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I am submitting herewith a dissertation written by Ali Adel Abdul-Khalek Albadawy entitled "Restructuring of World Shipping Capacity Under the Conditions of the United Nations Conference of Plenipotentiaries on a Code of Conduct for Liner Conference." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Business Administration.

Gary N. Dicer, Major Professor

We have read this dissertation
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Vice Chancellor
Graduate Studies and Research

RESTRUCTURING OF WORLD SHIPPING CAPACITY UNDER THE CONDITIONS OF THE UNITED NATIONS CONFERENCE OF PLENIPOTENTIARIES ON A CODE OF CONDUCT FOR LINER CONFERENCE

A Dissertation

Presented for the

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I would like to present this effort to the spirit of my father and the spirit of my mother who passed away before seeing it.

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ABSTRACT

The decade of the 70's has experienced the worst slump in international shipping in over a hundred years. Shipping firms, both private and government owned, had little warning of the political and economic factors that caused this slump to occur. As a result, the world shipping industry has substantial tonnage laid up, being used at less than full capacity, and slated for early scrapping. This overcapacity problem has been compounded by recent trends to promote national flag shipping, particularly by the developing countries of the world. This culminated in the 1974 United Nations Conference on Trade and Development proposal requiring 40% of liner trade to move in the exporting country's ships, 40% of the trade to move in the importing country's ships, and allowing only 20% to be available for third flag movements. More recent proposals want to expand this cargo splitting procedure to tanker and bulk carriage as well as the liner trades. Obviously, such cargo reservation requirements will lead to greater overcapacity since many of the developing countries will have to build or acquire ship capacity sufficient to meet their 40% requirements.

This particular research is an attempt to provide a model that can be used by an individual country in determining its required capacity for maritime transportation. Such a model would be of benefit to policy makers, financial institutions, as well as the ship building industry in forecasting future needs. The model developed is as follows:

$$S_x = \{[\sum_{j=1}^{k}\sum_{i=1}^{1} A_{ji})\, G_x + (\sum_{m=1}^{n}\sum_{i=1}^{1} A_{mi})\, R_x] \cdot 40 + C_x\}E_x$$

where: S_x = The shipping capacity required for country x

A_{ji} = Trade contract j for exports to country i

A_{mi} = Trade contract m for imports from country i

G_x = Rate of growth of imports of country x

R_x = Rate of growth of exports of country x

C_x = Amount of reserve needed by country x

E_x = Efficiency factor of country x $[1 + \frac{\text{dead freight}}{\text{capacity}}]$.

Nine years of data, 1967-1975, was applied and then compared with actual capacity to test the accuracy of the model. In addition, three specific countries, Argentina, Norway, and Yugoslavia, were analyzed in detail to explain the operation of the model and reasons for possible deviations. Measures used were both on the national and international level. The results indicated that international level variables tended to explain merchant shipping changes much stronger than variables on the national level. This supports the conclusion that any solution to the world shipping overcapacity problem has to be at the international level. The actions of individual countries in determining their shipping needs and cargo reservation policies cannot lead to a global solution.

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CHAPTER I

INTRODUCTION

Maritime transportation is a service upon which most of the business of the world depends. It is the means that creates the location and time utilization of goods and commodities. Maritime transportation is international by its nature, and, although some agreements exist (i.e., The Hague Rules, Uniform Charter Parties, Conferences), no uniform body of international law applies to the maritime industry. Individual countries have little control over the total international industry.

Complex problems which have developed because of this unregulated nature of the international maritime industry can be illustrated by the following hypothetical example: A ship registered in Liberia is owned by a British citizen whose company is based in Switzerland. The ship has a Greek captain, Italian engineer, and Spanish crew. The ship is carrying Nigerian peanuts to France, Turkey, and Lebanon. Insurance for the ship is provided through a Swedish company and for the cargo, insurance is provided through a Danish company. The charter was Egyptian and the broker was Canadian.

Maritime transportation is not only an important service activity, but it is also a major industry. Related activities extend to port operations, shipbuilding, land-side transportation facilities, warehouses, banks, lawyers and longshoremen. Maritime transportation is important because of its impact on the accounts

of the balance of payments.[1] For example, the purchase of ships built in foreign countries and the utilization of foreign ships to carry imports and exports will be a drain on currency reserves. Use of national ships to carry goods and commodities for other countries can be a source of revenue, foreign currency, and reserves. Generally, maritime transportation is important and necessary for a country to participate in international trade.

Public and private financing for the maritime transportation industry is a very important activity. Large capital investments involve some of the most important decisions faced by any government. By their very nature, they require the commitment of large amounts of scarce resources, including foreign exchange, to the maritime field and are thus of considerable importance in determining the pace and pattern of a country's economic development for many years into the future. Major arguments for state support, which are particularly applicable to developing countries, are as follows:

(a) The high capital costs involved in setting up a maritime transportation industry;

(b) The significance of economies of scale (particularly knowledgeable labor and management costs);

(c) Expensive labor since countries new to maritime industry are unable to draw on a pool of trained labor;

(d) Use of national fleets as a means of improving balance of trade;

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[1] See United Nations Conference on Trade and Development, "Establishment or Expansion of Merchant Marines in Developing Countries," Report by the Secretariat, United Nations, New York, 1968, Chapter 5, pp. 31-41, Annex A and B.

Although most countries have economically based reasons to establish or expand their national fleet capacity, many countries also have other reasons to expand their capacity and assist their maritime transportation industry. Some of the other reasons may be:

(a) A tendency to maintain a fleet for national emergencies and in case of war;

(b) Political motivation to prevent unemployment, in case of a close-down of shipyards, or to meet the demands of important vested interests in the country;

(c) National prestige and image in the world community;

(d) Use of maritime industry as a source of information for defense and diplomatic reasons.

Although the reasons why maritime transportation is important to a country differ, the importance of maritime transportation is recognized by all countries. Consequently, the governments of the countries of the world have to pay attention to the problems of the international maritime industry.

One of the most important of these problems is that of world overcapacity. This problem is the result of national interests in the economic and noneconomic benefits of expanding or establishing maritime transportation capacity. Each country wants an optimum capacity to meet its individual goals, but this usually leads to overcapacity of the world needs. This is particularly true when one mixes the economic and "political" needs for capacity. For example, the individual countries include political demands in their decision making while the world fleet is satisfying only economic demands for trade.

Table 1 shows the growth in the world capacity of maritime transportation.

Table 1

World Capacity of Maritime Transportation
('000 Metric Tons)

Year	Capacity	Rate of Change from 1967
1967	182,100	---
1968	194,152	6.6%
1969	211,661	16.2%
1970	227,490	24.9%
1971	247,203	35.8%
1972	268,340	47.4%
1973	289,927	59.2%
1974	311,323	71.0%
1975	342,162	87.9%
1976	372,000	104.3%

[a]Statistical Yearbook of the United Nations, The United Nations, New York, 1976.

I. The Issue of Overcapacity

The reasons for this continuous growth in the world's merchant shipping fleet is seen from several different points of view. Mr. Edwin Hood, president of Shipbuilders' Council of America, in his speech to the American Society of Naval Engineers, stated that he believes "a crisis is in the making." He indicates that a heavy volume of new building was generated in the U.S. by the 1970 Merchant Martine Act, which extended aid to all types of vessels in foreign trades. A reduction in world trade, a world recession, and other factors have combined to dampen the enthusiasm and the need for new vessels.

This has resulted in a drastic decline in orders for new vessels since 1972. The United States experience is shown in Table 2.

Table 2

U.S. Orders for New Vessels
Since 1972

Year	No. Vessels Ordered
1972	48
1973	43
1974	14
1976	15
1977	2

[a] Journal of Commerce (May 6, 1977), 1.

Mr. Svensalen, chairman of Rideni AbSulenia of Stockholm, addressed the general meetings of the Baltic and International Maritime Conference and commented that the bulk carrier market was headed for severe overcapacity. Mr. Svensalen said that at the end of 1977 there was a 15% surplus of bulk carriers of over 18,000 dwt (dead weight tons). The bulk carrier surplus will be even larger in 1977-78 when a large number of ships will be delivered. As governments encourage the shipyards to build ships at a loss, the present glut will worsen. This overcapacity could last for ten years.[2] Olls Norland, executive director of the Hambros Bank, London, estimated that the total global debt on ships afloat was approximately $38 billion, with more than one half of this total debt guaranteed by governments. Almost all new shipbuilding orders

[2] "Difficulties Forecast for Tanker Owners," Journal of Commerce (May 13, 1977), 9.

placed since the beginning of 1976 are being financed by government-backed credits. The glut will be worsened by governments attempting to rescue their shipyards, Mr. Norland warned. Very cheap long-term financing is being given to developing countries (under the heading of aid) and to domestic owners. Mr. Norland cautioned that the maintenance of shipbuilding capacity at an artificially high level will defer indefinitely the date when a genuine recovery can occur. Each ship built at a loss and financed through generous government credits pushes down the market for all similar ships and increases the credit risks associated with these ships.[3] Mr. Isano Yamashita, chairman of Mitsui Shipbuilding of Japan, urged a global response to the world's shipbuilding crisis. Shipyards in developing nations should be involved in any move to nationalize the industry, he said. Despite Japan's program of reducing capacity by 35% by 1980, it had come under attack from European yards. Mr. Yamashita offered an olive branch to European yards which have complained bitterly that Japan has monopolized the world's shipbuilding market for the past two years: "We are desirous to strive hand in hand to tide over the difficulties in a spirit of national understanding."[4]

A system of "semi-protection" for the European shipbuilding industry to ensure the future of the best production facilities while phasing out some of the less productive units was proposed by Graham Day, the former chief executive designate of the new state-owned British Shipbuilders. He warned that without harmonized action, very few European yards would survive. Addressing the

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[3] Ibid.

[4] Ibid.

Nor-Shipping Seminar, Mr. Day suggested some form of cargo preference on a European rather than national scale, and he urged European shipowners not to disassociate themselves from any such schemes as "they might be in line in seeking some structured environment." Mr. Day stressed that some yards have to be taken out of production for good if worldwide overcapacity is to be eliminated. There should be no mothballing of facilities so that they could be brought into operations every time there was short-term demand.[5]

Sir James Steel, the chairman of the Future Within Shipping Group, stated that it would be unrealistic for politicians to suppose that any kind of subsidy will fill U.K. yards with tanker or bulk carrier orders. A revival in world trade will bring dry cargo ships out of lay-up and eventually will create a genuine demand for new ships. Sir James added that "the grim reality is a choice between a brisk revival in world trade and a drastic reduction in world shipbuilding capacity."[6]

As seen in the previous comments by shipping leaders, the following are among the major symptoms and results of the overcapacity problem:

1. Many shipyards have closed. These closures have occurred because the capacity of all shipbuilding yards is much greater than that required by worldwide needs. Shipyards in countries

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[5] "Steps Urged to Protect Shipbuilders," Journal of Commerce (May 13, 1977), 13.

[6] "Trade Revival Seen More Help to Shipping Than Subsidies," Journal of Commerce (June 3, 1977), 9.

with high labor costs have been most vulnerable to closure because of their inability to compete in the world market.

2. Voluntary nationalization of shipyards and fleets is increasing. When private owners are unable to make a profit, they turn to government to redeem their investment. Labor supports these nationalization efforts in order to protect jobs.

3. Many ships are registered under the flag of convenience, not the flag of the owner's country. In many cases this is to avoid taxation. In other cases, as in the United States, it is to avoid requirements for having the ship built in and/or having the crew provided from the home country where labor is costly. These are economy measures necessitated by conditions within the international maritime industry.

4. There is no international means by which to control over-expansion by particular countries. Unless all countries work together to determine their aggregate needs and expand accordingly, this will continue to be a problem.

5. Subsidies paid by governments to operate national fleets are growing. These payments are necessary to cover the operating costs resulting from uneconomical operations.

There were some relief measures to assist in lightening the load, of course, but the aspirin that relieved the headache left the fundamental causes of the industry's malaise uncured. These relief measures included:

1. Early scrapping of older ships.

2. Cancellation of new orders.

3. Conversion of some tankers into bulk carriers.

4. Slow steaming to reduce operating costs.

5. American insatiable desire for oil imports.

6. Using tankers to stock crude oil.

7. Cargo preference bills.

On the other hand, there were also some negative factors that hampered the success of the relief measures, such as the growing flow of North Sea oil which has to be transported only a short distance; the threat to profits of shipping companies as a result of the rising crew costs; and U.S. demand that all tankers calling at American ports be equipped with segregated ballast tanks to cut down on marine pollution dangers which threaten to reduce profit margins.

Finally, the overcapacity problem is compounded by the countries of the Third World who are interested in expanding their national fleets (Table 3). Some of the countries are rich, some are poor, and there are numerous reasons which motivate them to expand their maritime transportation industries. These countries look upon ocean transportation as a key element in their development plans.

