and metal boxes	0.4	0.3	6.9	5.6	27.6	7.9
39 Other metal goods	7.9	0.8	28.0	3.1	9.5	25.4
40 Bricks, fireclay, etc.	2.2	1.3		0.2		
41 Pottery and glass	0.4	0.1		0.2		
42 Cement	0.1	0.1		0.3		
43 Other building materials	1.3	0.3		0.3		
44 Furniture and bedding, etc.	0.1	-	0.9	0.6	0.8	0.7
45 Timber and misc. wood manuf.	0.8	0.1		0.1		
46 Paper and board	1.2	0.3		0.2		
47 Paper and board packaging	1.2	0.3		0.1		
48 Other paper and board prods.	0.6	0.2		0.1		
49 Rubber	16.1	3.5		0.3		
50 Plastic products n.e.s.	1.2	0.4	9.0	3.0	9.5	8.8
51 Other manufacturing	0.2	0.1	3.3	1.3	3.6	2.8
52 Construction	1.5	-	22.6	0.8	1.3	18.7
53 Gas	5.3	0.9		0.2		
54 Electricity	8.1	0.5		0.3		
55 Water supply	0.6	0.4		0.1		
56 Railways	4.4	0.8		0.5		
57 Road transport	6.6	0.5		0.1		
58 Other transport	4.6	0.2		0.1		
59 Distributive trades	11.1	0.2		0.1		
60 ALL OTHER	17.8	0.1		0.1		
T O T A L			240.7		4.0	206.3

TABLE (9.13) Continued

(b) Primary Input Table Savings in primary input (labour in th. man-years).

			£M	%
IMPORTS			81.0	1.4
CAPITAL STOCK			675.2	0.8
LABOUR	Number	Operatives	64.8	0.5
		Other	20.5	0.5
	Wages, Salaries, etc.	Operatives	69.1	0.5
		Other	25.9	0.5
		T.I.F.E.	104.0	0.5
Total Value Added			142.6	0.5

(c) Final Buyer Table Percent price decrease and savings for final buyers.

	%	£M
Consumers	0.3	55.9
Public Authorities	0.6	20.7
Gross Domestic Fixed Capital	1.2	91.5
Stocks	-1.5	-1.7
Exports	0.9	74.1
TOTAL FINAL	0.6	240.5

TABLE (9.13) Continued

(d) Regional Employment Table

	NO SUBSTITUTION OF LABOUR				SUBSTITUTION OF LABOUR			
	Job losses		Total unemp.		Job gains		Total unemp.	
	th.	%	th.	%	th.	%	th.	%
1 North	6.6	0.5	62.5	4.8	6.6	0.5	55.9	4.3
2 Yorks. & Humb.	11.9	0.6	60.2	2.9	17.1	0.8	43.1	2.1
3 East Midland	6.8	0.5	31.0	2.2	8.9	0.6	22.1	1.6
4 East Anglia	0.8	0.1	15.9	2.5	2.7	0.4	13.1	2.1
5 South East	14.8	0.2	128.8	1.6	63.4	0.8	65.4	0.8
6 South West	2.8	0.2	31.1	2.3	8.5	0.6	22.6	1.7
7 West Midland	16.8	0.7	60.9	2.6	42.2	1.8	18.7	0.8
8 North West	8.9	0.3	75.5	2.5	34.8	1.2	40.7	1.4
9 Wales	9.2	0.9	44.6	4.5	6.9	0.7	37.7	3.8
10 Scotland	6.4	0.3	81.0	3.8	13.9	0.6	67.1	3.1
11 N. Ireland	0.5	0.1	36.5	7.0	1.1	0.2	35.4	6.7
TOTAL	85.4	0.4	627.8	2.7	206.3	0.9	421.5	1.8

TABLE (9.14) Total and relative requirements per £1 of final demand for steel, aluminium, and plastic: x 10^5.

(a) Industry Table $\delta_{i,j}$ for j = s, a, p

	Steel	Aluminium	Plastic	Steel / aluminium	Steel / plastic
1 Coal mining	5433	1036	1565	5.24	3.47
2 Stone, slate, sand, etc.	1070	97	170	11.03	6.29
3 Other mining, quarrying	742	58	94	12.79	7.89
4 Coke ovens, manuf. fuel	5976	312	385	19.15	15.52
5 Mineral oil refining	4023	1739	4782	2.31	0.84
6 Chemicals	2792	1857	25143	1.50	0.11
7 Paint	216	371	172	0.58	1.26
8 Plastic, synth. resins, etc.	463	447	100681	1.04	0.01
9 Iron castings, etc.	5348	251	168	21.31	31.83
10 Other iron and steel	102222	1494	1007	68.42	101.51
11 Aluminium and alloys	518	100249	353	0.01	1.47
12 Other non-ferrous metals	3462	4685	1166	0.74	2.97
13 Agricultural machinery	30	5	12	6.00	2.50
14 Machine tools	215	73	56	2.95	3.84
15 Pumps, valves, compressors	472	168	322	2.81	1.47
16 Industrial engines	141	64	91	2.20	1.55
17 Textile machinery	52	9	18	5.78	2.89
18 Const.& mech. handling equip.	388	118	106	3.29	3.66
19 Office machinery	32	10	39	3.20	0.82
20 Other non-electrical mach.	685	135	359	5.07	1.91
21 Indust. plant and steel works	529	202	359	2.62	1.47
22 Other mechanical engineering	2440	834	1186	2.93	2.06
23 Instrument engineering	147	39	54	3.77	2.72
24 Electrical machinery	386	189	151	2.04	2.56
25 Insulated wires and cables	472	477	237	0.99	1.99
26 Electronics and telecom.	114	67	51	1.70	2.24
27 Domestic elec. appliances	159	102	71	1.56	2.24
28 Other electrical goods	255	125	134	2.04	1.90
29 Shipbuilding, etc.	90	32	39	2.81	2.31
30 Wheeled tractors	45	6	10	7.50	4.50

TABLE (9.14) (a) Continued

	Steel	Aluminium	Plastic	Steel / Aluminium	Steel / Plastic
31 Motor vehicles	921	326	244	2.83	3.77
32 Areospace equipment	43	291	19	0.15	2.26
33 Other vehicles	481	86	103	5.59	4.67
34 Engineers' small tools	878	539	369	1.63	2.38
35 Cutlery and jewellery	44	30	44	1.47	1.00
36 Bolts, nuts, screws, etc.	255	70	56	3.64	4.55
37 Wire and wire manufactures	261	158	164	1.65	1.59
38 Cans and metal boxes	200	81	319	2.47	0.63
39 Other metal goods	4417	3186	1727	1.39	2.56
40 Bricks, fireclay, etc.	1842	91	56	20.24	32.89
41 Pottery and glass	150	69	794	2.17	0.19
42 Cement	90	20	42	4.50	2.14
43 Other building materials	993	147	427	6.76	2.33
44 Furniture and bedding, etc.	35	23	43	1.52	0.81
45 Timber and misc. wood manuf.	380	602	577	0.63	0.66
46 Paper and board	348	1256	1952	0.28	0.18
47 Paper and board packaging	454	429	1688	1.06	0.27
48 Other paper and board prods.	292	251	400	1.16	0.73
49 Rubber	820	374	538	2.19	1.52
50 Plastic products n.e.s.	628	749	956	0.84	0.66
51 Other manufacturing	74	68	133	1.09	0.56
52 Construction	883	471	519	1.87	1.70
53 Gas	3850	1028	408	3.75	9.44
54 Electricity	4711	3028	3494	1.56	1.35
55 Water supply	307	144	876	2.13	0.35
56 Railways	2936	580	713	5.06	4.12
57 Road transport	3642	1701	2723	2.14	1.34
58 Other transport	2367	1419	2174	1.67	1.09
59 Distributive trades	5327	4625	1620	1.15	3.29
60 ALL OTHER	8631	5275	13336	1.64	0.65

TABLE (9.14) Continued

(b) Primary Inputs Table $r_{i,j}$ for j = s, a, p

			Steel	Aluminium	Plastic	Steel / Aluminium	Steel / Plastic
IMPORTS			19424	42156	25622	0.46	0.76
CAPITAL STOCK			406023	251584	330634	1.61	1.23
LABOUR	Number	Operatives	33921	25983	21069	1.31	1.61
		Other	10515	8033	10266	1.31	1.02
	Wages, Salaries, etc.	Operatives	36397	27556	23175	1.32	1.57
		Other	13017	10226	14377	1.27	0.91
		T.I.F.E.	54258	51104	41140	1.32	1.32
Total Value Added			72387	52323	70588	1.38	1.03

(c) Regional Employment Table $r_{i,j}$ for j = s, a, p

	Steel	Aluminium	Plastic	Steel / Aluminium	Steel / Plastic
1 North	4209	1372	3763	3.07	1.12
2 Yorkshire and Humberside	8329	1115	1715	7.47	4.86
3 East Midland	3384	1210	1403	2.80	2.41
4 East Anglia	387	303	358	1.28	1.08
5 South East	6206	9643	7936	0.64	0.78
6 South West	1004	711	1721	1.41	0.58
7 West Midland	7099	10713	3081	0.66	2.30
8 North West	3620	3451	6775	1.05	0.53
9 Wales	6241	4500	1886	1.39	3.31
10 Scotland	3664	844	2444	4.34	1.50
11 Northern Ireland	293	154	253	1.90	1.16
TOTAL	44436	34016	31335	1.31	1.42

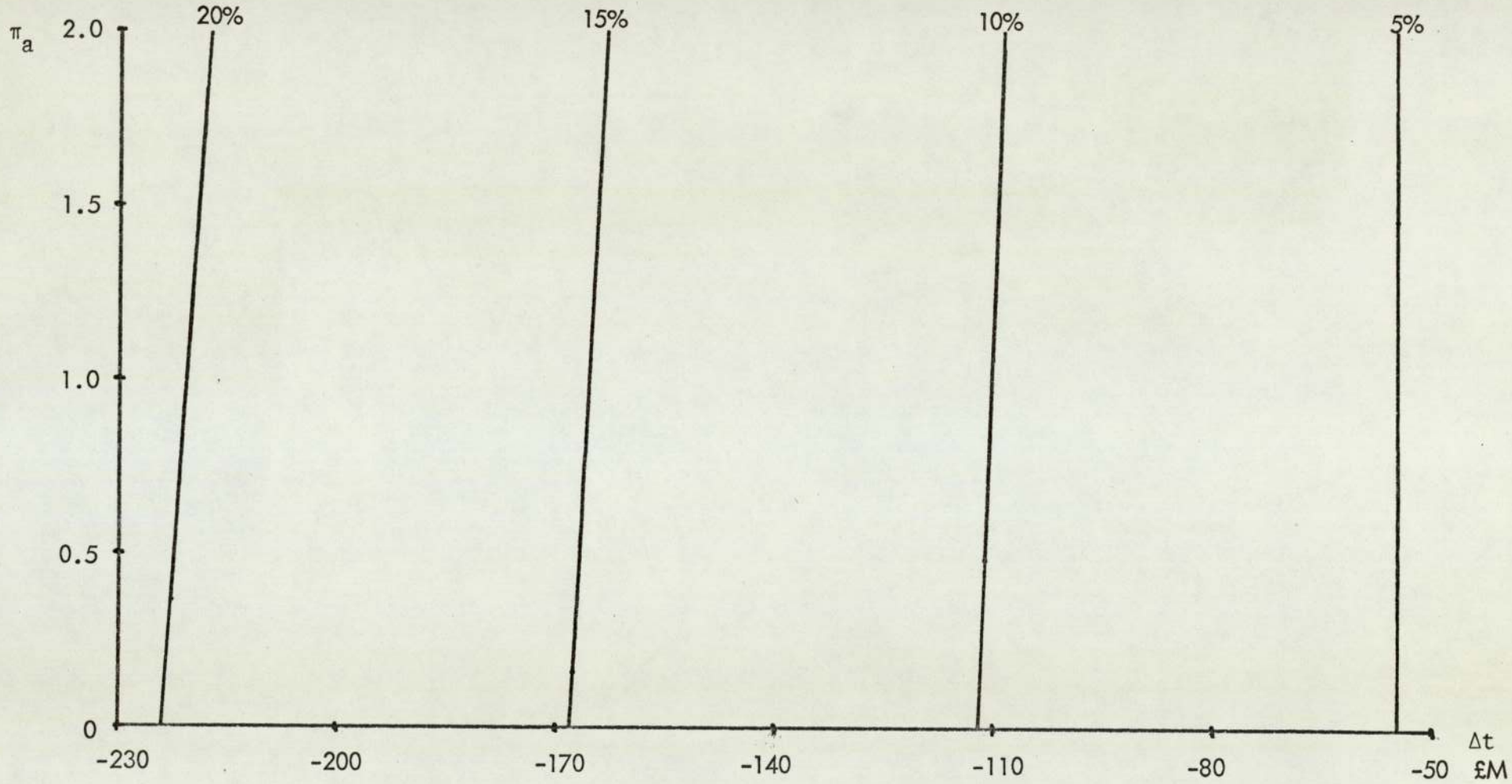


FIGURE (9.9) SUBSTITUTION OF STEEL BY ALUMINIUM IN ENGINEERING AND CONSTRUCTION INDUSTRIES

Substitution rates of 100k = 20, 15, 10, 5%, aluminium costing π_a relative to steel, resource saving Δt, Δg.