II. The UNCTAD Solution

The general assembly of the United Nations, by resolution 3035 (XXVII) of December 19, 1972, requested the Secretary-General of the United Nations to convene as early as possible in 1973, under the auspices of the United Nations Conference on Trade and Development, a conference of Plenipotentiaries to consider and adopt a convention or any other multilateral legally binding instrument on a code of conduct for liner conferences. The objective of the

Table 3

Merchant Shipping Fleets
(In '000 Gross Register Tons)

	1967	1968	1969	1970	1971	1972	1973	19974	1975
Argentina	3509	3388	3447	3583	3713	3965	4112	3985	4095
Belgium	2660	2640	2977	3006	3348	3373	3289	3439	3843
Brazil	3693	3662	3908	4873	4899	5335	5952	6874	7616
Columbia	555	592	583	665	592	657	634	597	592
Cyprus	1022	1848	2179	3220	4239	5702	8309	9608	9115
Denmark	8530	9067	9877	9379	9962	11377	11623	12622	12673
Egypt	668	708	676	674	682	688	761	705	852
Finland	3011	3192	3764	3954	4163	4613	4375	4268	5666
Germany (Fed. Rep.)	16952	18474	19886	22303	24562	2410	22400	22583	24103
Greece	21035	20978	24284	30994	36977	43381	54604	61578	63751
Italy	17600	18746	19918	31078	23033	23169	25094	26381	28688
Korea, Rep. of	866	1341	2171	2403	2660	2991	3124	3470	4596
Libyan Arab Rep.	000	9	11	11	14	17	105	453	685
Mexico	934	1143	1200	1078	1135	1180	1282	1458	1627
Netherlands	14498	14908	14872	14736	14911	14071	14232	15568	16072
Norway	52021	55658	55691	54752	61468	66525	66847	70434	74016
Philippines	2038	2417	2629	2677	2677	2618	2680	2168	2488
Spain	7276	7983	9003	9738	11133	12169	13677	14006	15375
Sweden	13117	13768	14232	13926	14088	15939	16043	17622	21183
U.K.	61456	62036	67479	73085	77358	81009	85353	89332	93834
U.S.A.	57542	55660	55327	52250	46033	42518	42201	40834	41281
Uruguay	357	371	317	399	461	405	405	368	371
Yugoslavia	3385	3586	4041	4290	4367	4494	4714	5032	5301

Source: Statistical Yearbook of the United Nations, pp. 493-515.

conference was to improve the liner conference system, recognizing the need for a universally acceptable code of conduct for liner conferences. The United Nations conference resulted in a final act on a code of conduct for liner conference.

The final act, stated in Chapter 11, "Relation Among Member Lines," in Article 2, items 4-a, 4-b is known as the 40-40-20 Rule and will be summarized and discussed in Chapter II.

4-a. The group of national shipping lines of each of two countries the foreign trade between which is carried by the conference shall have equal rights to participate in the freight and volume of traffic generated by their manual foreign trade and carried by the conference.

4-b. Third country shipping lines, if any, shall have the right to acquire a significant part, such as 20% in the freight and volume of traffic generated by that trade.

Mr. C. H. Tung, the managing director of Tung Group, stated that "All shipping countries have to be persuaded that overcapacity is no good for anyone." Tung said, "A satisfactory formula must be worked out." And, "The real key to the situation is to get other countries to expand only according to their needs."[7]

III. Statement of the Problem

The problem which this research attempts to address is determining the precise need for a country for maritime transportation capacity. This problem comes about as a result of the existing excess capacity in the world fleet and the conflicting interests of individual countries. The problem is compounded by the absence of international attention to the maritime industry. Individual countries look

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[7] Bruce Maxwell, "Expansion for Sake of the National Ego Only," Far East Economic Review (February 10, 1978), 36-37.

upon maritime transportation in terms of how it will serve their particular country. Thus, the individual decisions of the many countries of the world have led to the existing international problem. Thus, individual countries need a standardized method for determining the capacity of its maritime transportation fleet, under its own flag, capable of serving its import/export seaborne trade.

IV. The Purpose of the Study

The main purpose of this study is to provide a model to help decision-makers in any country to determine the needs of that country for a national maritime fleet. This model will be based on the UNCTAD (United Nations Conference on Trade and Development) 40-40-20 Rule determined in the United Nations Conference of Plenipotentiaries on a code of conduct for Liner Conferences held at Geneva from November 12 to December 15, 1973, and from March 11 to April 24, 1974, and subsequently ratified by a majority of the UNCTAD members. Such a model will help countries to set their national maritime policies, shipping investors to decide where to allocate their funds, shipbuilders to identify their target markets, and will help shippers to set their strategies for buying, chartering, or using liners for both long-term and short-term use.

V. Methodology

The model will be developed intuitively by the synthesis of current maritime operating procedures and practices, and tested through the use of data from 22 selected countries.

Briefly, the framework for the model is as follows:

In order to determine the need of a country for maritime transportation, a formula based on the 40-40-20 Rule will be used as follows:

$$S_x \left[\left\{ \left(\sum_{j=1}^{K} \sum_{i=1}^{L} A_{ji} \right) G_x + \left(\sum_{m-1}^{N} \sum_{i=1}^{L} A_{mi} \right) R_x \right\} .40 + C_x \right] E_x$$

where

A_{ji} = Seaborne trade imports (Tables 4 and 5).

G_x = Amount of growth of imports = (rate of growth of imports)

A_{mi} = Seaborne exports

R_x = Amount of growth of exports = (rate of growth of exports)

C_x = Amount of reserve needed

E_x = Efficiency factor $\left(1 + \frac{\text{dead freight}}{\text{capacity}} \right)$

There are differences among countries for each of the above components, but there are no data available that will help in identifying these differences. Some constant factors will be used in determining:

1. The percent of reserve required for emergencies (depending upon the country's national maritime policy, its rate of growth, and its stability).

2. The efficiency factor (a function of capacity and management skills).

The model will be applied to available data on seaborne trade and additional explanation will be provided to show the forecasting ability of the model in real situations.

The result of applying the model will be compared with the actual situation to determine if there is any deviation. If any

Table 4

Total Cargo Unloaded in External Trades (Seaborne)
(In '000 Metric Tons)

	1967	1968	1969	1970	1971	1972	1973	19974	1975
Argentina	8557	8234	11480	10867	11505	9725	11472	12178	12220
Belgium	45763	54505	62626	71079	63055	45488	61468	63782	50444
Brazil	19045	23648	24621	28073	32923	38487	49769	54898	55605
Columbia	941	1626	2165	2461	1941	1620	3224	2553	2101
Cyprus	1007	1034	1285	1441	1529	1809	2155	1404	1151
Denmark	24637	25789	28687	31521	30589	32369	33284	31701	29657
Egypt	8142	6740	6385	6985	8061	6682	8630	6919	9624
Finland	13902	15958	18419	20180	30506	21647	24400	253065	23175
Germany (Fed. Rep.)	78013	84888	92745	106332	101777	102019	110230	115119	99797
Greece	9872	10507	12038	13391	14170	17772	25257	25284	23022
Italy	144570	169115	182731	200916	209868	221930	237336	225515	198876
Korea, Rep. of	9737	13542	17109	18695	24257	24699	31798	33829	35142
Libyan Arab Rep.	2629	3039	3009	2600	3004	5649	5051	6413	9619
Mexico	1542	1871	2667	3376	4809	6868	10454	8962	9300
Netherlands	132294	151492	172410	202729	208912	232800	261833	250916	242590
Norway	15112	17136	17543	20804	19112	20533	22325	22644	20044
Philippines	10388	11772	12580	12539	13462	13363	13928	13532	15051
Spain	41651	46023	50689	52917	65959	72276	71398	76569	74366
Sweden	36443	41918	42454	46707	46870	47780	50487	55233	52151
U.K.	167548	179036	188620	200004	206519	206092	221085	213909	177220
Uruguay	2097	2543	2235	2412	2471	2718	2749	2764	2595
U.S.A.	249106	276442	281248	292786	306893	340961	422097	484878	409248
Yugoslavia	7938	8642	8826	11574	12707	11541	12333	14866	13980

Source: Statistical Yearbook of the United Nations, 1977, pp. 497-507.

Table 5

Total Cargo Loaded in External Trade (Seaborne)
(In '000 Metric Tons)

	1967	1968	1969	1970	1971	1972	1973	19974	1975
Argentina	12306	11751	13244	15237	14437	9979	14648	15662	11770
Belgium	21948	26122	26423	23270	28324	30805	36801	40156	34933
Brazil	21129	23487	30205	39970	43824	45604	64059	78462	92983
Columbia	7620	5906	6957	5364	1429	1700	3022	2272	3374
Cyprus	1448	1560	1558	1551	1359	1255	1167	1013	1330
Denmark	4938	5265	6204	6774	7373	8314	8313	8752	7531
Egypt	4454	6571	13020	12708	15911	8634	12681	3170	3102
Finland	9861	10754	12033	12360	11248	11883	12702	11440	4217
Germany (Fed. Rep.)	19394	21305	21878	22493	21007	22460	27791	15507	27368
Greece	3571	3920	4136	4158	4415	5229	8846	12179	14336
Italy	29741	31629	32469	34799	34938	37212	37041	35920	29400
Korea, Rep. of	1786	2254	2891	3589	4192	6010	7994	8258	9983
Libyan Arab Rep.	82873	124927	146927	158251	129380	109958	107300	75045	72994
Mexico	9362	9324	8958	9705	9588	10157	11663	13266	13988
Netherlands	37609	40489	47773	63935	67692	77219	88121	85120	80801
Norway	29641	36049	36833	35475	347646	39301	42499	40549	36478
Philippines	11858	13421	14408	15792	16148	15123	16768	12064	12943
Spain	11058	16836	14775	14517	16267	17278	17038	18031	17067
Sweden	23555	27244	27663	26985	30153	33533	40126	41284	72419
U.K.	35152	41027	45001	50267	40558	50714	56157	53739	51290
U.S.A.	171169	177264	181264	218256	185935	209058	250191	245518	245716
Uruguay	1163	1395	1617	1631	1359	1237	695	938	947
Yugoslavia	4246	4201	4064	3844	3336	3186	3247	3992	3481

Source: Statistical Yearbook of the United Nations, 1977, pp. 497-507.

deviations occur, an investigation will be conducted to identify the reasons for the discrepancy. This investigation will consist of an examination of the changes in shipping capacity in relation to two different set of parameters. The first set of parameters is on the national level and the other set of parameters is on the international level.

1. The national level parameters include:
   a. The balance of payments as measured by the changes the current account and the changes in the net reserve.
   b. The exports of a country represented by the seaborne cargo loaded.
   c. The imports of a country represented by the seaborne cargo unloaded.
2. The international level parameters include:
   a. World seaborne trade as measured by changes in the trade in
   - Crude oil in millions of tons
   - Oil products in millions of tons
   - Iron ore in millions of tons
   - Coal in millions of tons
   - Grain in millions of tons
   - Total seaborne trade in millions of tons
   b. World fleet as measured by changes in:
   - Number of oil tankers
   - Number of combined carriers
   - Total number of world fleet
   - Capacity of oil tankers in million dwt
   - Capacity of combined carriers in million dwt

- Capacity of bulk carriers

- Capacity of total world fleet in million dwt

c. World Order Book as measured by changes in:

- Number of oil tankers

- Number of combined carriers

- Number of bulk carriers

- Number of total (including other carriers)

- ('000) dwt oil tankers

- ('000) dwt combined carriers

- ('000) dwt bulk carriers

- ('000) dwt total (including others)

d. World laid up tonnage

- ('000) dwt oil tankers

- ('000) dwt dry cargo

- ('000) dwt total

Then a stepwise multiple regression will be made in order to identify the reasons behind the change in the capacity and its impact on international maritime transportation.

The data used were published in the following sources:

1. Tables of Merchant Shipping Fleets of the United Nations Statistical Yearbook.

2. Europa Yearbook.

3. World Table of the World Book (Table 6).

4. Fearnley Egers Chartering Co., Ltd., publication (Review 1976, January 1977).

5. International Monetary Fund Statistics.

Table 6

Average Annual Growth Rate of Imports and Exports, 1960-1973

	Imports	Exports
Argentina	4.5	2.0
Belgium	7.3	7.2
Brazil	19.6	11.3
Columbia	6.6	4.1
Cyprus	11.0	9.5
Denmark	7.3	7.2
Egypt	6.0	0.3
Finland	7.7	8.8
Germany (Feb. Rep.)	9.8	9.4
Greece	10.0	11.3
Italy	7.0	17.4
Korea (Rep. of)	25.6	34.4
Libyan Arab Rep.	9.9	11.8
Mexico	8.0	6.9
Netherlands	12.0	13.2
Norway	6.4	7.2
Philippines	2.0	4.1
Spain	8.1	14.0
Sweden	6.4	8.2
U.K.	5.8	6.1
U.S.A.	8.4	6.6
Uruguay	6.2	0.2

Source: "The World Tables," The World Bank, 1976.

6. International Financial Statistics.

The analysis will be conducted to:

1. Determine the capacity of each country under the 40-40-20 Rule (the formula will determine the capacity).

2. Analyze examples to show the motivations behind expansion.

3. Explain the different situations that result from connecting the capacity to the reason or, in another way, cause-effect relationship.

4. There will be some difficulties in applying the solution and the study will go on to explore the difficulties in application.

VI. Limitations of the Study

In the conclusion, the limitations of the study will be given. However, the primary limitation was in selecting the countries. It was difficult to find more than 22 countries which had similar data available.

A second problem of this study is that it deals with capacity as a whole and not capacity for a particular kind of carrier. However, the same principle can be followed for any classified data available for any country.

VII. Outline of the Study

Chapter I: Introduction, importance of maritime transportation, identification of the problem and its scope, the purpose of the study, outline of the study.

Chapter II: Background about the 40-40-20 Rule of the United Nations Conference on Trade and Development.

Chapter III: Review of literature, review of published

articles about overcapacity problem, the need for a solution to the problem.

Chapter IV: Methodology, how the model will be developed, limitations of the model, restructuring effects, the data and its limitations.

Chapter V: The analysis, introduction, development of the tables, identification of the deviations, explanatory model for Argentina, Norway, and Yugoslavia.

Chapter VI. Conclusions and recommendations, advantages of using the model, limitations of the model, further studies needed.

Appendix: Computer outputs for the regression analysis.

CHAPTER II

THE 40-40-20 RULE[1]

I. Background

> The liner conference system has been in existence for nearly a century and there are some 3609 liner conferences serving the trade routes of the world. It is generally accepted that the liner conference system plays a useful role in serving international trade. At the same time it is generally recognized that improvements need to be made in order to remove any unfair or discriminatory practices and to bring the system into line with present days needs and circumstances.[2]

In May 1970 the UNCTAD Committee on Shipping agreed that improvements in the liner's conference system were necessary and decided to transmit the report to the UNCTAD working group on international shipping legislation for consideration. In April/May 1972 the conference requested the general assembly at its twenty-seventh session to convene a conference of plenipotentiaries to adopt a code of conduct for liner conferences. It requested the assembly to establish a preparatory committee for the conference. In December 1972, responding to the request, the general assembly, in its resolution 3035 (XXVII) requested the secretary general of the United Nations to convene a conference of plenipotentiaries under the auspices of UNCTAD as early as possible in 1973. The conference was to convene to

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[1]This is a summary of the United Nations Conference of Plenipotentiaries on a Code of Conduct for Liner Conferences, held at Geneva from November 12 to December 15, 1973 (first part) and from March 11 to April 6, 1974 (second part), United Nations, New York, 1975

[2]Ibid., Vol. I, p. 1.