(a) STEEL

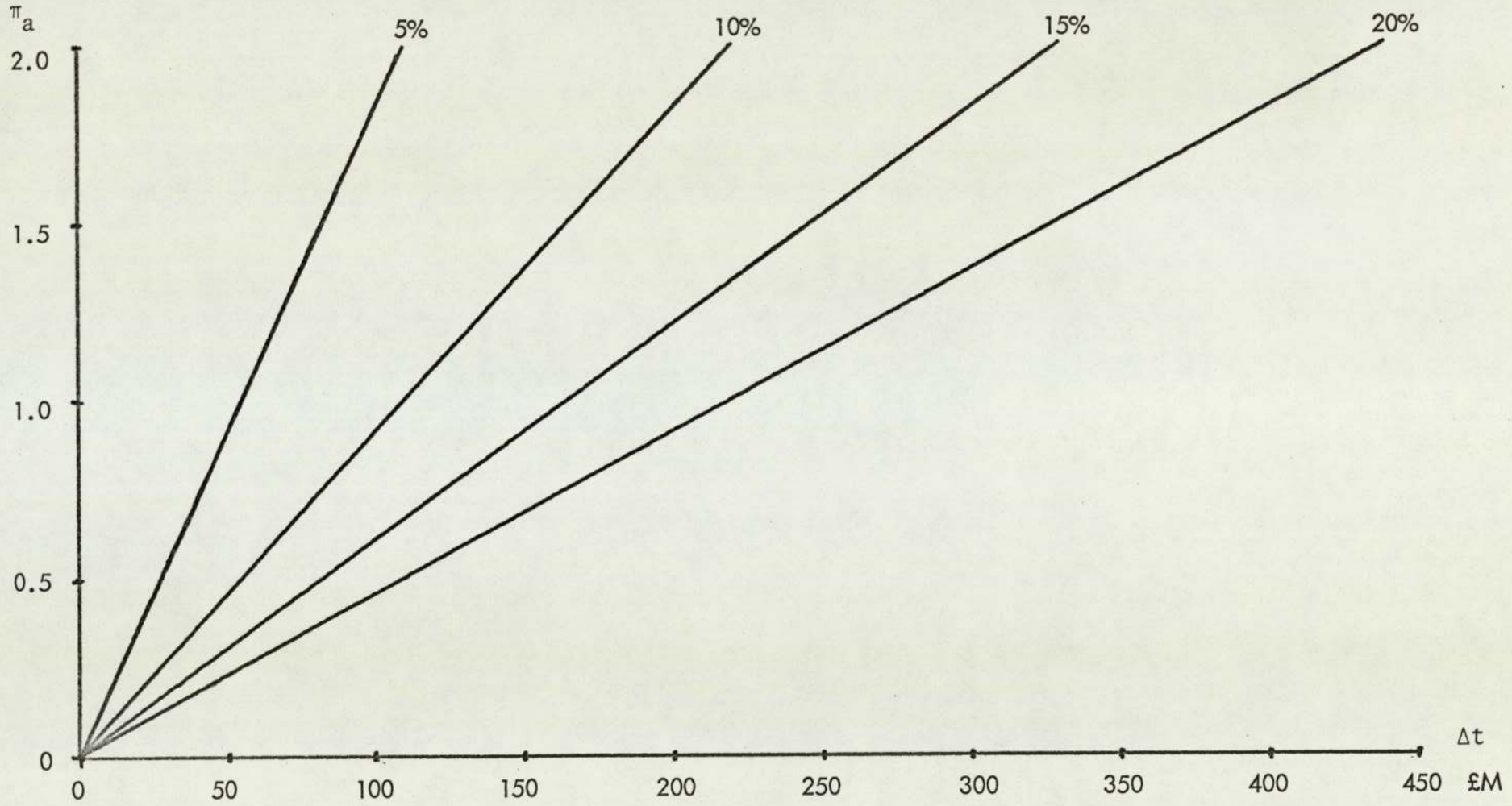


FIGURE (9.9) continued (b) ALUMINIUM

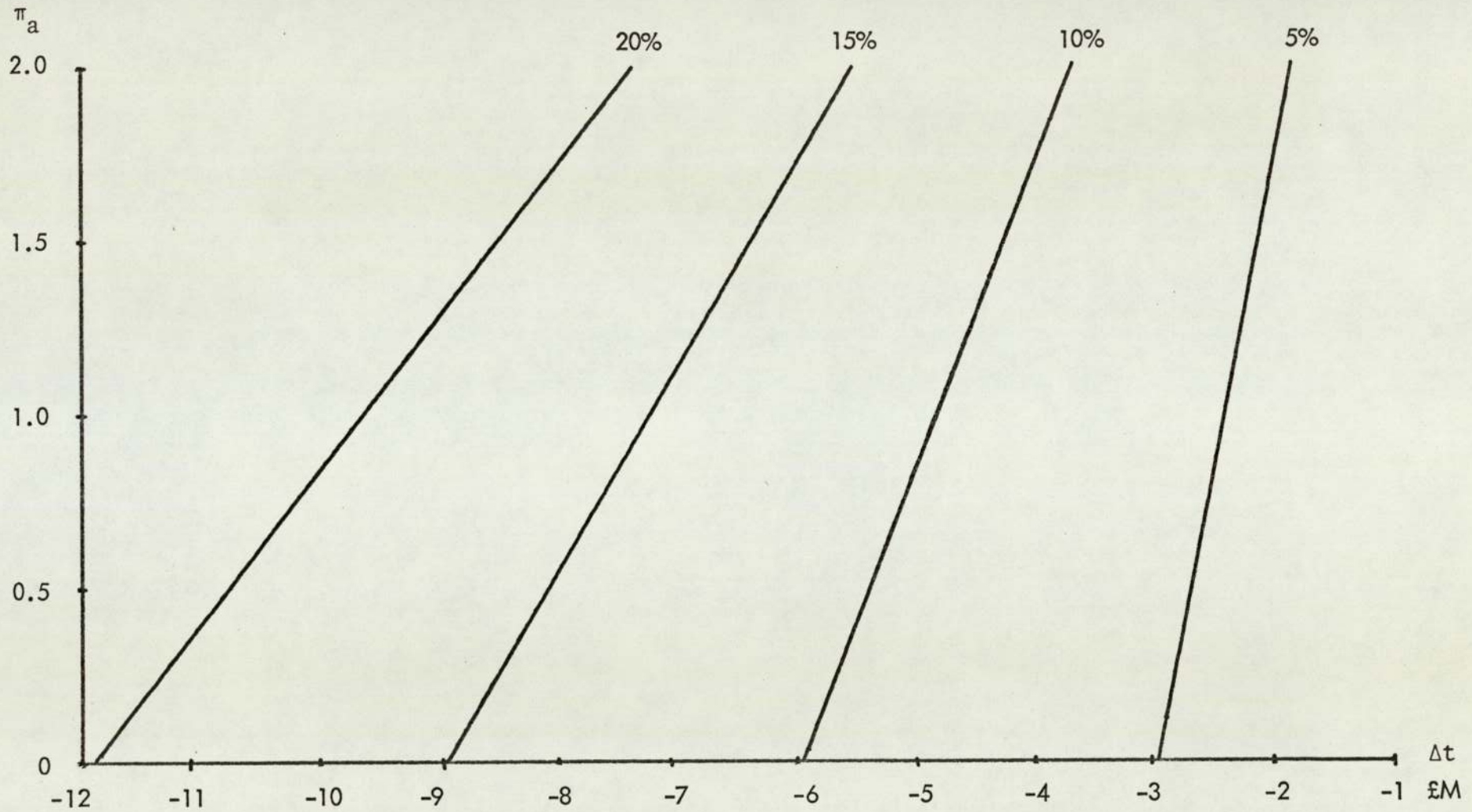


FIGURE (9.9) continued (c) COAL

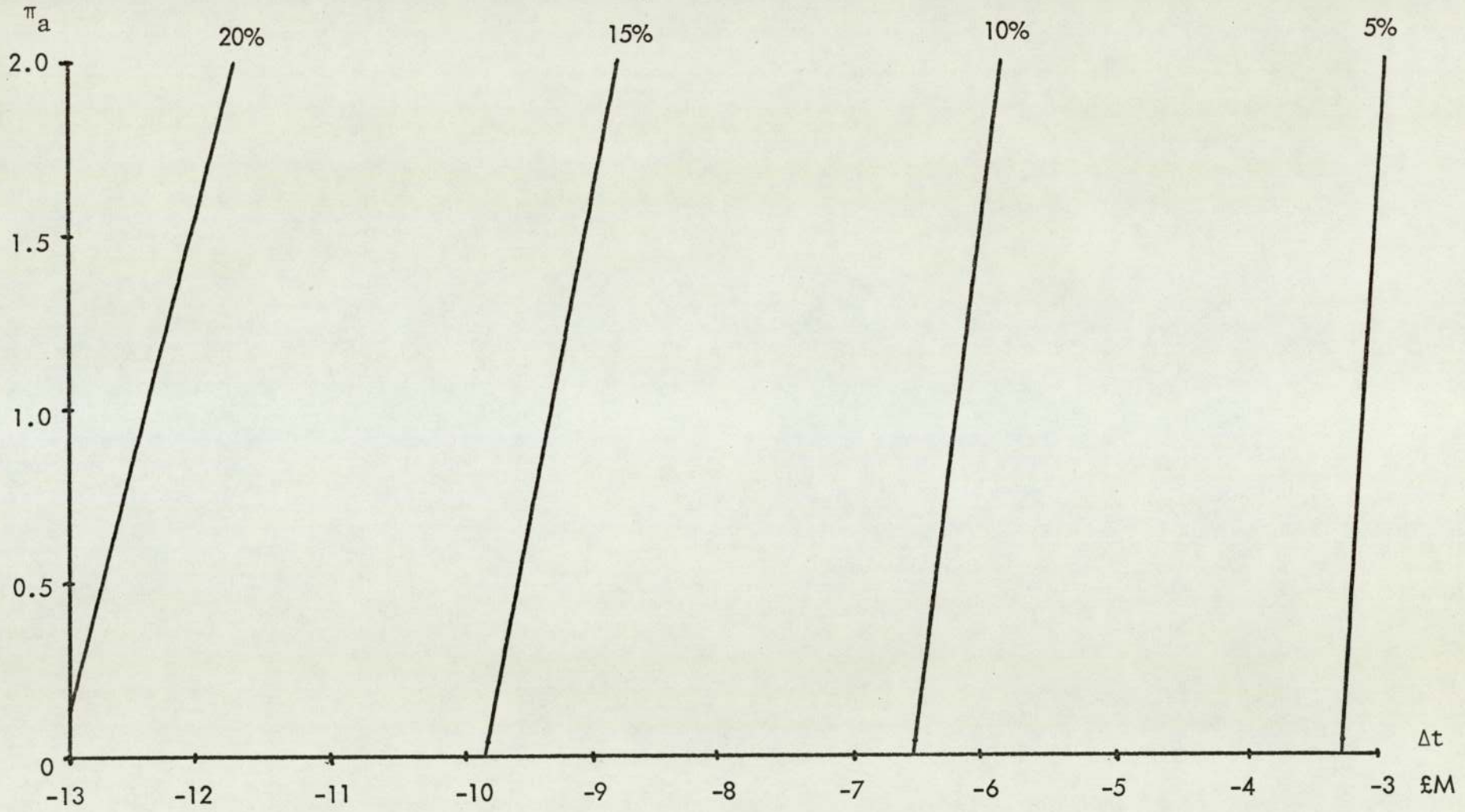


FIGURE (9.9) continued (d) COKE

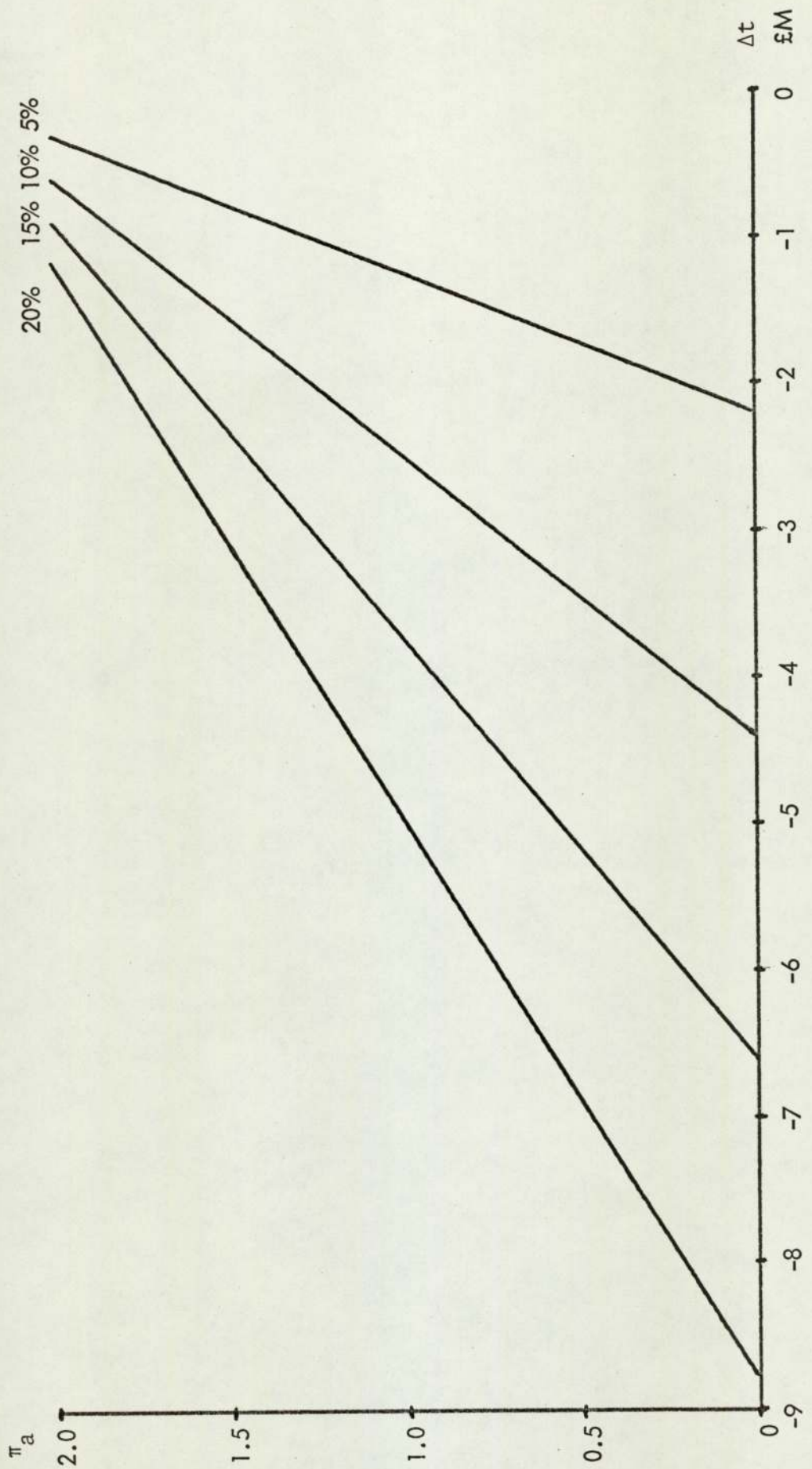


FIGURE (9.9) continued (e) OIL

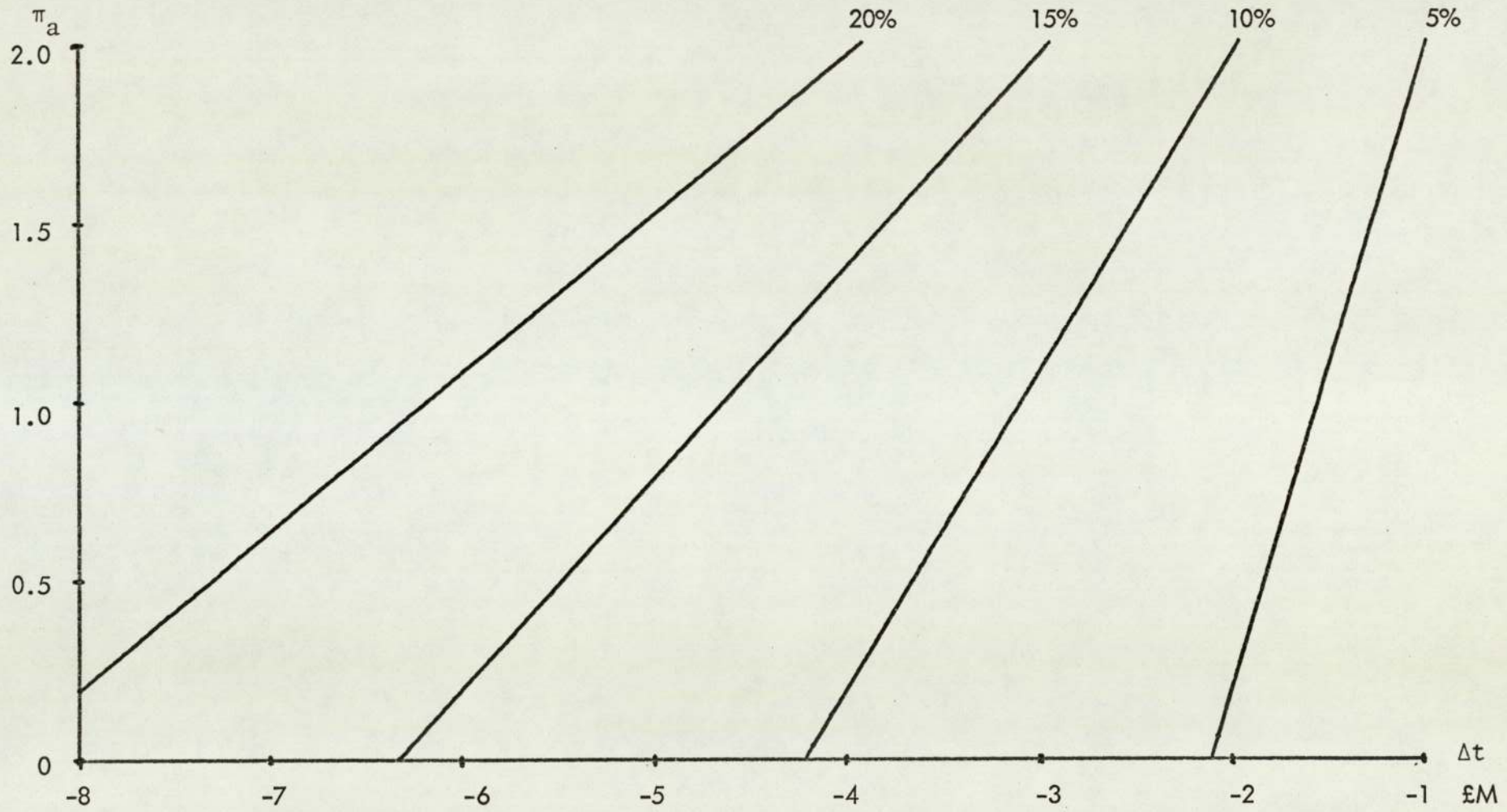


FIGURE (9.9) continued (f) GAS

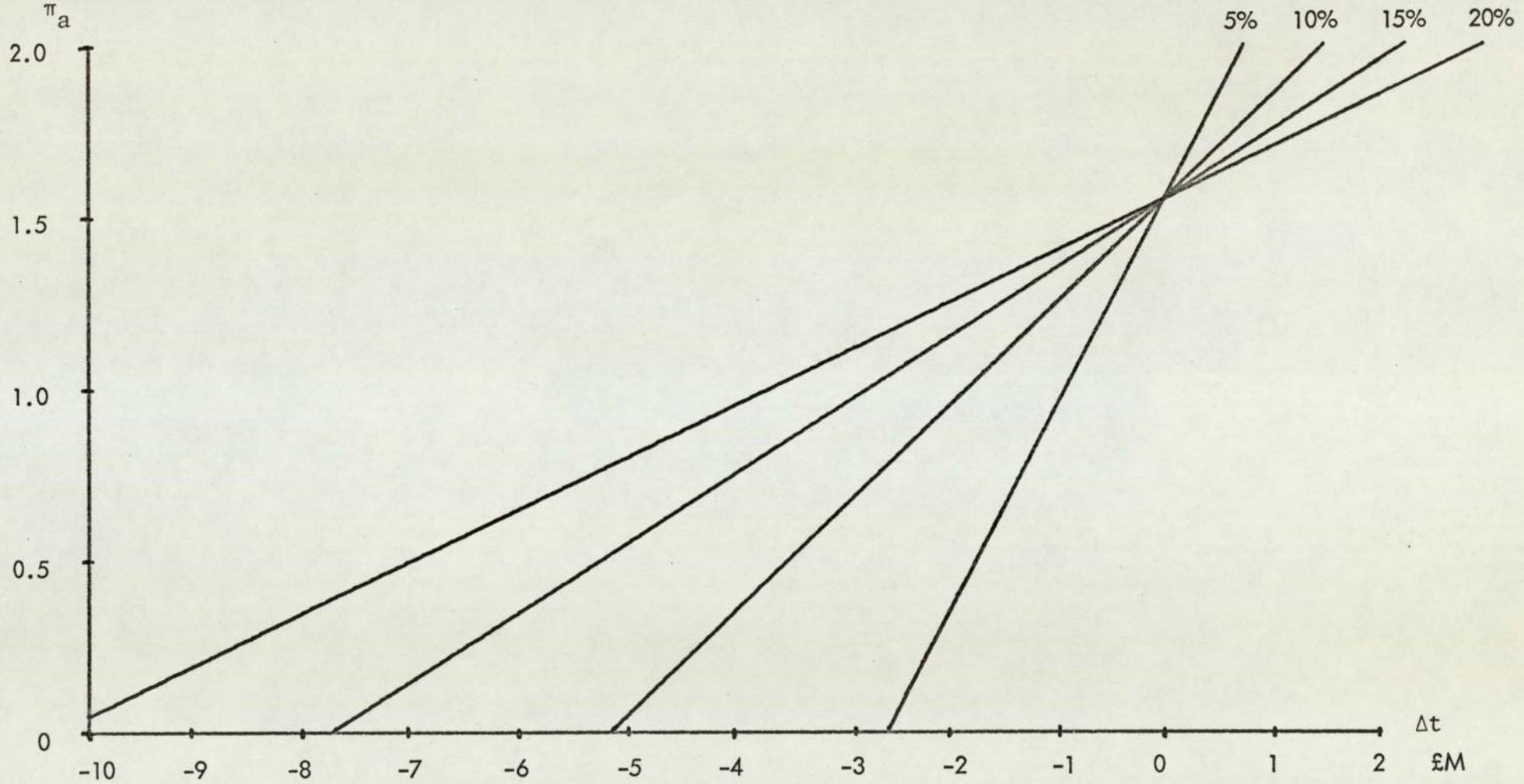


FIGURE (9.9) continued (g) ELECTRICITY

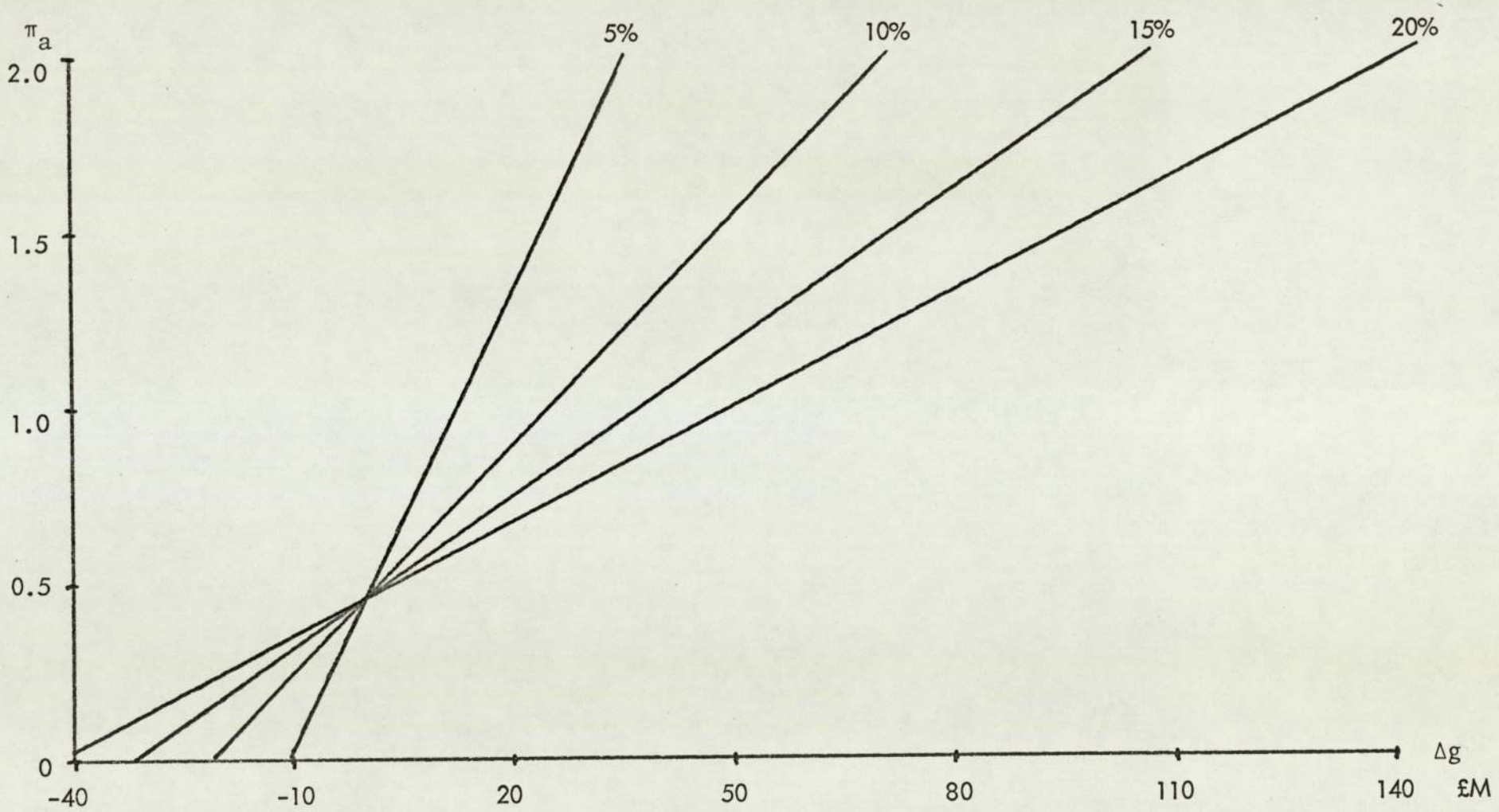


FIGURE (9.9) continued (h) IMPORTS

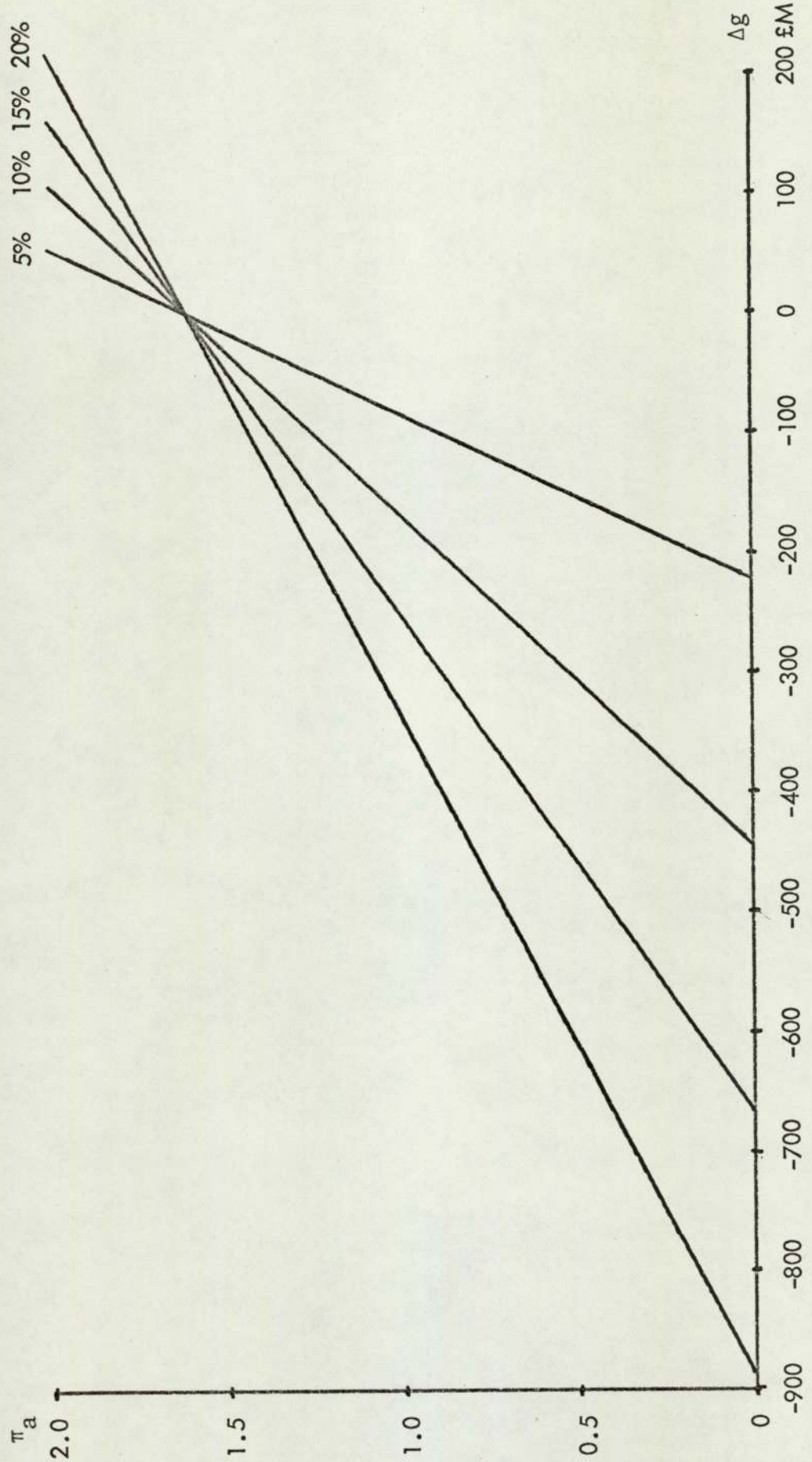


FIGURE (9.9) continued (i) CAPITAL STOCK

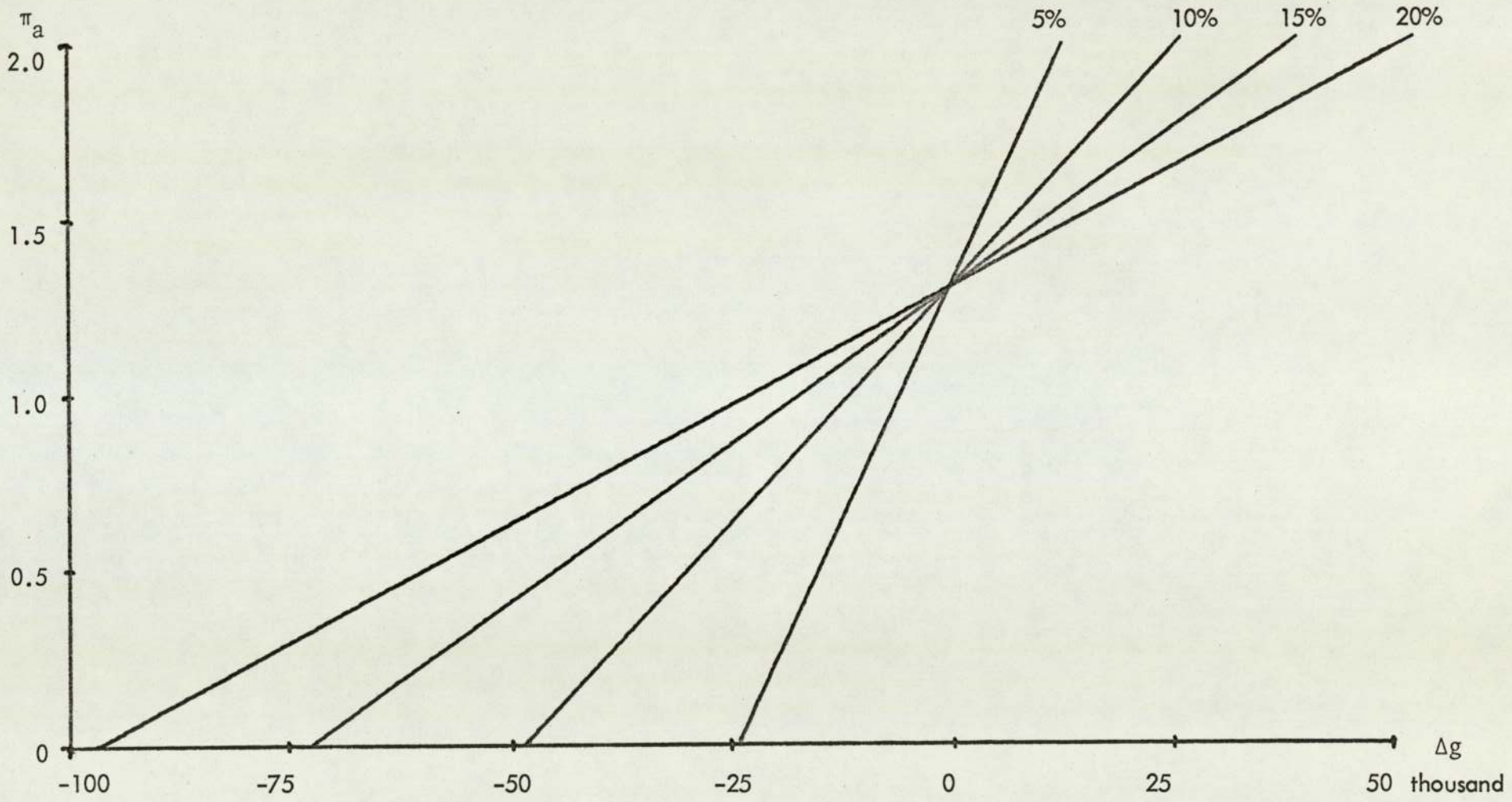


FIGURE (9.9) continued (j) TOTAL LABOUR

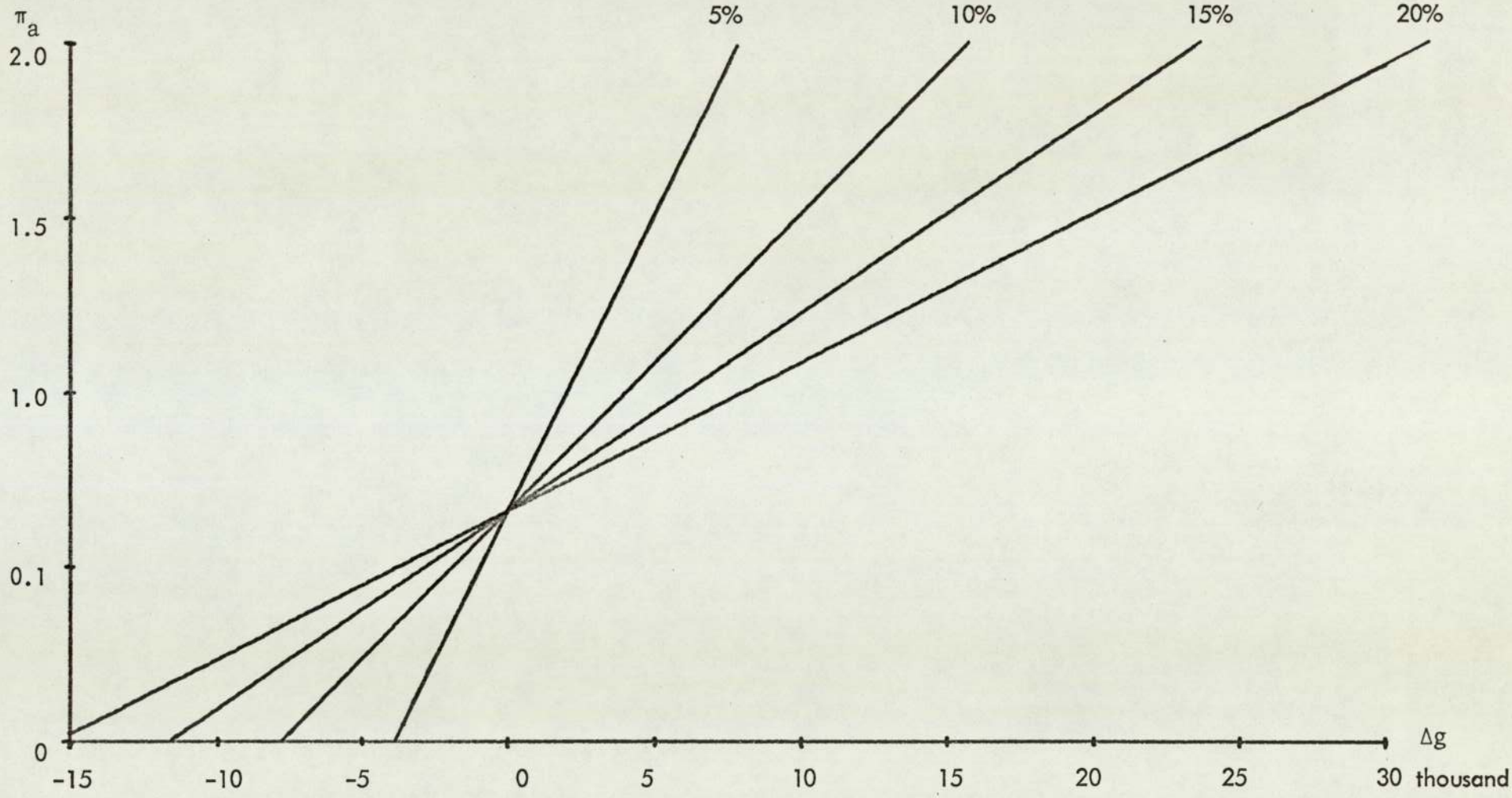


FIGURE (9.9) continued (k) WEST MIDLAND LABOUR

FIGURE (9.10) REGIONAL IMPLICATIONS OF SUBSTITUTION OF STEEL BY PLASTIC AND ALUMINIUM IN ENGINEERING AND CONSTRUCTION INDUSTRIES: Direct plus indirect employment in materials manufacturing.

BLACK BAR: % reduction of within region employment in steel manufacturing due to substitution of 100k% of steel.