> consider and adopt a convention or any other multilateral legally binding instrument on a code of conduct for liner conferences and establish a 40 member preparatory committee, the members of which were to be appointed by the secretary general of UNCTAD, to prepare a graph of the code for submission to the conference of plenipotentiaries.[3]

The resolution was adopted by 96 votes to 0 with 28 abstentions.

The preparatory committee held a first session in January 1973 and a second session in June 1973. The preparatory committee had before it, among other documents, the draft code of conduct for liner conferences annexed to conference resolution 66(111). At the second session 16 developed market-economy countries submitted counter proposals for a draft code of conduct for consideration by the United Nations Conference of Plenipotentiaries on a code of conduct for liner conferences.

In the absence of the secretary-general of the UN and the secretary-general of UNCTAD, the conference was opened by Mr. W. R. Malinowski, director-in-charge of the conference. Commenting on the task before the conference, he said that the conference would be attempting to bring the working arrangements of liner conferences into harmony with the needs and realities of present-day international trade and the partners that participate in it.

He said that here was growing acceptance among governments for the need to find global multilateral solutions to economic problems; he added that perhaps the need for this global multilateral solution was even greater in the field of maritime transportation because of the interregional, indeed truly intentional, character

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[3] Ibid., p. 2.

of shipping. He said at a closing meeting of the preparatory committee that there was unanimity among governments that the era of unregulated functioning of liner conferences should end and that the conference might be seen as the culmination of efforts stretching back over a number of years to bring about a new era--one in which there would be an equitable balance of interests between shippers and shipowners on the one hand and between the old-timers and new-comers to international shipping on the other.

The developing countries, which saw the present system as being weighted heavily against them, both as ship-using and as ship-owning nations, had invested tremendous efforts in this direction. They looked to the code to divide an equitable balance of interest between the partners in maintaining transport which was so necessary if their aims, needs, and aspirations in the field of maritime transport were to be met.

The governments of the following 79 state members of UNCTAD participated in both parts of the conference: Algeria, Argentina, Australia, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Burundi, Canada, Chile, China, Columbia, Cuba, Czechoslovakia, Democratic Yemen, Denmark, Equador, Egypt, El Salvador, Finland, France, Gabon, German Democratic Republic, Federal Republic of Germany, Ghana, Greece, Guatamala, Honduras, Hugary, India, Indonesia, Iraq, Italy, Ivory Coast, Jamaica, Japan, Khmer Republic, Libyan Arab Republic, Liberia, Madagascar, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Poland, Republic of Korea, Republic of Vietnam, Romania, Saudi Arabia, Senegal, Singapore, Spain, Sri Lanka, Sudan, Sweden, Switzerland,

Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukrainian Soviet Socialist Republic, Union of Soviet Socialist Republic, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela, Yugoslavia, and Zaire.[4]

The governments of the following four state members of UNCTAD participated only in the first part of the conference: Afghanistan, Costa Rica, Ethiopia, and Uganda.[5]

The governments of the following four state members of the UNCTAD participated only in the second part of the conference: Bhutan, Chad, Guinea, Guyana, Iran, Kenya, Kuwait, United Republic of Cameroon, United Republic of Tanzania.

The governments of the following state member of UNCTAD participated in both parts of the conference: Austria.[6]

Iran and Kuwait were merely observers for the first part of the conference.

The economic commission for Africa was represented at the first part of the conference.

A representative of the following specialized agency participated in both parts of the conference: International Monetary Fund.

A representative of the following specialized agency participated only in the first part of the conference: Food and Agriculture Organization of the UN.

The following international intergovernmental organizations participated in both parts of the conference as observers: Commonwealth's

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[4]Ibid., p. 2, [5]Ibid. [6]Ibid.

Secretariat, East African Community, European Economic Community, Organization of Economic Cooperation and Development, Organization of African Unity, Organization of American States.

The following non-governmental organizations were represented by observers at both parts of the conference: Baltic and International Maritime Conference, Council of European and Japanese National Shipowners Associations, (formerly Committee of European National Shipowners Association), International Air Transport Association, International Chamber of Commerce, International Federation of Forwarding Agents Associations, International Shipowners Association, National Shippers' Councils for Europe-Plenary.[7]

The following non-governmental organizations were represented by observers at only the second part of the conference: International Association of Ports and Harbors, International Cargo Handling, Coordination Association.[8]

II. Officers of the Conference

The conference, at its first part, elected Mr. C. P. Srivastava (India) as president of the conference. On his assumption of the office of secretary-general of the Inter-Governmental Maritime Consultative Organization on January 1, 1974, the conference, at its second part, decided that Mr. Srivastava should continue to preside as an independent president of the conference.

The conference, at its first part, elected the following vice-presidents of the conference: Mr. I Averin (Union of Soviet

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[7] Ibid.

[8] Ibid.

Socialist Republic), Mr. B. O. Awokoya (Nigeria), Mr. G. Breuer (Federal Republic of Germany), Mr. P. Daza Velenzuela (Chile), Mr. J. deGroot (Netherlands), Mr. S. K. Embukuswa ne Nlaza (Zaire), Mr. G. Negash (Ethiopia), Mr. R. J. Polaschek (New Zealand), Mr. M. Reed (Norway), Mr. R. E. Reynolds (Canada), Mr. J. Ruzicka (Czechoslovakia), Mr. M. Shanmugantham (Sri Lanka), Mr. H. Umar (Indonesia), and Mr. H. S. Walker (Jamaica).

The conference at the second part elected Mr. K. W. McQueen (United Kingdom of Great Britain and Northern Ireland) to replace Mr. M. Reed (Norway), who was not present at the second part of the conference. The conference elected Mr. P. J. Antoine (U.S.A.) as reporter. The following committees were established by the conference:

General Committee: Chairman, the president of the conference

Members: The president, vice-presidents and reporters of the conference and the chairmen of the main committees

First Main Committee: Chairman, Mr. D. Popov (Bulgaria)

Vice-Chairman-cum-Raporteur: Mr. H. Ben Salem (Tunisia)

Second Main Committee: Chairman, Mr. Y. K. Kwartay (Ghana)

Vice-Chairman-cum-Raporteur: Mr. T. Tscherning (Sweden)

Third Main Committee: Chairman, Mr. F. Castello (Nigeria)

Vice-Chairman-cum-Raporteur: Mr. M. Hussein (Pakistan)

Credential Committee: Chairman, Mr. V. Brum (Uruguay)

Members: China, Greece, Japan, Nicaragua, Sengal, USSR, United Republic of Tanzania, USA, Uruguay

The secretary-general of the United Nations was represented by Mr. M. Perez Guerrero, Secretary-General of UNCTAD; Mr. W. R.

Malinoinski, Director of Division of Invisibles of the secretariats of UNCTAD served as director in charge of the conference, and Mr. M. T. Edebanjo, Secretary of the Trade and Capital Development and Capital Board, served as secretary of the conference.

III. Basis for Working[9]

The conference had before it, as a basis for its work, the reports of the preparatory committee of the conference on its first and second sessions. At its second part, the conference also had before it the report of the conference of its first part. The conference also had before it three notes prepared by the UNCTAD secretariats: the glossary of terms used in the draft code of conduct for liner conferences, glossary of terms used in the proposed text of a code of conduct for liner conferences, and transitional arrangements for the codes' final clauses.

At its second part, the conference also had before it a document prepared by the UNCTAD secretariats entitled "Texts for a Code of Conduct for Liner Conferences, with Changes Suggested by the UNCTAD Secretariats.

On the basis of its deliberations as summarized in the reports of the capital conference on its first and second parts, the conference prepared and decided to open for signature the Convention on a Code of Conduct for Liner Conferences which is annexed to the final act.

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9 Ibid, p. 3.

IV. Objectives and Principles[10]

The contracting parties to the present convention, desiring to improve the liner's conference system, recognizing the need for a universally accepted code of conduct for liner conferences, agreeing to reflect in the codes the following fundamental objectives and basic principles:

(a) The objective to facilitate the orderly expansion of world seaborne trade;

(b) The objective to stimulate the development of regular and efficient liner services adequate to the requirements of the trade concern;

(c) The objective to insure a balance of interest between suppliers and users of liner shipping services;

(d) The principle the conference practices should not involve any discrimination against the shipowners, shippers, or the foreign trade of any country;

(e) The principle the conference hold meaningful consultations for shippers' organizations, shippers' representatives, and shippers on matters of common interest with, upon request, the participation of appropriate authorities;

(f) The principle that the conference should make available to interested parties pertinent information about their activities which are relevant to those parties and should publish meaningful information on their activities have agreed on:

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[10] Ibid., p. 4.

Chapter I was about definitions.

Chapter II was about relations along member lines.[11]

Article I was about membership.

Article 2 was about participation in trades, or what we call the 40-40-20 rule:

(1) Any shipping line admitted to membership of a conference shall have sailing and loading rights in the trades covered by that conference.

(2) When a conference operates a pool, all shipping members serving the trades covered by the pool shall have the right to participate in the pool for that trade.

(3) For the purpose of determining the share of pay which member lines shall have the right to acquire, the national shipping lines of each country, irrespective of the number of lines, shall be regarded as a single group of shipping lines for that country.

(4) When determining a share of trade within a pool of individual member lines and/or groups of national shipping lines in accordance with article 2, paragraph 2, the following principles regarding their right to participation in the trade carried by the conference shall be observed, unless otherwise mutually agreed:

(a) The group of national shipping lines of each two countries the foreign trade between which is carried by the conference shall have equal rights to participate in the freight and volume of traffic generated by their mutual foreign trade and carried by the conference:

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[11] Ibid., p. 5.

(b) Third-country shipping lines, if any, shall have the right to acquire a significant part, such as 20%, in the freight and volume of traffic generated by that trade.

(5) If, for any one of the countries whose trade is carried by a conference there are no shipping lines participating in thecarriage of that trade, the share of the trade to which national shipping lines of that country would be entitled under article 2, paragraph 4, shall be distributed among the individual member lines, participating in the trade in proportion to their respective shares.

(6) If the national shipping lines of one country decide not to carry their full share of the trade, that portion of their share of the trade which does not carry shall be distributed among the individual member lines participating in the trade in proportion to their respective shares.

(7) If the national shipping lines of the countries concerned do not participate in the trade between those countries covered by a conference, the shares of trade carried by the conference between those countries shall be allocated among the participating member line of third countries by commercial negotiations between those lines.

(8) The national shipping lines of a region, members of a conference at one end of the trade covered by the conference, may redistribute among themselves by mutual agreement the shares in trade allocated to them in accordance with article 2, paragraph 4 to 7, inclusive.

(9) Subject to the provisions of article 2, paragraphs 4 to 8, inclusive, regarding shares of trade among individual shipping lines or groups of shipping lines, pooling or trade-sharing agreements shall be reviewed by the conference periodically, at intervals to be stipulated in those agreements and in accordance with criteria to be specified in the conference agreement.

(10) The application of the present article shall commerce as soon as possible after entry into force of the present convention and shall be completed within a transition period which in no case shall be longer than two years, taking into account the specific situation in each of the trades concerned.

(11) Shipping lines members of a conference shall be entitled to operate chartered ships to fulfill their conference obligations.

(12) The criteria for sharing and the revision of shares as set out in article 2, paragraphs 1 to 11, inclusive, shall apply when in the absence of a pool there exists berthing, sailing and/or any other cargo allocation agreement.

(13) Where no pooling, berthing, sailing or other trade participation agreements exist in a conference, either groups of national shipping lines, members of the conference, may require that pooling arrangements be introduced in respect of the trade between their countries carried by the conference, in conformity with the provisions of article 2, paragraph 4; or alternately they may require that the sailings be so adjusted as to provide an opportunity to these lines to enjoy substantially the same rights to participate in the trade between those two countries carried by the conference as they would have enjoyed under

the provisions of article 2, paragraph 4. Any such request shall be considered and decided by the conference. If there is no agreement to institute such a pool or adjustment of sailing among the members of the conference, the groups of national shipping lines of the countries at both ends of the trade shall have a majority vote in deciding to establish such a pool or adjustment of sailings. The matter shall be decided upon within a period not exceeding six months from the receipt of the request.

(14) In the event of a disagreement between the national shipping lines of the countries at either end whose trade is served by the conference with regards to whether pooling shall be introduced, they may require that within the conference, sailings be so adjusted as to provide an opportunity to these lines to enjoy substantially the same rights to participate in the trade between these two countries carried by the conference as they would have enjoyed under the provisions of article 2, paragraph 4. In the event that there are no national shipping lines in one of the countries whose trade is served by the conference, the national shipping line or lines of the other country may make the same request. The conference shall use its best endeavors to meet this request. If, however, this request is not met, the appropriate authorities at both ends of the trade may take up the matter if they so wish and make their views known to the parties concerned for their consideration. If no agreement is reached the dispute shall be dealt with in accordance with the procedures established in this code.

(15) Other shipping lines, members of a conference, may also request that pooling or sailing agreements be introduced, and the requests shall be considered by the conference in accordance with the relevant provisions of this code.

(16) A conference shall provide for appropriate measures in any conference pooling agreement to cover cases where the cargo has been shut out by a member line for any reason excepting late presentations by the shipper. Such agreement shall provide that a vessel with unbooked space, capable of being used, be allowed to lift the cargo even in excess of the pool share of the line in the trade, if otherwise the cargo would be shut out and delayed beyond a period set by the conference.