WHITE BARS: % increase within region employment in plastic (P) and aluminium (A) manufacturing due to substitution.

π is the variable cost of plastic and aluminium required to replace £1 of steel.

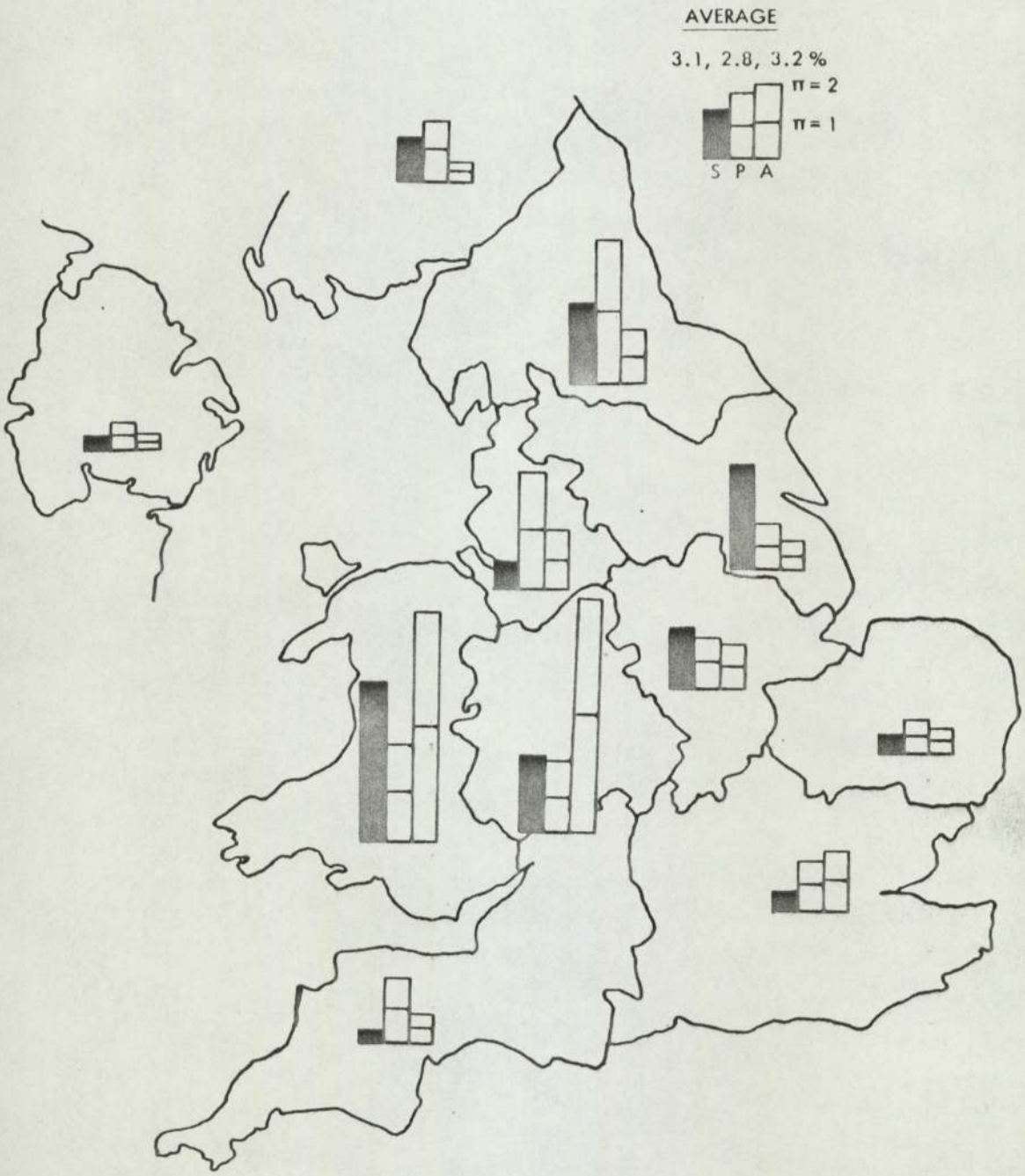
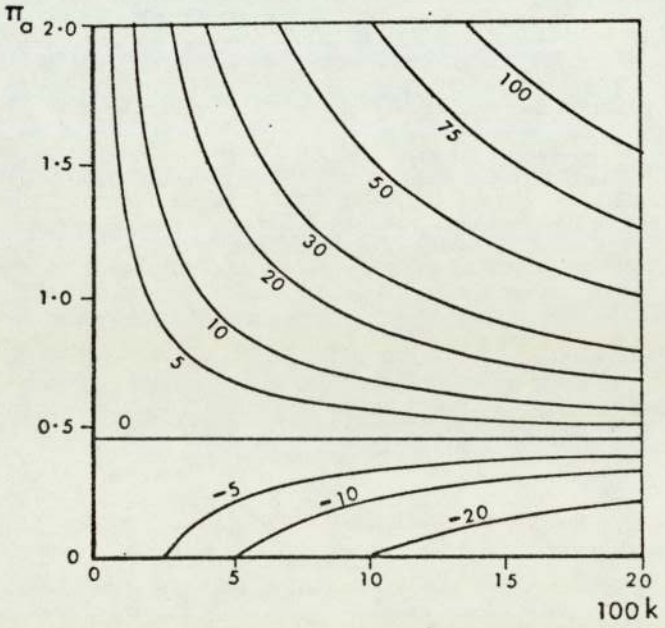


FIGURE (9.11) RESOURCE ISOQUANT CURVES FOR SUBSTITUTION OF STEEL BY ALUMINIUM IN ENGINEERING AND CONSTRUCTION INDUSTRIES. Effect on imports and capital stock. Each curve passes through combinations of π_a (cost of aluminium required to replace £1 of steel) and 100k (percent of steel substituted for) with equal Δg (changed resource requirement).