(17) The provisions of article 2, paragraphs 1 to 16, inclusive, concern all goods regardless of their origins, their destination or the use for which they were intended, with the exception of military equipment for national defense purposes.

Article 3 is about decision making procedures.

Article 4 is about sanctions.

Article 5 is about self-policing.

Article 6 is about making conference agreements available to appropriate authorities.

Chapter III is about organizing relations with shippers.

Chapter IV is about freight rates.

Chapter V is about other matters, such as fighting ships, adequacy of service and others.

Chapter VI is about provisions and machinery for settlement of disputes.

Chapter VII is about final clauses such as signature ratification and others.

There was also an annex to the convention, "Modern rules of procedure for international mandatory conciliation."

Annex 2 was about resolutions adopted by the conference.

V. Ratification

By December 1, 1974, only 16 countries representing between 1% and 2% of the world merchant tonnage had ratified the 40-40-20 rule. For the rule to become operative, the code would have to be ratified by at least 24 countries and account for at least 25% of all tonnage.

Germany, France and Belgium signed with the reservation that the commitments under the Rome treaty [which created the EEC (European Economic Community)] must not be infringed.

Already the United States and Canada, which together supply around 11% of all seaborne trade, have stated that they would never apply the code. Should the EEC (with another 30%) finally and collectively come out against it, that would leave the code applicable to at least one-third of seaborne trade, even if Japan did line up behind it.[12]

The U.S. Council of the International Chamber of Commerce[13] is unalterably opposed to the cargo provision in the conversion

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[12] Peter Dryer, "Dockets Grow in Eventual Ratification of the U.S. Shipping Code of Conduct," Journal of Commerce (December 1, 1975).

[13] "U.S. Remains Implacably Opposed to Cargo Sharing," Fairplay International Shipping Weekly (April 12, 1979), p. 17.

on a code of conduct for liner conferences. Such a protectionist measure is contrary to the sound economic development of international shipping.

After almost five years the foreign ministers of the nine European Economic Community nations in May 1979 approved, without further discussion, the controversial UNCTAD proposals for allocating liner shipping.[14] If the provisos accompanying the EEC acceptance are agreed to by the developing nations at the quinquennial of UNCTAD session at Manila, the way will be clear for formal ratification of the code.

The EEC acceptance follows a prolonged bitter internal division over the UN proposals with Britain. The final format adopted by the EEC reflects the compromise demanded by the U.K. and supported by Denmark.

Recognition of the rights of the developing nations to the proposed 40% of the liner cargos which they import and export should increase the likelihood of their accepting the EEC proposals which then demand that the 40% share reserved for the developed nations should be open to competing lines from any of the EEC member nations. It is further proposed that any OECD (Organization for Economic Cooperation and Development) country which is prepared by grant similar rights to EEC operators should also be permitted to cross traders. Belgian interests are keen to build up their participation in the tanker lines and the remaining nations have agreed that where an EEC country does not already enjoy a "fair" share of its

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[14] "Last Minute EEC Approval for UNCTAD Liner Code," Fairplay International Shipping Weekly (May 17, 1979), 16.

own liner trade, other lines must negotiate for the right to participate for that nation's allotment.[15]

The other major modification carried in the EEC proposal is that in trades between EEC member nations and between EEC countries and those belonging to the OECD, developing nations should be permitted to compete for the 20% of cross traffic but the remaining 80% should not be split as proposed by UNCTAD but should remain a matter for commercial competition between the various conference lines engaged in the trade. At the closing plenary session of UNCTAD "V" in Manila with voting aligned 81 for, 23 against, the UN Liner Code passed.[16]

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[15]Ibid. [16]Ibid. (June 7, 1979), 6.

CHAPTER III

THE REVIEW OF LITERATURE

INTRODUCTION

This chapter will focus primarily on the overcapacity problem currently facing the maritime transportation industry. This problem has been growing in severity over the last several years, despite all attempts at a solution. The role of overcapacity in oil and gas tankers, combined carriers and bulk carriers, will be a concern of this chapter, which will be divided into four parts.

Part I is a discussion of the origins and extent of the problem. Part II discusses the effects of overcapacity on both maritime shippers and the governments and financiers who support them. Part III describes the current attempts to solve the problem and why those attempts at solution are aggravating, rather than alleviating, the problem. Part IV expresses the need for a practical global solution to the problem.

I. Origins and Extent of Overcapacity in Maritime Shipping

The problem of overcapacity has been evident for several years and has precipitated the fall of the world shipping market into a deep depression.[1]

The trouble began in 1973 when oil price hikes led to a sharp fall-off in international trade, curbing demand for both

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[1]Paul Sturm, "The Scrutable Chinese Sea Lords," Forbes (February 19, 1979), 52.

tankers and other cargo carriers. But new vessels ordered during the boom years of the early seventies kept gliding down the shipways, prolonging the shipping slump.

As mentioned in Chapter I, Mr. Svensalem, Chairman of Rideni AbSulenia of Stockholm, suggested that the crisis of the shipping industry was worsening. Addressing the general meeting of the Baltic and International Maritime Conference (BIMCO), he warned also that the bulk carrier market was headed for severe overcapacity and added that at the end of 1976 there was a 15% surplus of bulk carriers of over 18,000 dwt tons. The bulk carrier surplus was expected to peak when a large number of ships were delivered.[2]

The staff of the Journal of Commerce reported:

> Including combined tanker and cargo ships, the world's tanker tonnage climbed to a total of 353 million tons at the end of December 1977, a full 100 million tons more than is needed in today's very dull market. Liners are the only healthy sector in an otherwise sick industry, but even this market is being increasingly threatened by stiff competition from the Eastern Block Nations and the developing countries. Tramps are also in trouble. Overtonnage has been increasing since 1975; it is now estimated at over 40 million tons. Since growth in the dry cargo business has traditionally been slower than for tankers, the supply and demand gap is not nearly as wide; however, with more new tonnage coming, the tramp market could become even more of a disaster area than the tanker market in a short time.[3]

The results of the overcapacity problem can be seen in several ways:

1. Operating loss or very low profit margin.
2. Lay-up of ships.
3. Partially loaded ships (less efficiency).
4. Cancellation of charter parties or new orders.
5. Decline in the price of ships.

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[2]"Difficulties Forecast for Tanker Owners," loc. cit.

[3]"Shipping Lines Hit by Tanker Oversupply," Journal of Commerce (June 12, 1978), 6A.

1. Operating Loss or Very Low Profit Margin

Because of the disorganization of the shipping industry, there are no rules for operation of ships in the world-free market. The Eastern Block community invaded the western market with a huge fleet and carried the freight at very low rates. In the Journal of Commerce an article appeared entitled "Soviets Held Threatening U.K. Shipping."[4] This article discussed the British shipping lines that had been forced to run cargo liner operations at a loss because of unfair Soviet competition and the possibility that Britain could be forced to drop certain trades. This led the British shipping industry to join its American and European counterparts in calling for government action against the growing Soviet threat to their business.

The British shipowners also reported that the Soviets are undercutting rates by 25% in the North American St. Lawrence-Great Lakes trades; by 30% in the North American-West Coast, South American, and U.K.-East Africa trades; and by up to 40% in North American-Australian trades. The competition became excessive to the extent that an Ellorman's spokesman commented that western liners trading to East Africa were already forced to operate at a loss by the Soviet competition and could be pushed out of the trade altogether. "No one can afford to operate at a loss indefinitely except the Soviets," he said.[5]

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[4]"Soviets Held Threatening U.K. Shipping," Journal of Commerce (January 16, 1976), 1.

[5]"Difficulties Forecast for Tanker Owners," loc. cit.

Because of these losses, owners and bankers fear that they will face financial problems before the deep-rooted tanker depression is alleviated by President Carter's commitment to reduce U.S. oil imports. Having seen the industry suffer a 3-year-long slump, shipping economists are beginning to ponder just how much "fat" has been left for survival until freight rates move back into profitable areas once more.[6]

Shipping firms have also seen their profitability squeezed by rising crew costs. Wages and fringe benefits have radically increased. As a direct result, vessels have almost entirely lost their international competitiveness with other countries which have cheap manpower, or to the Eastern Block where the labor force is government employed.

2. Lay-Up of Ships

Because of the overcapacity problem and the increasing supply which exceeds the demand, some owners find a solution by laying-up some of their ships, either to avoid the low prices of second-hand ships or because they do not want to operate at a loss. This worsens the problem because ships that are laid-up cost money--at the very least trhe cost of idle capital.

In the London shipping market the correspondent of the Journal of Commerce discussed the increasing number of tankers that were going into lay-up. He also discussed the trading oilers in the world that were either slow steamers or acting as floating storage. He further said that

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[6]Ibid.

> at this time, the best estimates indicated that, apart from those tankers anchored off loading areas--about seven million tons--somewhere in the region of 20 million tons were laid-up. This figure could expand to 65 million tons according to brokers in London if more lay-up berths become available.[7]

Because of the poor condition of the market, one economist said,

> Who is going to buy a liquified natural gas carrier built for $80 million, now laid up on Norway? These assets can no longer recover their debt costs and it's a problem both for the shipping companies and their lenders.[8]

In a published article about surplus, the author said

> According to John I. Jacobs' Latest World Tanker Fleet review, at the end of December 1976, the surplus capacity was put at 68.6 million tons on the basis of laid-up tanker, 29 million, laid-up combined carriers, 1.50 million, slow steaming of tankers and combined carriers 23.1 million, and miscellaneous inefficiency 15 million.[9]

3. Partially Loaded Ships

As mentioned in the preceding paragraph, there were 15 million tons in miscellaneous inefficiency. To illustrate the effect of this inefficiency in partially loaded ships, assume, by using the break-even analysis, that a ship breaks even at 90% of its full capacity and makes a profit of 10% before taxes. If all other conditions were perfect, this ship cannot operate with more than 10% dead freight because at that point it will operate at a loss (see Figure 1).

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[7] "Number of Tankers in Lay-Up Still Rising," Journal of Commerce (April 10, 1975), 24.

[8] "Difficulties Forecast for Tanker Owners," loc. cit.

[9] Martin Bendell, "Tankers: Living With the Surplus," Petroleum Economist (October 1977), 385-386.

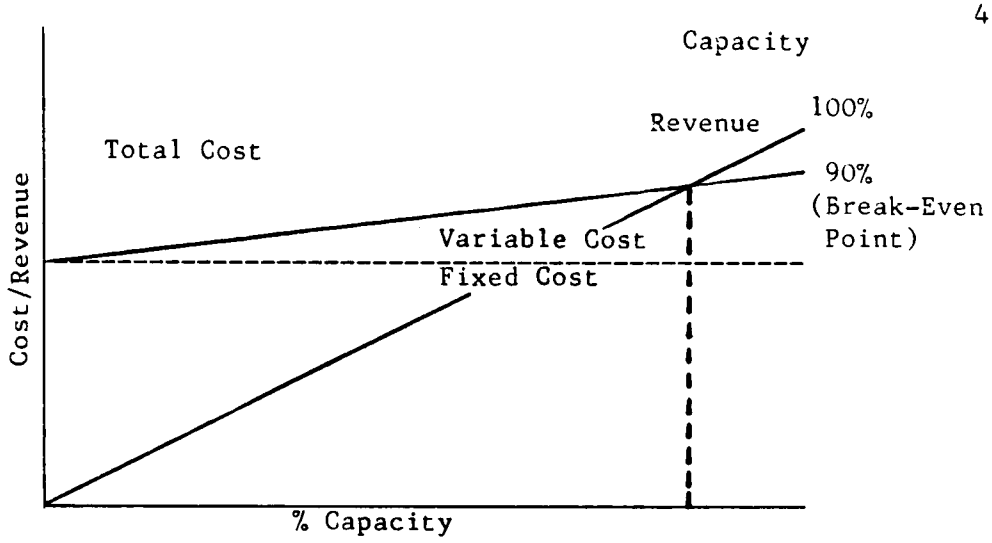
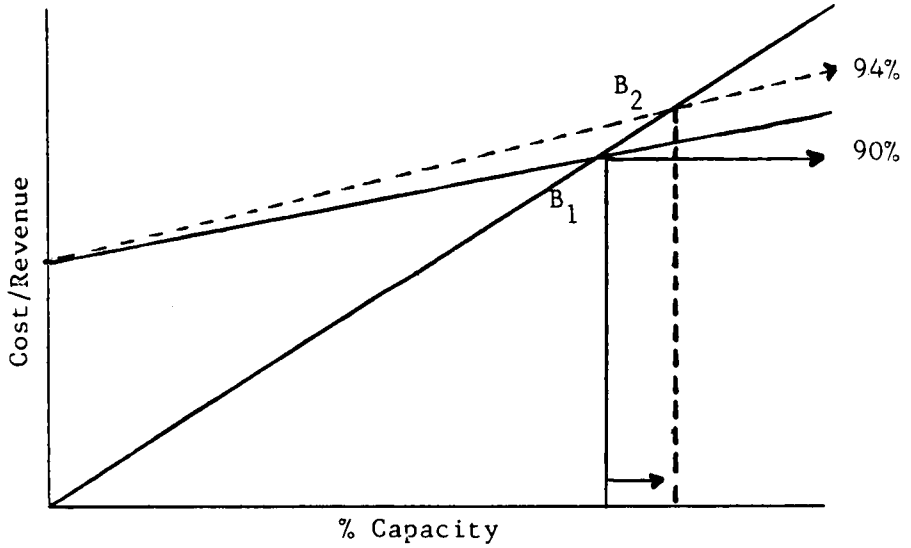


Figure 1. Effect of Inefficiencies on the Break-Even Point.

This is assuming no slow steaming, no increase in fuel price, and no increase in manpower wages or fringe benefits. Any increase in any of these items will cause the total cost to shift upwards above the break-even point to more capacity needed. This will affect the profits of the company and reduce the income of the government (taxes) (Figure 2).



B_1 = Break-even point without change.

B_2 = Changes cause a shift in the break-even point.