IMPORTS



CAPITAL STOCK

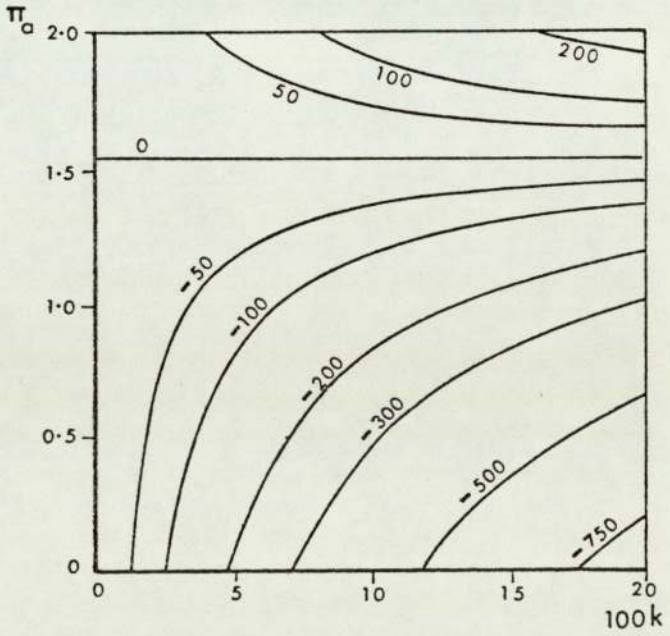
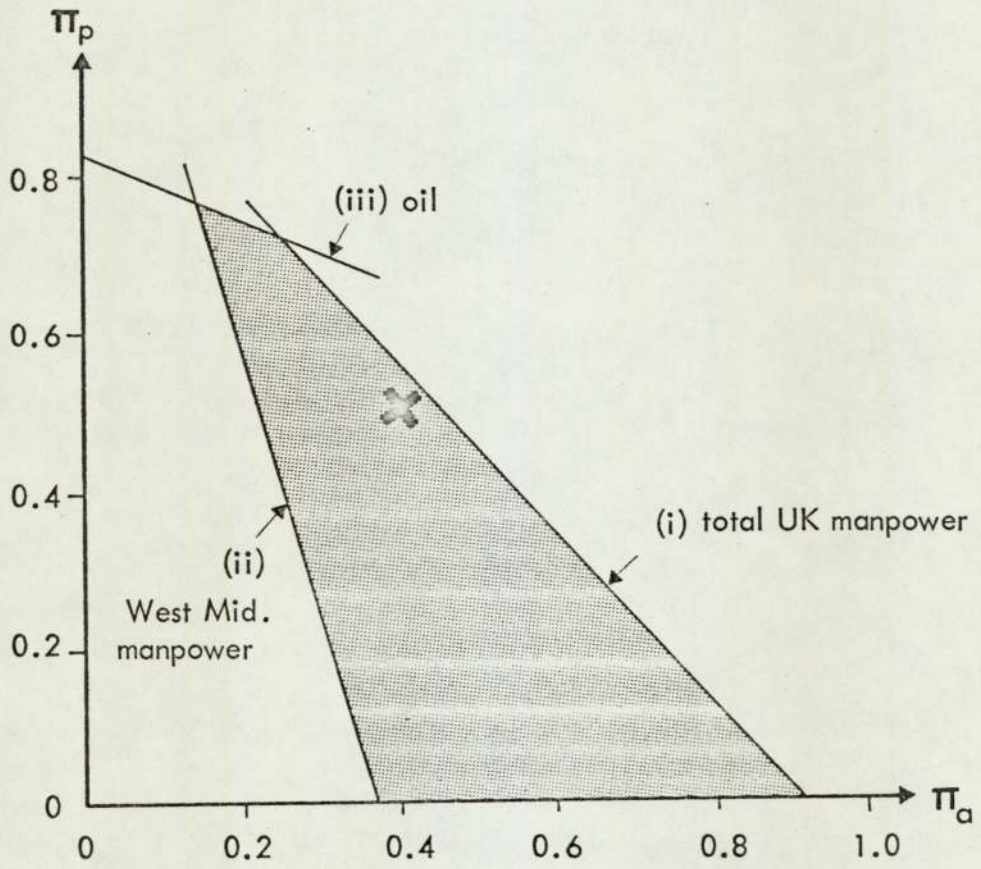


FIGURE (9.12) CONSTRAINTS FOR 15% SUBSTITUTION OF STEEL BY ALUMINIUM AND PLASTIC. Constraints satisfy (i) total manpower saving of 20,000 for UK, (ii)of which no more than 5,000 are in the West Midlands, and (iii) oil comsumption does not rise. Plastic and aluminium cost π_p and π_a respectively relative to steel in the engineering and construction industries.



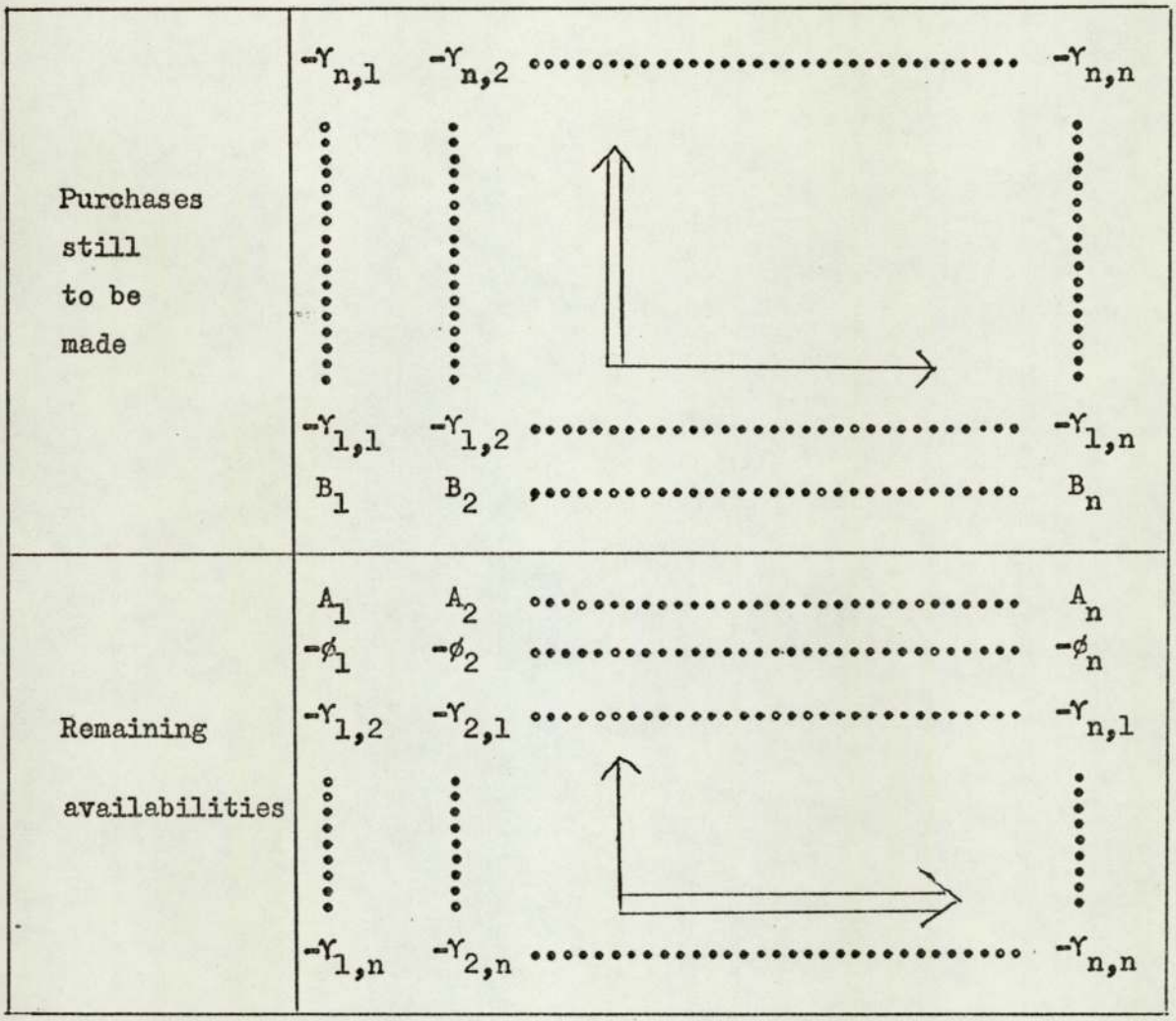


FIGURE (A1.1) COMPUTATION ACCOUNT FOR INTERINDUSTRY DISCIPLINE BY ALGORITHM.

TABLE (A3.1)

Aggregation of input-output classifications for the present work.

PRESENT CLASS	INPUT-OUTPUT CLASS	
60	1	Agriculture
60	2	Forestry and fishing
1	3	Coal mining
2	4	Stone, slate, chalk, sand, etc. extraction
3	5	Other mining and quarrying
60	6	Grain milling
60	7	Other cereal foodstuffs
60	8	Sugar
60	9	Cocoa, chocolate and sugar confectionery
60	10	Oils and fats
60	11	Other food
60	12	Soft drinks
60	13	Alcoholic drink
60	14	Tobacco
4	15	Coke ovens and manufactured fuel
5	16	Mineral oil refining, lubricating oils and greases
6	17	General chemicals
6	18	Pharmaceutical chemicals and preparations
6	19	Toilet preparations
7	20	Paint
6	21	Soap and detergents
8	22	Synthetic resins, plastic materials and synthetic rubber
6	23	Dyestuffs and pigments
6	24	Fertilizers
6	25	Other chemical industries
9	26	Iron cast.ngs, etc.
10	27	Other iron and steel
11	28	Aluminium and aluminium alloys
12	29	Other non-ferrous metals
13	30	Agricultural machinery
14	31	Machine tools
15	32	Pumps, valves and compressors
16	33	Industrial engines
17	34	Textile machinery
18	35	Construction and mechanical handling equipment
19	36	Office machinery
20	37	Other non-electrical machinery
21	38	Industrial plant and steel work
22	39	Other mechanical engineering
23	40	Instrument engineering
24	41	Electrical machinery
25	42	Insulated wires and cables
26	43	Electronics and telecommunications
27	44	Domestic electrical appliances
28	45	Other electrical goods
29	46	Shipbuilding and marine engineering
30	47	Wheeled tractors
31	48	Motor vehicles
32	49	Aerospace equipment
33	50	Other vehicles
34	51	Engineers' small tools
35	52	Cutlery and jewellery
36	53	Bolts, nuts, screws, etc.
37	54	Wire and wire manufactures
38	55	Cans and metal boxes
39	56	Other metal goods
60	57	Production of man-made fibres
60	58	Cotton, etc. spinning and weaving
60	59	Woollen and worsted
60	60	Hosiery and knitted goods
60	61	Carpets
60	62	Household textiles and handkerchiefs
60	63	Textile finishing
60	64	Other textiles
60	65	Leather, leather goods and fur
60	66	Clothing
60	67	Footwear
40	68	Bricks, fireclay and refractory goods
41	69	Pottery and glass
42	70	Cement
43	71	Other building materials, etc.
44	72	Furniture and bedding, etc.
45	73	Timber and miscellaneous wood manufactures
46	74	Paper and board
47	75	Packaging products of paper, board, etc.
48	76	Other paper and board products
60	77	Printing and publishing
49	78	Rubber
50	79	Plastic products n.e.s.
51	80	Other manufacturing
52	81	Construction
53	82	Gas
54	83	Electricity
55	84	Water supply
56	85	Railways
57	86	Road transport
58	87	Other transport
60	88	Communication
59	89	Distributive trades
60	90	Miscellaneous services

TABLE (A3.2) Capital Stock in broad categories of input-output industries; 1968, 1970 prices, £ thousand million. Obtained from Table 64, National Income and Expenditure, 1973. Figures in ( ) obtained directly from C.S.O.