Figure 2. The Shift in the Break-Even Point as a Result of an Increase in the Total Cost.

A report for the Shell Company points out that any significant rise in demand will be offset at least partially by the return to service of the large amount of tonnage now laid-up or temporarily operated at less than full capacity.[10]

4. Cancellation of Charter Parties or New Orders

Because of the overcapacity problem and in addition to the laid-up tonnage,

> some 20 million tons of new building tankers on order have been cancelled out of 200 million tons on order. Scandinavians reduced their fleets or are reducing the carrying capacity of their unit ships chartered such as Exxon.[11]

Cancellation sometimes is at an expensive price. Cancelling charters also will increase the overcapacity problem by adding more capacity to the over-capacitated market and worsen the problem.

5. Decline of the Output and Price of Ships

Despite Japan's lead, it did record a drop in output of over 1.2 million tons on 1975's record high of nearly 17 million tons.[12] "The slump has sent the sale price of bulk ships trembling. Owners are trying to get rid of their ships before a market reaction sets in and forces prices down further."[13] The article added that

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[10]"Few Agree on Cure for Tanker Surplus," Journal of Commerce February 14, 1977), 32.

[11]"Number of Tankers in Lay-Up Still Rising," loc. cit.

[12]"Global Ship Output Shows Decline in 1976: Production Falls A Bit Short of Record 1975 Level," Journal of Commerce (March 16, 1977), 1, 2.

[13]"U.K. Shippers Fear Overcapacity in Dry Market," Journal of Commerce (January 28, 1977), 32.

new buildings contracted at Japanese yards at end-1975 for dollars worth 10 million are now selling for less than that. Most recently a 27,000 dwt ton Japanese-built vessel sold for $9.25 million for March delivery, compared with a probable price from a European shipyard of some $15 million.[14] Buyers are also taking advantage of a weak second-hand market, including buyers from India, Turkey, and South America, who are using vessels for shipments on their own account. This has the effect of less efficient operations of new carriers, as well as reducing the demand because of the buyers' decision to carry their own cargo.

II. Effects of Overcapacity on Maritime Shippers, Governments, and Financiers

In an attempt to find a solution to the problem of overcapacity, there are several courses of action that should be considered:

1. Governmental action (subsidizing).
2. Individual action (early scrapping, slow steaming, lay-ups, cancellation of new orders and cancellation of new charters.

1. Subsidizing

Market conditions have led bankers and investors to be more careful about the risks involved in any maritime transportation business. Since the risk was already high for some businesses, governments interferred to guarantee the debt. Mr.Otto Norland, executive director of Hambros Bank, London, put figures onto the

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[14] Ibid.

ships at risk. He reckoned that the total global debt on ships afloat and on order was some $38 billion, with half this probably at government risk. Also, the government's share of the total credits is growing. Hence, practically all new shipbuilding orders placed from the beginning of 1976 are being financed by government backed credit. The glut will be worsened by government attempts to rescue their shipyards, Mr. Norland warned. Very cheap, long-term financing is being given to the developing countries and to domestic owners under the heading of aid. Mr. Norland cautioned that the maintenance of shipbuilding capacity at an artificially high level would defer indefinitely the day when a genuine recovery could occur.

> Each ship built at a loss and financed through generous government creditors pushes down the market place for all similar ships and increases the credit risk associated with these ships. If no new orders for bulk carriers are placed, the market will return to balance by the end of the decade. However, as governments encourage the shipyards to build ships at a loss, the present glut will worsen and the overcapacity could last for another ten years.[15]

Government subsidies prevent the market mechanism from working, which is against the free enterprise system. The Norwegian government's decision to throw a $350 million lifeline to some of the country's foundering shipowners is no act of charity. The lfieline--the proposed "temporary guarantee institute for ships and drilling rigs"--will not solve all the industry's problems either. Given the enormous oversupply of tonnage on the world market, the government recognizes that some Norwegian shipowners are going to be put out

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[15]"Tanker and Shipbuilding Industry Faces Crunch as Crisis Worsens," Journal of Commerce (June 3, 1977), 9.

of business, and that many ships will have to be sold. It hopes, however, that the guarantee institute will enable owners with modern, competitive vessels to maintain them until the market improves.[16] Politics play a big role in the maritime transportation industry all over the world. Pay-off may be given by subsidizing a certain sector and preserving jobs. Sir James Steel, chairman of The Furness Withy Shipping Group, said at the launch of a new cargo liner:

> A revival in world trade will help shipyards more than construction subsidies. It would be unrealistic for politicians to suppose that any kind of subsidy will fill U.K. yards with tankers or bulkers orders.[17]

2. Individual Actions

In trying to solve the problems the companies have tried to take what is called "corrective measures."[18] These corrective measures came from the shipowners, mainly the Scandinavians, by reducing their fleets or the carrying capacity of their unit ships chartered. Some other solutions such as early scrapping and slow steaming were suggested.[19]

There was no real solution to the problem. Martin Bendell recognized the problem and the absence of any realistic solution.

> The surplus capacity problem of the world tanker fleet is expected to stay until the early 1980's, if not beyond. Thus far, there is no international agreement on measures to alleviate the surplus.[20]

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[16] "Shipping: Help Ahoy," The Economist (October 11, 1975), 10.

[17] "Trade Revival Seen More Help to Shipping Thru Subsidies," Journal of Commerce (June 3, 1977), 9.

[18] "Number of Tankers in Lay-Up Still Rising," loc. cit.

[19] See pp. 44.

[20] Bendell, loc. cit.

III. Current Attempts to Solve the Problem of Overcapacity

One of the major studies made about the change in a country's national fleet was the study made by the United Nations Conference on Trade and Development entitled "Establishment or Expansion of Merchant Marines in Developing Countries."[21] This report discusses the conditions under which countries might find entry into shipping or expansion of existing fleets economically justified. The report mentioned that over the last twenty years (1948 to 1968) four factors appear to have led to the emergence of shipping fleets in many previously non-maritime countries:

1. The disruption of shipping services caused by the withdrawal of tonnage from commercial services during the Second World War.
2. The balance-of-payment problems in the year following the Second World War which placed a premium on the saving of foreign exchange and gave rise to a great number of bilateral trading arrangements, many of which contained a shipping clause.
3. The attainment of independence of colonial territories and the consequent emergence of national consciousness.
4. The conscious efforts being made by countries with low per capita income to develop and diversify their economies.

The report examined the changes in maritime fleets from the point of view of developing countries and not from a macro

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[21] Establishment or Expansion of Merchant Marines in Developing Countries, United Nations Conference on Trade and Development, United Nations, New York, 1968.

point of view. The report also doubted the shipping services provided by the traditional maritime nations have, in general, served well the interests of world trade.

The main purpose of the report was twofold:

1. To discuss the meaning of "Second Economic Criteria" and, in particular, to consider whether a definition of that solely in terms of commercial profitability is satisfactory or whether there are economic effects of merchant marines which do not appear in the profit calculations of ship operators.

2. To discuss the conditions under which developing countries might find the establishment or expansion of their own shipping fleets ecoomically justified.

The report mentioned, however, that a number of previously (before 1968) non-maritime nations have established shipping fleets; their reasons for doing so are not necessarily identical in each case.

This study did not mention anything about the proper size of the fleet, nor did it mention any criteria to avoid the problem of excess capacity. Further, the study directly said that

> there is no prior "right" size for the merchant fleet of any country, or a "right" proportion of national trade which should be carried in national ships. The "right" size for the merchant fleet of any country can only be determined in relation to the whole structure of its economy, its trade and to the aims which it is pursuing in its economic growth.[22]

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[22]Ibid., p. 2, paragraph 7.

From an economic point of view, the most general growth aim is to maximize the rate of increase of real income per capita. For some countries the rate of income growth may be increased by entering the field of merchant shipping; for others, establishment of a merchant marine could reduce the rate of income growth as the opportunity to make other investments is lost.

Since the study represented the point of view of the developing countries and because of the first purpose of the study, one can easily understand why the report came to this conclusion about the "right" size, in spite of the fact that this same report said, as mentioned above, that there were four factors leading to the emergence of shipping fleets in many previously non-maritime countries and not all of them were based on "sound economic criteria."

The report also mentioned a look at the individual developing countries from a macro point of view. In reality, a country is a subset of the rest of the world and the nature of maritime transportation is not the internal affair of one single country. It is the international world of business which plays an important role in a nation's economically sound fleet.

The Problem is Worsening

There are other factors influencing the future of maritime transportation activity. For example, the rising oil output from North Sea and Alaskan fields is reducing long-haul imports and the Sumed (Suez-Mediterranean) pipelines are reducing tanker transports around the Cape of Good Hope.

> The surplus capacity problem may well be exacerbated by the American government's attempts to enlarge the U.S. tanker

> fleet by adding American-built vessels and new buildings. The Jones Act reserves American coastal trade for American ships, including intercoastal trade between U.S. territory separated by seas or oceans (such as U.S. Mainland and Hawaii). Strengthening cargo preference legislation with the proviso that foreign flag ships cannot be added to the U.S. fleet even if originally built in the U.S. and retro-fitted with segregated ballast tanks (advanced safety standards U.S. demands that all tankers calling at American ports be equipped with segregated ballast tanks to cut down on marine pollution danger) would lead to a massive new building programme in the U.S. which would do nothing to lessen the worldwide tanker surplus.[23]

Some of the developing countries are looking for foreign currency and they think of maritime transportation as a source.[24] This will push some countries, such as China, to expand or establish their fleets.

> Over the past two years, they have quietly bought $500 million worth of used tonnage. Heavy on commodity carriers instead of tankers, the Chinese fleet is now half the size of the U.S. merchant marine. Many potential competitors worry lest Peking may soon try price-cutting in the bulk trades, such as the Soviets started recent liner-trade price wars to obtain foreign exchange.[25]

According to Behnam,

> Up to World War II international shipping was controlled almost exclusively by a few traditional maritime countries, but since then a drive has been maintained by the majority of the developing countries to establish or expand their merchant fleets.[26]

The reasons for the developing countries to enter into the field

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[23] Ibid., p. 10.

[24] UNCTAD: The Economic Effects of the Closure of the Suez Canal, United Nations, New York, 1973, p. 1.

[25] Sturm, op. cit., 52-53.

[26] A. Behman, "Political Factors and the Evolution of National Fleets in Developing Countries," Maritime Studies and Management (March 1976), 131-140.

of maritime transportation were numerous. A study done by D. Cohen and D. Shneerson commented that "expansion of a fleet that operates along domestic routes is more profitable to the economy than investment in a fleet that is engaged in cross-trade."[27] The same study said: "It may be wise in the early stages of developing their fleets for such countries not to enter into heavy capital commitment and to supplement the several owned vessels with chartered vessels."[28] This was not the case with the newcomers in the maritime transportation industry.

> Five years ago, when scheming how to spend petrodollars became a major Middle East pastime, nine Arab governments launched Arab Maritime Petroleum Transport Co. (AMPT) with $100 million in front money and plans to up that quickly to $2 billion. AMPT's early backers talked expensively of owning 20% of the world's tanker fleet and of forcing giants like Exxon and Shell to charter from them. AMPT and other would-be shipping moguls ran afoul of the law of supply and demand. Their current tanker fleet of 5 million deadweight tons is less than 2% of world capacity, and one-third of their vessels are not idle!!! So far, the $350 million that AMPT has spent alone on ships had yielded operating losses of over $15 million, enough to bankrupt less wealthy operators and the current market value of AMPT's fleet--nearly all under 4 years old, is only 40% of its cost--a paper loss of another $200 million.[29]

There is another factor that has added to the problem--the artificial demand for ships. This is not a real demand, because the demand has risen out of the temporary need of a country for a large amount of commodities to help in their development plans, such as the case of Saudi Arabia and the huge amount of oil money they have and want to use in their development.

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[27] D. Cohen and D. Sheerson, "The Domestic Resource Costs of Establishing/Expanding a National Fleet," Maritime Studies and Management (March 1976), 233.

[28] Ibid., 234. [29] UNCTAD, loc. cit.

> Rumours that Nigeria may be ready to embark on large scale purchases of cement have startled shipping circles here who fear a report of the severe congestion that last year left up to 300 ships waiting off Lagos port for six months before unloading.[30]

This, of course, will lead to a temporary shortage in supply or what is called here "artificial demand." The latest reports in 1977 indicated that berthing delays range from 90 to 270 days.

IV. Necessity of a Global Solution to the Problem

What is necessary now is an international solution to the problem. The General Council of British Shipping (GCBS) has called on the government to promote international action against the growing "Soviet merchant fleet."[31] In a pamphlet published by GCBS, they commented that "the Soviet fleet ranks sixth in the world overall but has the biggest single amount of conventional liner tonnage." The pamphlet continues that "what is more worrying is the rate of expansion of the Soviet Cargo Liner Fleet."[32]

In an attempt to give the problem dimension, Mr. C. H. Tung, the director of Tung Group, said: "All shipping countries have to be persuaded that overcapacity is no good for anyone. . . . A satisfactory formula must be worked out." He then added, "We have a historic role here. The real key to the situation is to get other countries to expand only according to their needs."[33]

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[30]"Shipping Circles Uncertain About Nigerian Congestion," Journal of Commerce (May 2, 1977), 34.

[31]"Soviet Held Threatening U.K. Shipping," loc. cit.

[32]Ibid.

[33]Bruce Maxwell, "Expansion for Sake of the National Ego Only," Far Eastern Economic Review (February 10, 1978), 63.

CHAPTER IV

METHODOLOGY

I. Introduction

This chapter will discuss the methodology behind the model developed to facilitate the restructuring of the size of the world's merchant fleets. This discussion will consist of two parts. Part I will consist of the model itself and its limitations, while Part II concerns the data acquisition and the limitations involved in the search for reliable and consistent data using current international sources. As this chapter explains, the single factor most involved in preventing a solution to the model is the lack of adequate data on the part of the countries involved. Therefore, any model that is constructed must take into account this lack of generalized data and allow for the deviation from real life caused by inadequate data. This model was constructed in such a manner as to offset to as great a degree as possible any deviations caused by the lack of complete data on the seaborne trade of the nations involved.

In order to restructure the size of the fleets of the world we will use the formula developed in Chapter I:

$$S_x = \{[(\sum_{j=1}^{K} \sum_{i=1}^{L} A_{ji})\, G_x + (\sum_{m=1}^{N} \sum_{i=1}^{L} A_{mi})\, R_x] .40 + C_x\}\, E_x$$

S_x = The shipping capacity required for country x.

A_{ji} = Trade contract j for exports to country i

A_{mi} = Trade contract m for imports form country i

G_x = Rate of growth of imports

R_x = Rate of growth of exports

C_x = amount of reserve needed by country x

E_x = efficiency factor of country x $[1 + \frac{\text{dead freight}}{\text{capacity}}]$.

A_{ji} and A_{mi} are the sum of all seaborne exports and imports, respectively, to and from all countries in metric tons. In the model, the seaborne trade is computed according to published data on seaborne cargo unloaded (which represents seaborne imports) and seaborne cargo loaded (which represents seaborne exports). In real life, exports are the sum of all contracts that will be transported by sea, to all countries; imports are the sum of all contracts that will be transported by sea from all countries. The published data about seaborne exports and imports in the United Nations Statistical Yearbook gives seaborne totals only and not details about origins or destinations. The model will measure the shipping capacity needed through these totals of seaborne trade. As a matter of fact, seaborne trade is the measure of particular interest to this research.

The seaborne trade is composed of seaborne cargo loaded and unloaded and transit shipments. The reason for using seaborne as a measure was to avoid all imports and exports that use other means of transportation. For example, some countries, like Saudi Arabia, export some oil through pipelines to the Mediterranean Sea. Some other countries use railroads, trucks, or inland waterways. Another reason for using seaborne trade as a measure is its importance as a means of serving many areas from a central port. For example, the port of Amsterdam serves not only the Netherlands, but also other European countries. Latakia in Syria and Beirut in Lebanon serve most of the area of Arabia, including Iraq, Jordan, Kuwait, Saudi Arabia, and Qatar. All of these countries have their own

ports but using Beirut or Latakia is much cheaper and faster than using their own ports for certain imported commodities. Also the country that is in reality unloading the cargo is Syria or Lebanon, which is the seaborne importer and then exports by truck or railroad. This is different from trans-shipment, which is using an area in the port as a free-zone area or as a storage area. Here, there is no actual export or import to be considered in the model. The problem of determining the size and makeup of each vessel in the fleet to carry this seaborne trade is another problem beyond the scope of this research, but it will be discussed briefly in the final recommendations.

G_x and R_x are the rate of growth of all imports and exports, respectively. This percentage represents the average rate of growth over 14 years from 1960 to 1973. As the notation implies, the rate of growth is stated explicitly for both imports and exports. The use of average annual rates of growth allows one to abstract from years of abnormal activity. In actuality, the situation may be different and more accurate data might be available from actual trade contracts. These contracts could be used to compare data from the previous periods and consequently detemine capacity needs. The projection of external trade growth is also difficult because of the many unknown factors that may affect it, like war or famine. Thus, projections are limited to one or two years.

Applying the 40-40-20 rule of the United Nations Conference on Trade and Development, a contract will be divided as follows:

40% of the total shipment (in metric tons or any other measurement unit) will be transported by the national fleet of the exporting country; the same will be transported by the importing country; and 20% will be transported by the third flag countries.

C_x = the amount of shipping capacity reserve needed (in metric tons). This reserve will obviously differ from one country to another. It is very difficult to predict what a country might want to have as a reserve, and the purpose of this reserve. National objectives, cohesion, financial ability and other factors dictate the nature and extent of the reserve. In the model we used an arbitrary percentage of 2% for all countries; in actuality, this percentage may be 10% or it may be 1%, depending on an individual country's need. This assumption will allow the model to operate, but applications in real life would use the actual percentage determined by the country. Factors affecting the shipping capacity reserve needed could be the purpose that it would serve, currently existing situations, and the international environment, such as the situation in the Middle East. How much reserve each country wants can be directly influenced by factors such as the degree of tension in the area and the refusal of some countries to carry commodities into areas where conflict exists. In the case of the South Africa's boycott, their need to reserve will increase.

E_x is the efficiency factor--how efficiently the stowage and other operations of the ship's productivity are run. The efficiency factor is important because one can determine total capacity of maritime transportation, but one may not be using it efficiently. This factor depends on:

a. Stowage Plan:[1] A stowage plan considers the best possible use of a ship's deadweight and cubic capacity in order to prevent damage or leakage and to assure proper arrangement of various consignments to prevent spoilage and delay. In developed countries, computers are used to make stowage plans. In the developing countries, calculations are used to make these plans and there is a great difference in efficiency.

b. Stowage factor:[2] The stowage factor of a commodity is a measurement of the number of cubic feet of cargo space in which a long ton (2240 lbs) of the commodity may be stored, i.e., the space taken up by the cargo itself. The efficiency is in the balance of different commodities within a limited space to maximize the profit. In stowing cargo, some space will be unavoidably lost in the stowage of general cargo (such as stowage around pipes and sides of the ships) and will, thus, cause broken stowage. This broken stowage formerly ran as high as 10%-25% in package cargo.[3] In modern trade and technology, this is no longer true because in bulk commodities there is little broken stowage and containerizing the vessels uses every inch of the vessel's space without any broken stowage.[4] There is no broken stowage in the case of tankers and most ocean transportation is in bulk commodities.

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[1]Alen E. Branch, The Elements of Shipping (London: Chapman and Hall, Ltd.), Chapter 13, pp. 126, 127.

[2]James V. Metcalfe, The Principles of Ocean Transportation (New York: Simmons-Boardman Publishing Co.), Chapter 9, pp. 71-75.

[3]Ibid., p. 71.

[4]One still must realize, however, that the efficiency of containerizing the cargo by the shipper may still result in broken stowage.

A low efficiency factor for the model was chosen because of:

1. The advanced technology in stowage plans.

2. The advanced technology in shipbuilding and shipping patterns.

3. The small quantity of general cargo moved relative to bulk commodities.

In spite of the fact that efficiency is different from country to country and from trip to trip, the model used a fixed percentage to be added to all 22 countries. In actuality, this percentage will be different because it can be measured accurately over the past years and averaged to predict future needs and to determine the efficiency of a particular country's fleet.

Limitations of the Model

A particular defect in the model is that it does not consider the scheduling problem and utilization of the total fleet. In actuality, not all exports and imports are moving in any one moment. As a matter of fact, scheduling is a problem beyond the scope of this study because of its complexity, but in real life it is very important. Another, and important, limitation is that shipping distances are ignored in model solutions. Contracts are made with countries which are not in the same range, for example, the U.S. may export to Japan, Mexico, Brazil, and Kuwait among other countries. It takes a ship only a few hours from Houston to any Mexican port, while it takes several weeks to go to Kuwait. The model ignores this variation, but it cannot be ignored in actuality. This will be discussed in the recommendations in the last chapter of this research.

The model did not consider specifically the stowage factor, but considered only metric tons. This differs from a realistic

situation because commodity stowage is a function of both weight and volume. This model also did not consider the characteristics of the commodities; for example, no one can load wheat and cement together in one hold because the cement will spoil the wheat.

The model did not consider the differences in ports. Ports are not only a safe berth, but also a blend of facilities and accommodations. Some ports have facilities to unload a ship in several hours, while others will unload the same shipment in several days. The differences in cargo loading and unloading is not considered in the model, although these are factors that must be considered in real life.

Ships are not the same. There are tankers, bulk carriers, combined carriers, live-stock carriers, and others. The model did not consider the capacity needed for each type, which does not reflect the particular situation of any country. However, more details about this aspect will be discussed in the last chapter in the recommendations.

Restructuring the Fleet

To apply the model, several tables will be developed. The first part of the equation will be in one table (Table 7). This table will be a prediction of the years 1968 to 1975, using the data of 1967 as a base. The table will show how the computation will be done for the year 1968, and then for each following year there will be three columns, one for 40% predicted imports, one for 40% predicted exports, and the third column for the sum of

Table 7

40% of Projected External Trade
(In '000 Metric Tons)

	1968	1969	1970	1971	1972	1973	1974	1975
Argentina	8619.7	8881.6	9152.6	4433.3	9724.0	10025.1	10337.0	10660.2
Belgium	29555.2	32561.3	35434.3	38799.9	42485.4	45421.9	50942.6	55184.3
Brazil	18517.7	21366.4	24685.3	28556.4	33077.0	38362.0	44547.5	51794.5
Columbia	3574.2	3730.8	3894.4	4065.5	4244.4	4431.3	4626.8	4831.2
Cyprus	1081.3	1190.8	1311.3	1344.2	1590.5	1751.8	1424.5	2125.4
Denmark	12700.2	13625.2	14617.6	15682.2	16824.4	18049.7	19364.4	20774.7
Egypt	5228.5	5430.3	5644.6	5872.0	6113.4	6369.6	6641.6	6930.1
Finland	10280.5	11119.4	12026.8	13008.8	14071.3	15221.0	16464.4	18711.0
Germany (Feb. Rep.)	42750.1	46905.7	51465.3	56468.3	619957.7	67981.0	74589.9	81841.4
Greece	5933.5	6547.	7225.3	7973.4	8799.2	9710.9	10717.2	11828.2
Italy	75842.4	82603.9	90091.4	98399.8	10763.8	117931.9	124426.5	142289.3
Korea (Rep. of)	5852.1	7434.7	9451.6	12023.8	15307.1	19501.3	24864.3	31727.5
Libyan Arab Rep.	38216.5	42704.1	47718.1	53323.4	59586.4	66585.5	74407.5	83148.8
Mexico	4669.3	4998.8	5351.6	5728.5	6134.0	6567.2	7031.1	7527.9
Netherlands	76297.1	85657.1	96167.3	107969.3	121222.0	136104.1	152816.5	171584.5
Norway	19141.8	20468.5	21887.5	23405.2	25028.4	26764.5	28621.4	30607.5
Philippines	9176.0	9463.3	9760.4	10068.0	10386.4	10715.8	11056.9	11410.0
Spain	6843.5	8379.4	9437.6	10634.1	11989.3	13522.7	15259.0	17225.8
Sweden	25704.7	27533.4	29494.0	31596.4	33851.1	36269.0	38862.3	41644.0
U.K.	85824.8	90847.4	46164.1	101791.9	107749.3	114055.5	120730.8	127792.2
U.S.A.	83798.9	299551.6	321427.5	344928.4	370170.2	397285.9	426416.8	457714.7
Yugoslavia	5415.1	6018.2	6690.3	7439.2	8273.9	9204.4	10242.2	11399.5

Source: The Statistical Yearbook of the United Nations, 1977.

The figures are based on computing {(1 + Rate of Growth of Imports) Imports + (1 + Rate of Growth of Exports) Exports} · .40 to give us projected 40% of seaborne trade.

both. Another table will complete the model and show a new restructuring for the capacity of the 22 countries, applying the 40-40-20 rule of the United Nations for the years 1968 to 1975.

A table for the actual capacity will be developed (Table 8) to indicate the actual existing capacity of the 22 countries in metric tons. These calculations are done in order to compare actual capacity with the restructured capacity. Then a table will be developed for three countries as examples of applying the model to determine if there is any deviation between the restructured and the actual capacity by using the model. If there are any deviations, then an explanation for such deviation is needed. In Chapter I, there is a list of variables to be tested. These variables will be tested against the change in merchant shipping fleet. The variables are analyzed singly and jointly in order to attempt to identify important characteristics and relationships. The analysis was directed toward finding:

1. The means of the variables over the 9-year period to find any negative means.

2. Correlation coefficients between variables on the national level and the merchant shipping fleet.

3. The set of variables that is associated with the dependent variable, MS, and which one variable has the strongest relationship; then which are the two best variables, etc., by the use of stepwise multiple regression techniques.

4. The means of all variables, national and international, over the 9 years to find all negative means among the 35 variables.

Table 8

Actual Capacity of the Fleets of the 22 Countries
(In '000 Metric Tons)[a]

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Argentina	9930.5	9588.0	9755.0	10139.9	10507.8	11221.0	11637.0	11277.6	11688.9
Belgium	6395.8	7471.2	8424.9	8507.0	9474.8	9545.6	9307.9	9732.4	10875.7
Brazil	10451.2	10363.5	11059.6	13790.6	13864.2	15098.1	16844.2	19453.4	21553.3
Columbia	1570.7	1675.4	1649.9	1882.0	1675.4	1859.3	1794.2	1689.5	1675.4
Cyprus	2892.3	5229.8	6166.6	9112.6	11996.4	16136.7	23514.5	27190.6	25795.5
Denmark	24139.9	25639.6	27951.9	26542.6	28192.5	32196.9	32893.1	35720.3	35864.6
Egypt	1890.4	2003.6	1913.1	1907.4	1930.1	1947.0	2153.6	1995.2	2411.2
Finland	8521.1	9003.4	10652.1	11189.8	11781.3	13054.8	12381.3	12078.4	16034.8
Germany (Fed. Rep.)	47974.2	52281.4	56277.4	63117.5	69510.5	68203.0	63392.0	63909.9	68211.5
Greece	59529.1	59393.2	68723.7	87713.0	104644.9	122768.2	154529.3	174265.7	180415.3
Italy	49808.0	53051.2	56367.9	87950.7	65183.4	65568.3	71016.0	74658.2	81187.0
Korea (Rep. of)	2430.8	3795.0	6143.9	6800.5	8528.9	8464.5	8840.9	1282.0	13006.7
Libyan Arab Rep.	0.0	25.5	31.1	31.1	39.6	48.1	297.2	4126.1	1938.6
Mexico	2643.2	3234.7	3396.0	3050.7	3212.1	3339.4	3628.1	44057.4	4604.4
Netherlands	41029.3	42189.6	42087.8	41702.9	42198.1	39820.9	40276.6	49057.4	45483.8
Norway	147219.4	157512.1	7605.5	154948.2	173954.4	188265.8	189177.0	199045.2	209466.3
Philippines	5761.9	6840.1	7440.1	7575.9	7575.9	7408.9	7584.4	6135.4	7041.0
Spain	20591.1	22591.9	25620.0	28558.5	31506.4	34438.3	38705.9	39637.0	43511.3
Sweden	37121.1	38963.4	40276.6	39410.6	39869.0	45107.4	45401.7	49870.3	59947.9
U.K.	173920.5	175361.9	190765.6	206830.6	218923.1	229255.5	241549.0	252809.8	265550.2
U.S.A.	162843.9	157517.3	136575.4	147867.5	130273.4	120325.9	117428.8	115560.2	116825.2
Yugoslavia	9579.6	10148.4	11436.0	12140.7	12358.6	12718.0	13340.6	14240.6	115001.8

[a]This unit of measure shown in Table 2 as gross registered tons.