I - O industry	Capital Stock
1	2.9
2 + P.A.*	16.2
4, 5	2.3
6 - 14	(4.2
3, 15, 16	1.7)
17 - 25	4.9
26, 27	4.0
47 - 50	(4.8
28 - 46, 51 - 56	8.6)
56 - 64, 78 - 80	(3.14
65 - 67	1.94)
68 - 71	1.5
72 - 73	0.6
74 - 77	2.5
81	2.0
82	2.4
83	11.1
84	3.1
85	7.9
86	1.8
87	5.6
88	4.4
89, 90	16.8

* Public Authorities

TABLE (A3.3) Derivation of UK Capital Stock

	(1) UK Capital Stock 1970 £M	(2) US Capital Stock 1968 $M	(3) US Labour 1968 $M	(4) $\left(\frac{C}{L}\right)_{US} \times L_{UK}$ 1968 £M	(5) K	(6) Adjustment 1970 £M	(7) UK Capital Stock 1968 £M
1 Coal mining	871						784
2 Stone, slate, sand, etc.	1663						1497
3 Other mining, quarrying	637						573
4 Coke ovens, manuf. fuel	154						139
5 Mineral oil refining	675	13107	1256	364	1.9		608
6 Chemicals	3680	22222	5644	1631	2.3	3880	3492
7 Paint	355	775	566	53	6.7	155	140
8 Plastic, synth. resins, etc.	862	7148	1640	349	2.5		776
9 Iron castings, etc.	837	1698	1215	165	5.1	437	393
10 Other iron and steel	3163	26871	7832	1299	2.4	3563	3207
11 Aluminium and alloys	86	4158	1228	236	0.4	486	437
12 Other non-ferrous metals	401	4108	1889	191	2.1		361
13 Agricultural machinery	68	1192	1118	25	2.7		61
14 Machine tools	181	1161	1121	91	2.0		163
15 Pumps, valves, compressors	261	705	674	104	2.5		235
16 Industrial engines	84	1331	1014	52	1.6		76
17 Textile machinery	169	305	282	59	2.9		152
18 Const.& mech. handling equip.	638	2659	2490	136	4.7	538	484
19 Office machinery	85	1497	1777	31	2.7		77
20 Other non-electrical mach.	682	1549	1715	243	2.8		614
21 Indust. plant and steel works	1124	967	1006	201	5.6	824	742
22 Other mechanical engineering	463	2907	5107	129	3.6		417
23 Instrument engineering	442	3261	3343	183	2.4		398
24 Electrical machinery	498	1682	1668	194	2.6		448
25 Insulated wires and cables	150	243	288	54	2.8		135
26 Electronics and telecom.	853	5867	8055	253	3.4		768
27 Domestic elec. appliances	181	1337	1348	78	2.3		163
28 Other electrical goods	388	3682	4087	105	3.7		349
29 Shipbuilding, etc.	360	874	1466	132	2.7		324
30 Wheeled tractors	539	1192	1117	39	13.8	200	180

TABLE (A3.3) Continued

		(1) UK Capital Stock 1970 £M	(2) US Capital Stock 1968 £M	(3) US Labour 1968 £M	(4) $\left(\frac{C}{L}\right)_{US} \times L_{UK}$ 1968 £M	(5) K	(6) Adjustment 1970 £M	(7) UK Capital Stock 1968 £M
31	Motor vehicles	3527	10380	8463	733	4.8		3174
32	Areospace equipment	709	4936	8469	184	3.9	829	746
33	Other vehicles	26	786	950	61	0.4	245	221
34	Engineers' small tools	181	294	277	79	2.3		163
35	Cutlery and jewellery	178	122	81	55	3.3		160
36	Bolts, nuts, screws, etc.	92	1185	1017	47	1.9		83
37	Wire and wire manufactures	92	396	444	40	2.3		83
38	Cans and metal boxes	70	1277	632	51	1.4		63
39	Other metal goods	872	4445	4677	332	2.6		785
40	Bricks, fireclay, etc.	153	838	404	137	1.1	305	275
41	Pottery and glass	454	10563	4148	331	1.4		409
42	Cement	187	3125	1298	47	4.0	140	126
43	Other building materials	705	1758	888	219	3.2	600	540
44	Furniture and bedding, etc.	215	2005	2706	82	2.6		194
45	Timber and misc. wood manuf.	385	4999	3341	238	1.6		347
46	Paper and board	384	13675	3244	389	1.0	528	475
47	Paper and board packaging	250	2550	1664	137	1.8		225
48	Other paper and board prods.	323	397	397	69	4.7	179	161
49	Rubber	489	358	2424	218	2.2		440
50	Plastic products n.e.s.	356	2724	1813	148	2.4		320
51	Other manufacturing	335	2242	2716	77	4.3		302
52	Construction	2000						1800
53	Gas	2400						2168
54	Electricity	11100						9990
55	Water supply	3100						2790
56	Railways	7900						7110
57	Road transport	1800						1620
58	Other transport	5600						5040
59	Distributive trades	8318						7486
60	ALL OTHER	25070						22563
	TOTAL	97821						88044

TABLE (A3.4) Manpower used by each UK input-output industry; thousands, £M.

	NUMBER		WAGES, ETC.	
	Operatives	Others	Operatives	Others
1 Coal mining	355.4	35.2	322.2	45.9
2 Stone, slate, sand, etc.	11.7	2.6	12.7	2.9
3 Other mining, quarrying	6.6	1.6	7.4	2.5
4 Coke ovens, manuf. fuel	14.5	2.9	15.4	3.6
5 Mineral oil refining	15.7	8.4	18.7	12.7
6 Chemicals	194.0	123.2	192.9	178.4
7 Paint	16.3	15.9	14.5	19.5
8 Plastic, synth. resins, etc.	34.5	22.2	39.5	32.7
9 Iron castings, etc.	83.8	16.4	88.7	20.5
10 Other iron and steel	239.2	74.0	259.1	89.6
11 Aluminium and alloys	44.9	13.1	47.3	16.7
12 Other non-ferrous metals	53.3	19.4	53.5	26.3
13 Agricultural machinery	15.1	6.1	14.1	7.2
14 Machine tools	48.9	22.7	50.2	29.0
15 Pumps, valves, compressors	54.3	29.9	52.1	36.4
16 Industrial engines	22.0	11.4	22.4	13.4
17 Textile machinery	37.3	11.4	35.5	14.0
18 Const.& mech. handling equip.	67.1	34.4	72.0	42.6
19 Office machinery	19.9	10.8	19.6	13.6
20 Other non-electrical mach.	146.4	77.4	146.0	95.8
21 Indust. plant and steel works	97.9	55.5	112.8	75.8
22 Other mechanical engineering	146.3	51.5	143.5	61.7
23 Instrument engineering	108.7	60.8	89.9	76.9
24 Electrical machinery	106.0	61.1	98.5	74.4
25 Insulated wires and cables	37.3	16.6	38.3	20.4
26 Electronics and telecom.	212.4	122.5	157.1	151.2
27 Domestic elec. appliances	51.2	24.1	45.0	26.1
28 Other electrical goods	91.4	28.2	72.7	32.7
29 Shipbuilding, etc.	148.1	38.2	153.7	49.6
30 Wheeled tractors	19.0	7.4	23.6	10.1

TABLE (A3.4) Continued

	NUMBER		WAGES, ETC.	
	Operatives	Others	Operatives	Others
31 Motor vehicles	354.6	100.9	411.0	138.6
32 Areospace equipment	129.6	106.9	142.6	137.6
33 Other vehicles	56.0	12.0	55.7	13.9
34 Engineers' small tools	48.6	15.5	48.2	18.9
35 Cutlery and jewellery	24.8	8.7	20.5	11.4
36 Bolts, nuts, screws, etc.	31.8	8.6	26.7	10.0
37 Wire and wire manufactures	31.2	9.5	26.4	10.0
38 Cans and metal boxes	24.3	4.9	16.8	6.0
39 Other metal goods	232.6	64.4	199.3	75.4
40 Bricks, fireclay, etc.	49.2	8.8	49.3	11.0
41 Pottery and glass	102.4	24.9	88.5	30.2
42 Cement	10.7	3.2	13.4	4.6
43 Other building materials	18.0	7.4	18.8	8.9
44 Furniture and bedding, etc.	69.6	14.9	69.3	18.7
45 Timber and misc. wood manuf.	29.3	5.7	25.5	5.6
46 Paper and board	61.7	14.3	66.5	18.4
47 Paper and board packaging	72.3	17.3	59.8	21.5
48 Other paper and board prods.	52.1	16.9	43.3	19.1
49 Rubber	90.2	33.3	92.5	41.5
50 Plastic products n.e.s.	74.5	21.9	60.4	27.8
51 Other manufacturing	62.6	17.1	45.3	19.4
52 Construction	1231.9	256.7	1341.5	323.6
53 Gas	68.4	54.8	70.2	64.0
54 Electricity	154.3	85.8	160.3	116.3
55 Water supply	32.3	13.4	31.6	17.2
56 Railways	205.3	70.3	247.6	89.2
57 Road transport	421.2	144.3	507.9	183.0
58 Other transport	336.5	115.3	405.8	146.2
59 Distributive trades	1532.8	525.1	1848.3	666.1
60 ALL OTHER	4492.2	1538.8	5416.6	1952.1
TOTAL	12600.2	4326.5	14028.5	5488.4