Source: Table 2, page 5.

5. Stepwise multiple regression for all independent variables to get the set of variables on both the national and international level which tends to be the strongest, to find out whether the national or international environment is the stronger influence on the national merchant shipping fleet, and to get a reasonably good "best" set of independent variables.

6. Stepwise multiple regression for the best four independent variables the model will find.

7. Graphs will be developed for each independent variable against time to illustrate the direction and pattern of change in the variable over the 9-year period.

8. The general trend will be developed in order to illustrate the general direction of all independent variables over the 9-year period. More data will be needed to determine why a change occurred in a fleet.

II. Data

One major problem in international reasearch is the availability and accuracy of data. For example, in the Statistical Yearbook of the United Nations, one can find a wide variety of data in the maritime transportation section. In one table, the data are classified in Net Register Tons; in another table, in Metric Tons, then number of vessels without their capacity; then in deadweight tons. Some data are classified by country and others by region. And when one finds some data applicable to immediate research needs, it is not available for all countries for all years, other than the time span of 9 to 10 years.

Getting data from more than one source may be more difficult. Because of these and similar difficulties, only 22 countries (among all countries published in the Statistical Yearbook of the United Nations) have similar data--for cargo loaded, cargo unloaded, current account of the balance of payments, and the net change in the balance of payments for 9 years. So, the reason for selection of these particular 22 countries was comparability of data from several sources to the same countries over the same period of time. The primary sources were Statistical Yearbook of the United Nations, World Book Statistics called "World Tables," and international financial statistics.

There are many motivations for countries to increase or establish their maritime transportation capacity. Some of these reasons are quantifiable and some of them are non-quantifiable. Examples of the reasons that may motivate a country to expand capacity is prestige or national security. There is no way to easily quantify such a motivation. Also, some of the motivating factors may be economic and some may not. Among all motivations, the following will be tested against the changes that occur in the national fleet (Table A-1).

1. The seaborne cargo loaded in metric tons. It is difficult to obtain the details of data, but in the U.N.'s Statistical Yearbook there are totals for all 22 countries for the last 9-year period.

2. The seaborne cargo unloaded in metric tons. The same problem as seen above existed in Europe Yearbook. The data are broken down per country but are listed in dollars. This will create another problem: what is the value of each commodity and what is the value of the dollar itself? However, some sources of the U.N. were used to get the totals. No accounting was made for commodities

in transit. Transit is a service to facilitate the transportation process to all foreign countries. Commodities in transit will be unloaded and loaded but will not enter a country. Therefore these commodities do not represent a burden on the available shipping capacity.

3. The current accounts of the balance of payments will show us if there was any relationship between changes in the national fleet and changes in exports, imports, and services. The test will show is there is a relationship between the change in national maritime fleet and the change in external trade and services.

4. The change in the net reserve is the final result and will reflect negative or positive results. The difference between this net reserve and the current account is the capital investment which will be reflected by any change in the national fleet.

The four motivations above are national motivations--a country may be motivated by some other international reasons. Any country is part of the world, and it affects the world, just as it is affected by the world. Working from this premise and because of the nature of international maritime transportation, motivation on the international level will be tested as follows:

1. World Seaborne Trade. The test will show the relationship between change in international trade and change in the national fleet measured in million metric tons and in billion metric ton-miles. This is done in order to distinguish between an increase in the scope of international trade and an increase in size and distance simultaneously. Also, each measure will be divided into

several categories to find the category that has a strong relationship with the national fleet of the country.

2. Merchant Shipping Fleet of the World. This list will show the relationship between changes in the national fleet and changes in the Merchant Shipping Fleet of the World as a general trend following a particular pattern or a particular forecast. In order to be more accurate, a break-down of these data will be measured by change in the number of ships and change in the deadweight tonnage. Then each of these two will be classified into oil tankers, combined carriers, bulk carriers, or total world fleet, including other types of ships which were not in any of these four categories.

3. World Order Book. This test will reveal the effect and relationship of new shipbuildings and new orders on change in the national fleet. Positive relation will be indicated by new orders by a country as a result of new shipbuildings. That does not mean that they built new ships but they may buy some ships on the market; but this purchase was the result of the same reason for order booking. If there is no change, this means no buying or replacement has occurred.

4. Tonnage Laid-Up. That means the country's change was negative and was the result of laying up some tonnage.

All international data were published in the review 1976 of Fearnley & Egers Chartering Co., Ltd.

The analysis will include three representative countries:

1. Argentina was selected as the developing country;

2. Yugoslavia will represent a communist country from the eastern block because it was the only communist country on the list;

3. Norway had all the information required and represents a developed country with special interests in maritime transportation.

CHAPTER V

THE ANALYSIS

I. Introduction

This chapter will discuss the results of applying the proposed model and restructuring the world fleet. The output of various tests will be examined and analyzed to find out if there is a deviation between the actual fleet and the fleet as restructured by the model. Using the knowledge from these tests, a second explanatory model will be developed using multiple regression techniques. Three countries will be used as examples of how application of this technique can be used for planning and policy-making by national governments.

By applying the model for all the 22 available countries in order to adjust their fleet capacity, a new table will be developed. This table will give us the projected external trade which includes the first part of the model. This part will compute 40% of the seaborne exports (Rate of Growth of Exports) plus 40% of the seaborne imports (Rate of Growth of Imports) as shown in Table 7, page 60. Table 9 will add to the projected capacity 2% as reserve and 3% as dead freight, then the estimated total capacity will be equal to the projected capacity plus 5%. Table 9 is the restructuring of world fleet applying the 40-40-20 rule. A new table (Table 8, p. 62) was also developed to transfer the gross register tons to metric tons.

Table 9

Restructuring the Fleets of the 22 Countries After Applying the Model
(In '000 Metric Tons)

	Projected Capacity							
	1968	1969	1970	1971	1972	1973	1974	1975
Argentina	9050.7	9325.7	9610.2	9905.0	10210.2	10526.4	10853.9	11193.2
Belgium	31033.0	33979.4	37206.0	40734.7	44609.7	4680.6	53489.7	58573.5
Brazil	19443.6	22434.7	25919.6	29884.2	34730.9	40280.0	46774.9	54384.2
Columbia	3752.9	3917.3	4088.1	4268.8	4456.6	4652.9	4858.1	5072.8
Cyprus	1135.4	1250.3	1376.9	1411.4	1670.0	1839.4	2026.0	2231.7
Denmark	133352.2	14306.5	15348.5	16466.3	17665.6	18452.2	20332.6	21813.4
Egypt	3489.9	5701.8	5926.8	6165.6	6419.1	6088.1	6973.7	7276.6
Finland	10744.5	11675.4	12628.1	13659.2	14774.9	15982.1	17288.2	18701.6
Germany (Feb. Rep.)	44887.6	44251.0	54038.6	59291.7	56055.6	71380.1	78319.4	85933.5
Greece	6230.2	6875.0	7586.6	8372.1	9239.2	11253.1	11253.1	12419.6
Italy	79634.5	86734.1	94596.0	103319.8	113019.9	123827.9	135897.8	149403.8
Korea (Rep. of)	6144.7	7806.4	9924.2	12625.0	16072.5	20476.4	26107.5	33313.9
Libyan Arab Rep.	40127.3	44839.3	50105.1	55989.6	62565.7	69914.8	78124.7	87306.2
Mexico	4902.8	5248.7	5619.2	6016.0	6440.7	6895.6	7382.7	7904.3
Netherlands	80112.0	89940.0	100975.7	113367.8	127283.1	142909.3	160451.3	180163.7
Norway	20098.9	21491.9	22951.9	24575.5	26279.8	28102.7	30052.5	32137.9
Philippines	9634.8	9936.5	10248.4	10571.4	10905.7	11251.6	11609.8	11980.5
Spain	7185.7	8798.4	9909.5	11166.4	12588.8	14198.8	16022.0	18087.1
Sweden	26989.9	28910.1	30968.7	33176.2	35543.7	38082.5	408054.4	43726.2
U.K.	90116.0	95389.8	100972.3	106881.5	113136.8	119758.3	126767.3	134187.1
U.S.A.	87988.8	314524.2	33750.0	362174.8	388678.7	417150.2	447737.6	480600.4
Yugoslavia	5685.9	6319.1	7024.8	7811.2	8687.6	96646.8	10754.3	11969.5

A comparison of the estimated total capacity and actual capacity revealed a deviation from the actual capacity. There were some countries that have actual capacity less than the estimated capacity after applying the model. Some other countries show excess in their capacity. The comparison, by summing the total for the 22 countries will not give a proper measure because some countries, like the U.S. for example, have an estimated capacity need of 480,600,400 metric tons while the actual capacity is 116,825,200 metric tons. This means a shortage of 363,775,200 metric tons. This is known because of the huge amount of oil imported by the U.S.,and this huge amount will affect the final result of summing the 22 countries.

Among these 22 countries, the three countries selected were Argentina, Norway and Yugoslavia, chosen as examples of a developing country, a developed country, and a communist country, respectively. These countries will be the subject of the statistical analysis that will give us the reason or reasons associated with changes in its national fleet. The analysis will be conducted separately for each country (see Table 10).

The analysis of the merchant shipping expansion is somewhat restricted because of the limited number of observations with which we must conduct the analysis. There are only 9 observations and 35 independent variables, 4 of them on the national level and 31 on the international level. It is not reasonable to include more than 3 or 4 independent variables in the models. The stepwise procedure contained in the statistical analysis technique is allowed to search through the set of the 35 variables and find that set of variables, of size 2, 3, or 4, which yields the highest value for the coefficient of determination.

Table 10

Comparing Estimated Capacity to Actual Capacity Over the Nine Year Period from 1968 to 1975 (Mil Metric Tons)

	Argentina			Norway			Yugoslavia		
	Estimated Capacity	Actual Capacity	Divia.	Estimated Capacity	Actual Capacity	Divia.	Estimated Capacity	Actual Capacity	Divia.
1968	9050.7	9588.0	+537.3	20098.9	157512.1	+137413.2	5685.9	10148.4	+4462.5
1969	9325.7	9755.0	+429.3	21491.9	157605.5	+136113.6	6319.1	11436.0	+5116.9
1970	9610.2	10139.9	+529.7	22981.9	154948.2	131966.3	7024.8	12140.7	+5115.9
1971	9905.0	10507.8	+402.8	24575.5	173954.4	+149378.9	7811.2	12358.6	+4541.4
1972	10210.2	11221.0	+1010.8	26279.8	188265.8	+161986.0	8687.6	12718.0	+4030.4
1973	10526.4	11637.0	+1100.6	28102.7	189177.0	+161074.3	9664.6	13340.6	+3676.0
1974	10853.9	11277.6	+423.7	30052.5	199045.2	+168992.7	10754.3	14240.6	+3486.3
1975	11193.2	11588.9	+395.7	32137.9	209466.3	177328.4	11969.5	15001.8	+3032.3

The variables are identified below:

MS = Merchant shipping fleet of the country

CA = Current account (goods and services)

BP = Net change in the net reserve in the balance of payments

CL = Cargo loads (seaborne exports)

CU = Cargos unloaded (seaborne imports)

T = the period from 1967-1975 (9 years)

X_1 = trade of crude oil in million metric tons

X_2 = trade of oil products in million metric tons

X_3 = trade of coal in million metric tons

X_5 = seaborne grade of grain in million metric tons

X_6 = total world seaborne trade in million metric tons

X_7 = seaborne trade in million metric ton-miles of crude oil

X_8 = seaborne trade in million metric ton-miles of oil products

X_9 = seaborne trade in million metric ton-miles of iron ore

X_{10} = seaborne trade in million metric ton-miles of coal

X_{11} = seaborne trade in million metric ton-miles of grain

X_{12} = total world seaborne trade in million metric ton-miles

X_{13} = number of world fleet of oil tankers

X_{14} = number of world fleet of combined carriers

X_{15} = number of world fleet of bulk carriers

X_{16} = total number of world fleet

X_{17} = capacity of world fleet of oil tankers in million dwt.

X_{18} = capacity of world fleet of combined carriers in million dwt.

X_{19} = capcity of world fleet of bulk carriers in million dwt.

X_{20} = total capacity of world fleet in million dwt.

X_{21} = number of world order book of oil tankers

X_{22} = number of world order book of combined carriers

X_{23} = number of world order book of bulk carriers

X_{24} = total number of world order book

X_{25} = capacity of world order book or oil tankers in thousands of dwt.

X_{26} = capacity of world order book of oil tankers in thousands of dwt.

X_{27} = capacity of world order book of bulk carriers in thousands of dwt.

X_{28} = total capacity of world order book in thousands of dwt.

X_{29} = world laid-up tonnage of tankers in thousands of dwt.

X_{30} = world laid-up tonnage of dry cargo in thousands of dwt.

X_{31} = total world laid-up tonnage in thousands of dwt.

Argentina

On the National Level

The results of the technique, as shown in Appendix B, were that among variables, the current account has a negative mean. This indicates that over the period of 9 years the goods and services rendered to foreign trade by Argentina was less than those goods and services needed.