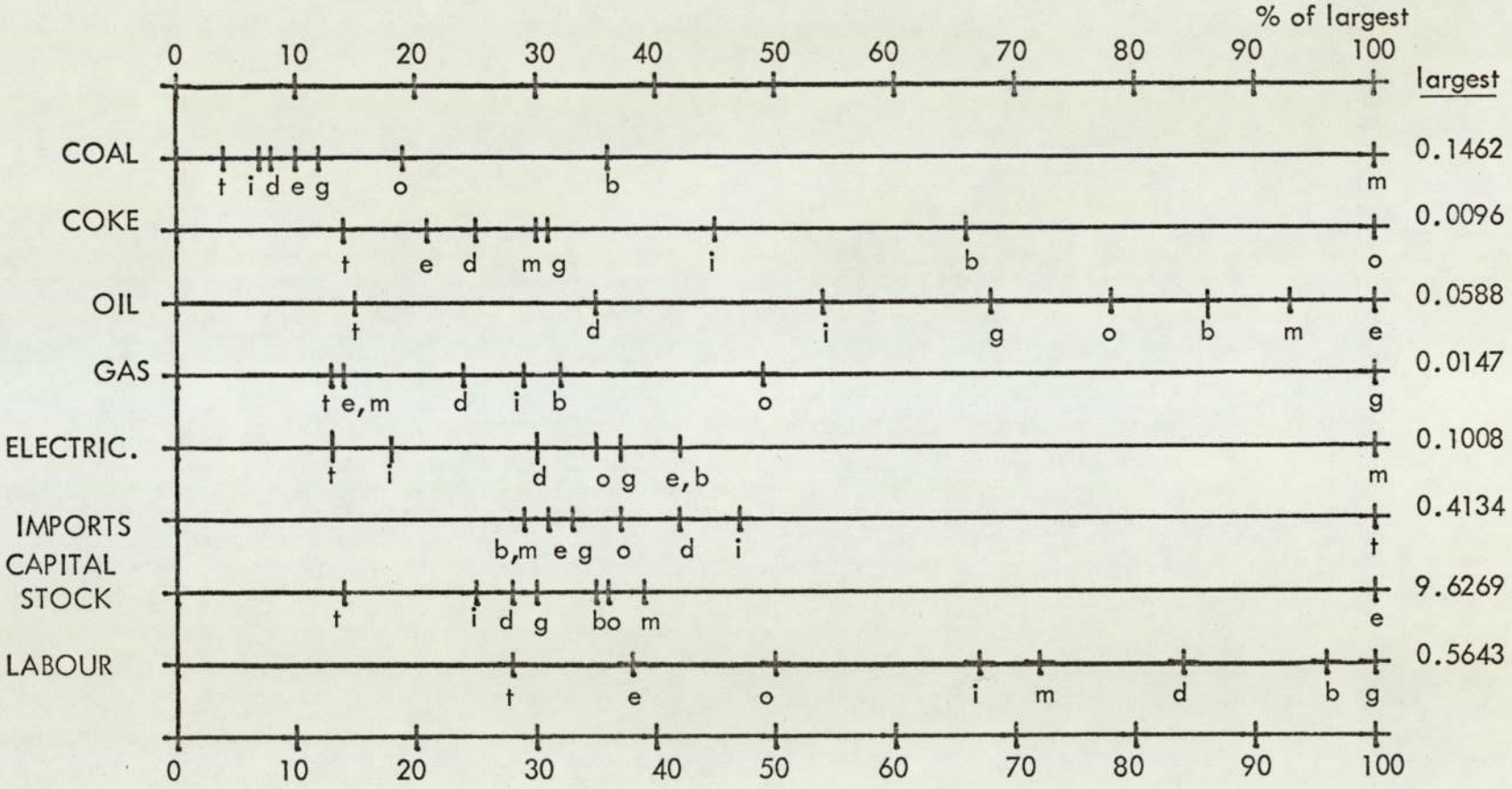


FIGURE (A5.1) COMPARISON OF DIRECT PLUS INDIRECT RESOURCE INTENSITY OF BUILDING MATERIALS.

£ of resource (10^{-3} man-years) required per £ of material: stone, sand, etc. (e), bricks (b), glass & pottery (g), cement (m), other building materials (o), timber (t), paint (i), plastic products (d). (cf. Fig. (9.1))

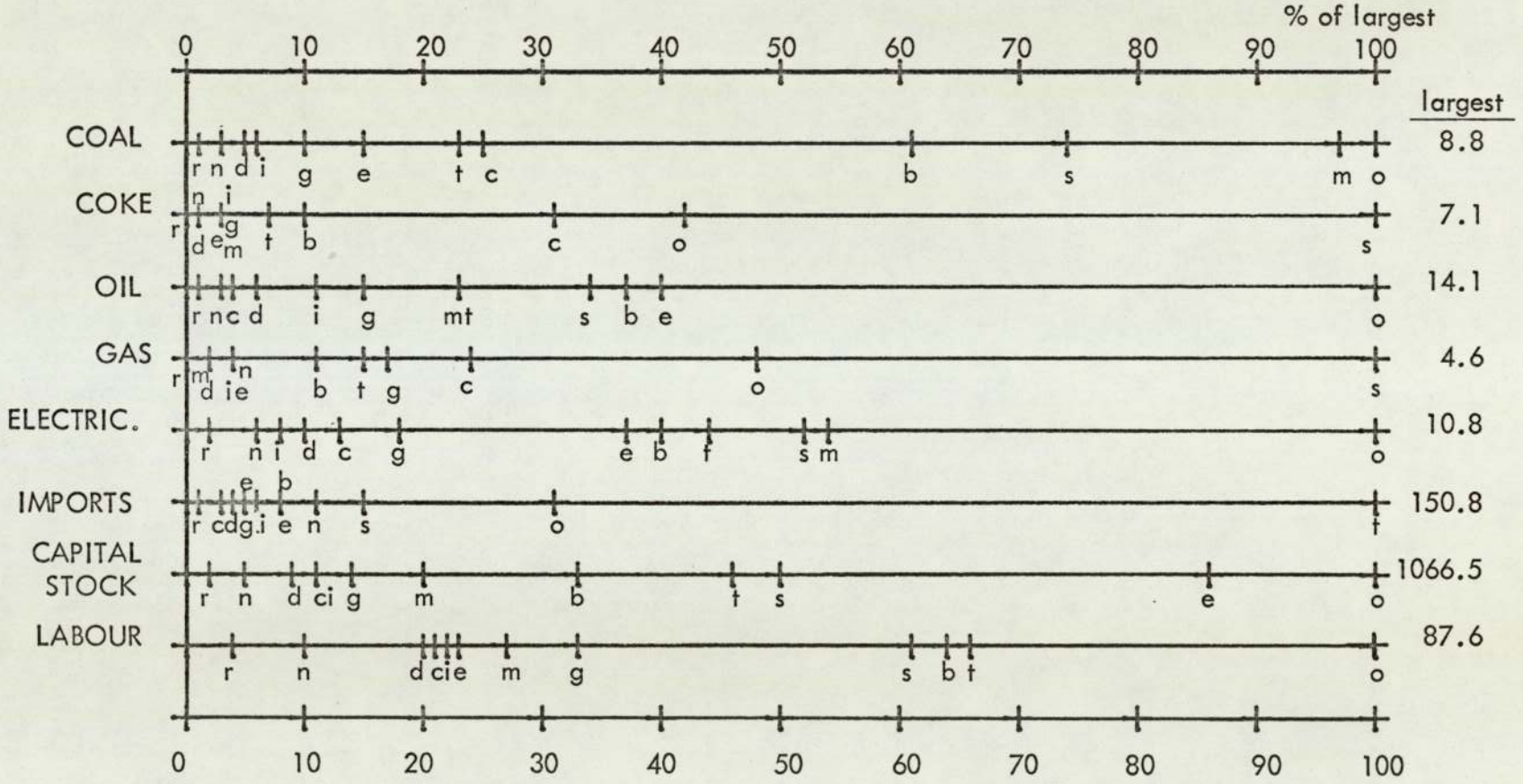


FIGURE (A5.2) TOTAL RESOURCE USE VIA MATERIALS BY UK CONSTRUCTION INDUSTRY.

£M, thousand man-years: cast iron (c), steel (s), non-ferrous metals excepting aluminium (n), rubber (r), stone, sand, etc. (e), bricks (b), glass and pottery (g), cement (m), other building materials (o), timber (t), paint (i), plastic products (d). Aluminium and plastic materials .. insignificant.

LIST OF SYMBOLS AND NOTATION

The following symbols have been used throughout the text. In addition there have been other symbols defined locally to some sections.

SECTION (3-2.1) See also Figure (3.1)

Matrix Order	Matrix	Definition
n x n	Flow A	the matrix of total sales by each industry of each commodity (make matrix)
n x n	Flow B	the matrix of total purchases by each industry of each commodity (absorption matrix)
n x n	Flow D	the matrix of total purchase by each industry of the products of each industry (interindustry flow matrix)
s x n	Flow U	the matrix of total purchase by each industry of primary inputs
n x m	Flow W_C, Flow W_I	the matrix showing for each category of final demand the total purchase of commodities, industrial products, respectively
n x 1	f_C, f_I	the matrix of total final demand for each commodity, industrial product, respectively
n x 1	z	the matrix of total output of each commodity
n x 1	t	the matrix of total output (= input) of each industry
s x 1	g	the matrix of total demand for primary inputs by all industries
n x 1	p_C, p_I	the matrix of price indices for commodities, industries, respectively

Matrix Order	Matrix	Definition
	A^*, A, B, D, U	the coefficient matrices of the corresponding flow matrices (defined in equation (3.1))
	$a_{i,j}$, $b_{i,j}$, $d_{i,j}$	the i,j elements of the coefficient matrices
	$\hat{x}$	a diagonal matrix with vector x on the diagonal
n x 1	θ	the matrix whose j^{th} element is the sum of industry j primary inputs in coefficient form (see equation (3.26))
	D^+, D^*, Flow W_I^+, Flow W_I^*, f_I^+, f_I^*	matrices corresponding to D, Flow W_I, and f_I obtained by the PMPA and POPA, respectively. (see equations (3.12) to (3.19))

SECTION (8-2.1)

t_i, g_i, p_i, θ_i, $u_{i,j}$, $d_{i,j}$, f_i the elements of matrices t, g, p_I, θ, U, D, f_I respectively

$\delta_{i,j}$ the elements of $(I - D)^{-1}$, i.e. the total input coefficient from industry i to industry j

$\gamma_{i,j}$ the elements of $U(I - D)^{-1}$, i.e. the total primary input coefficient of primary input i to industry j

m — a subscript which may take any value corresponding to the manufacting industries in which the technical change occurs (columns of D)

$\sum_m$ — a summation only over those industries m involved in the technical change

p — a subscript corresponding to the material used in a changed amount

ε_m — an increase in $d_{p,m}$

$\nu_{i,m}$ — an increase in $u_{i,m}$

Δ — a forward difference operator signifying an increase in a variable

(n) — a superscript to a variable which has taken a new value
e.g $t^{(n)} = t + \Delta t$

For convenience define

$$\sigma_i = \sum_m \varepsilon_m \delta_{m,i}$$

SECTION (8.3)

ℓ — a subscript which may take any value corresponding to the inputs which are involved in the technical change by industries m (rows of D), including p

$\sum_\ell$ — a summation only over those inputs ℓ involved in the technical change

$\Pi_{\ell,m}$ a proportion signifying the increase in input ℓ per unit increase in p in industry m. I.E. $\Delta d_{\ell,m} = \Pi_{\ell,m}\epsilon_m$, NB $\Pi_{p,m} = 1$

Π_{ℓ} a proportion signifying the increase in input ℓ per unit increase in p in all industries. I.E. $\Pi_{\ell} = \Pi_{\ell,m}$ if Π_{ℓ} is constant (common technology) for all m.

$\Pi_{i,m}^{(\theta)}$, $\Pi_{i}^{(\theta)}$ as $\Pi_{\ell,m}$, Π_{ℓ} but relevant to primary input i

k a constant signifying the proportion increase in the use of material p by industry m, i.e. $k \geq -1$

LIST OF ASSUMPTIONS

The following are the abbreviated assumptions used in the text.

(CMSA) Constant Market Share Assumption

"Every industry maintains a constant share of each commodity market in which it participates."

(CCIA) Constant Commodity Input Assumption

"Every industry purchases its commodity inputs in a constant ratio."

(CCOA) Constant Commodity Output Assumption

"Every industry produces its commodity output in a constant ratio."

(CIIA) Constant Industry Input Assumption

"Every industry purchases its industrial inputs in a constant ratio."

(IIPA) Identical Industry Product Assumption

"For all industries, all products produced by the same industry are identical."

(ICAA) Identical Commodity and Availability Assumption

"For all commodity markets, all commodities in the same market are identical and equally available to all purchasers."

(PMPA) Proportional Market Purchase Assumption

"Each commodity is purchased from every producer of that commodity in proportion to each industry's market share of that commodity."

(POPA) Proportional Output Purchase Assumption

"Every purchaser purchases from each industry all commodities that the industry makes, and in proportion to the output mix of the industry."

(CRDEA) Constant Regional Distribution of Employment Assumption

"In every industry each unit of output is produced by employment which has the same regional distribution as the total employment in that industry."

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