The correlation coefficient between the independent variable MS and each of the other variables (CA, BP, CL, CU) was not very strong. It was noticed that 66.75% of the variation in MS is associated with the set of variables CA, BP, CL, and CU.

In the stepwise multiple regression procedure the variable Current Account (CU) was selected first as exhibiting the strongest association among all national variables, but even that association was not very strong. In an attempt to introduce another variable,

Cargo Loaded (CL) was brought into the equation. However, (CL) was not successful in improving the model. Once CU is inserted in the model, the inclusion of other national variables does not appear to be statistically useful.

On the National and International Levels

The changes in merchant shipping are apparently more strongly associated with changes in variables on the international level than with changes in variables on the national level. International variables that are rather strongly associated with changes in MS are (with coefficient of correlation exceeding 0.9):

a. World seaborne trade in crude oil in tons
b. World seaborne trade in crude oil in ton-miles
c. Total world seaborne trade in ton-miles
d. Number of world fleet of oil tankers
e. Number of world fleet of combined carriers
f. Number of world fleet of bulk carriers
g. Total number of world fleet
h. Capacity of world fleet of oil tankers in dwt.
i. Capacity of world fleet of combined carriers in dwt.

So, it seems that Argentina is moving in expanding their national fleet in the same direction as variables that indicate change in the world fleet. There is also evidence that the international crude oil business may have a relationship with the change in the national fleet of Argentina. Also, the change in Argentina's national fleet was associated with the change in the world capacity of the combined carriers.

In the stepwise regression procedure the variables selected in the best two variable equation were X_3 and X_{18}, with the resulting equation being:

$$\hat{Y} = 3217.16 - .2583\ (X_5) + 25.1805\ X_{18}$$

with standard errors of estimated coefficients of (.0907) for X_5 and (2.624) for X_{18}.

for MS, 96.05% of the variation is associated with the set of variables (X_5 and X_{18}) where the coefficient of determination (R^2)

$$R^2_{y/X_5,X_{18}} = \frac{SSR(X_5,X_{18})}{SSY} = \frac{635350.03425}{661465.55556} = .9605.$$

While the two variables indicated above yield the largest value for the coefficient of determination, the sign on the variable X_5 is not consistent with experience or prior understanding. The negative sign is a result of the correlation between X_5 and X_{18} and should be interpreted in that light. The main point is that there is apparently a sronger relationship between MS and the variables on the international level than between variables on the national level.

In selecting four variables from the set of all variables, national and international, the stepwise regression procedures selected CL, X_3, X_{14} and X_{24} as yielding the largest value of R^2. The estimated equation is:

$$\hat{Y} = 2999.084 + .07827\ CL + 2.3828X_3 + 6.8485X_{14} - 1.2193X_{24}$$

with standard errors of estimated coefficient of (.0244) for CL, (.4221) for X_3, (.8965) for X_{14} and (.2880) for X_{24}.

Of the variation in MS, 99.04% is associated with the set of variables (CL, X_3, X_{14}, X_{24}) where:

$$(R^2_{y/CL,X_3,X_{14},X_{24}} = \frac{SSR(CL,S_3,X_{14},X_{24})}{SSY} = \frac{655112.950}{661485.555} = .9904)$$

This equation means that the merchant fleet of Argentina tends to increase with increases in Argentina's exports (seaborne cargo loaded), with world trade increases and with the world number of combined carriers. As long as the total world book decreases the merchant fleet of Argentina will increase. This may mean that they are buying second-hand ships and are using the world slump to make good deals.

In Appendix B, a computer graph of the time trend of each variable over the 9-year period is included for the 35 variables, plus MS.

Norway

On the National Level

The result of processing the data for Norway showed that the mean of the current account and the mean of the net change in the reserve of the balance of payments indicates a deficit in the balance of trade.

The correlation coefficient between the change in the merchant shipping fleet and each of the variables CA and CU was relatively

high while other variables (BP and CL) were not as highly associated with MS. The four national variables account for 94.9% of the variation in the merchant shipping of Norway.

In the stepwise multiple regression, CA and CL made the strongest joint contribution to accounting for variation in MS. The estimated equation on the national level is:

$$\hat{Y} = 11271.356 - 8.159\ CA + 1.274\ CL$$

with standard errors of estimated coefficients of (1.4381) for CA and (.2575) for CL.

$$R^2_{y/CA,CL} = \frac{SSR(CA,CL)}{SSY} = \frac{446434597.9043}{490177666.2222} = .91076$$

Of the variation in MS, 91.07% is associated with the set of the variables CA and CL. Where BP and CU do not significantly contribute to the explained variation, given that CA and CL are in the model.

Apparently an increase in seaborne exports (CL) is associated with an increase in (MS). While changes in the current account tend to be associated with changes in the opposite direction in MS.

On the National and International Level

Combining variables at the national and international levels it seems that the national merchant shipping is in accordance with the changes on the international level much more so than with the national level. The changes in MS are rather strongly associated

with changes in the individual series (with correlation coefficient exceeding 0.9).

a. World seaborne trade in crude oil in million tons

b. Total world trade in crude oil in million tons

c. World seaborne trade in crude oil in ton-miles

d. World seaborne trade in iron ore in ton-miles

e. Total world seaborne trade in iron ore in ton-miles

f. World number of oil tankers

g. World number of combined carriers

h. World number of bulk carriers

i. Total number of world fleet

j. Capacity of world oil tankers in million dwt.

k. Capacity of world combined carriers

The bivariate association between MS and some other variables is not as strong as with the previous variables. However, the linear association in the range of .91076 to 1.00 is significant and these variables should be identified. They are:

a. World seaborne trade in coal in million tons

b. World seaborne trade in grain in million tons

c. Total capacity of world fleet

d. Total number of world order book

MS for Norway was moving, generally, in the same direction as world fleet and world seaborne trade, particularly regarding crude oil. This move was associated also with the number of combined carriers and number of bulk carriers. The capacity of crude oil and the capacity of combined carriers was also associated with the change in merchant fleet.

The stepwise regression procedure model gave the best single variable equation as:

$$\hat{Y} = 48703.4576 + 540.8222\ X_{18}$$

with standard error of estimated coefficient of (44.7127) for X_{18} (World Capacity of Combined Carriers). This was the only independent variable given. Adding any other variable did not improve the model. Apparently any increase in world capacity of combined carriers seems to account for an increase in the Norway merchant shipping fleet. Of the variation in MS, 95.43% is accounted for by the variable X_{18} where:

$$R^2_{y/X_{18}} = \frac{SSR(X_{18})}{SSY} = \frac{467795281.160}{590177666.222} = .95433822)$$

Allowing the procedure to provide a four-variable model resulted in including CU, X_9, X_{16}, and X_{31}. The equation was:

$$\hat{Y} = 155030.971 - 1.5428\ CU - 20.4217\ X_9 + 14.3639\ X_{16} + .192124\ X_{31}$$

with standard errors of estimated coefficient of (.2246) for CU, (3.3099) for X_9, (.8815) for X_{16}, and (.0243) for X_{31}, and 99.82% of the variation in merchant shipping associated with the set of variables (CU, X_9, X_{16}, and X_{31}) where

$$R^2_{y/CU,X_9,X_{16},X_{31}} = \frac{SSR(CU,X_9,X_{16},X_{31})}{SSY} = \frac{489334327.3197}{490177666.2222} = .9982795)$$

This equation indicates that the merchant fleet of Norway tends to increase with decreases in seaborne imports and decrease in the ton-miles of iron ore moved. This is a misleading result because the model was programmed to get four variables, while the normal stepwise regression gave us that X_{18} (World Capacity of Combined Carriers) was the only independent variable that is associated with the change in the merchant shipping fleet of Norway. Programming the model to produce the "best" four variables gave us the misleading negative results because of the high intercorrelation among the variables. It was noticed also that the variables on the international level were more strongly associated with the change in MS, than the variables on the national level.

The time trend of each variable is shown in graph form in Appendix B.

Yugoslavia

On the National Level

The results of processing the data on Yugoslavia showed that the means of the current account and the change in the next reserve were negative, indicating that Yugoslavia's import of goods and services exceeded its exports of goods and services for the time period in question. There was on the average a deficit in the balance of payments over the 9-year period.

The correlation coefficient between the dependent variable MS and the independent variables at the national level (CA, BP, CL, and CU) showed a strong relation between seaborne cargo unloaded (imports) and merchant shipping.

It was noticed that 92.58% of the variations in merchant shipping was associated with the set of variables (CA, BP, CL, CU). In the stepwise multiple regression the variable seaborne imports (cargo unloaded) was apparently stronger than the relationship between MS and the other variables on the national level. This means that the increase in seaborne imports is associated with the increase in the merchant shipping fleet. The inclusion of other variables did not improve the linear model.

On the National and International Level

By combining variables on the national and international level, and computing the simple correlation coefficient between each of these variables and MS, it was noted that the changes in merchant shipping moved in accordance with the changes on the international level more than with national level variables. The association between MS and each of the following variables was rather strong, with the correlation exceeding 0.9 in each case.

1. World seaborne trade in crude oil in million tons
2. World seaborne trade in coal in million tons
3. Total world seaborne trade in million tons
4. World seaborne trade in crude oil in million ton-miles
5. World seaborne trade in iron ore in million ton-miles
6. Total world seaborne trade in iron ore in million ton-miles
7. World number of oil tankers
8. World number of combined carriers
9. World number of bulk carriers
10. Total number of world fleet

11. World capacity of oil tankers in million dwt

12. World capacity of combined carriers

Yugoslavia seems to be changing its national merchant shipping fleet in the same direction as world fleet and world trade changes, particularly as applicable to bulk commodities, liquid or dry.

When the stepwise procedure is used to search among the set of all variables and select the four variables yielding the largest value for the multiple coefficient of determination, the resulting equation is:

$$\hat{Y} = 5919.4816 + .7054\ X_9 + .449\ X_{18} + 40.991\ X_{22} - .221\ X_{26}$$

We will not use this equation because the variable X_{26} will not significantly add to the equation with standard error of .2206.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this research was to determine the precise need for maritime transportation capacity for a particular country under its own flag capable of securing its import and export seaborne trade. It was decided this could be done by developing a model that would produce the desired results based on UNCTAD recommendations.

I. The Advantages of Applying the Model

The model was developed to consider all seaborne exports, all seaborne imports, the rate of growth, the amount of reserve needed, and the differences in th shipping expertise of the participating countries. By using an equal share of 40% for both exporting and importing countries and 20% for third flag countries as suggested by the UNCTAD 40-40-20 rule, the model indicates the needed maritime capacity of a country to carry its 40% share. Application of the model can be useful as:

1. A guideline for determining the maximum capacity on an international and national level which each country cannot exceed, yet which will satisfy its needs;

2. A guideline to help shipbuilders anticipate future markets and develop production accordingly;

3. A guideline for shippers to determine both available and required capacity needs. Some companies charter ships for several years and others have certain rebates based on amounts

to be shipped. Knowing the quota to be used will help these shippers in their planning;

4. A means of helping investors locate potential markets. Financial planners can use the model as a guideline for planning capital needs so as to remain within the limits of the 40% share;

5. A guideline for governments as they develop national maritime transportation policy. This would include the need for and amount of subsidies to the maritime fleet, and the development of international policy which recognizes national limitations as well as the limits of the 40% share of foreign trade.

II. Problems in Application

In applying the model there are several practical problems on both the international and national level.

The International Level Problem

1. A major problem is getting approval from all the member countries of the United Nations to accept the UNCTAD Convention, and resolving the anticipated conflicts among these countries and the United Nations organization. There must be an agreement on how to enforce the policy and how to control the application of such an agreement. If the United Nations adopts such an agreement, the cost invovled in enforcement, application, and management will be high.

2. Some countries have shortages in maritime shipping capacity, while others have a surplus. It is not probable that countries that have excess capacity will scrap ships and reduce labor. Likewise, those countries with a shortage of capacity may not have the facilities

to build ships. So any agreement should include some sort of an interim solution, such as chartering, with the purpose of purchase or proposing a fair financial agreement of value for this excess/ shortage in capacity.

3. The aspect of international competition between capitalistic firms and state controlled firms also poses a serious problem. Can the state controlled carriers be expected to compete on the same basis as a private capital firm?

The National Level Problem

1. The first problem is how to allocate the quota determined among shipowners--assigning cargo, establishing capacity, and determining routes. This is a very complicated situation because some shipowners receive subsidies while others do not. In some countries, ships of the national fleet may be owned by private investment, by corporations, or by the government. If a country has more than one shipyard, similar ownership problems will arise. In addition, political aspects are involved, especially if the unions are strong.

2. The second problem is how to enforce use of the national flag by shippers, assignment of which carriers to designated shippers, and determination of freight rates, further complicated by the differences in operating costs and in operators' efficiency among countries. How would they guarantee the level of service rendered? Would such a situation lead to a monopolistic market or oligopoly? Does another country have the right to accept or refuse the rate of freight charged?

3. A third problem is the conflict between rules and regulations on the national level and those on the international level, such

as safety standards, cargo preference bills, conditions to operate under a certain flag, and taxes. These regulations are to be worked out in the final agreement. However, individual countries should not be allowed to set rules that are outside of the global framework agreed upon.

III. Recommendations

The model developed in this study was necessarily simplistic because of the difficulty of obtaining actual data from a country. While the variables included are major determinants of capacity, other variables which should also be included are:

D = Distance between two points in days

L = The Loading factor for commodity of contract i

U = The Unloading factor for commodity of contract i

S = Speed per ship

T = Time when to move contract i

P = Capacity per ship

G = Stowage factor per contract

The assumption that the difference between the speed of a fully loaded ship and the speed of an empty ship is not important. The goal is to maximize the difference between revenue and total cost, which means the ship is always required to be full. Also, the number of hatches is not important. What is important is the capacity of the largest hatch and how efficiently every hatch is loaded. For example, if two hatches are of equal size but one is loaded with 700 tons and another with 200 tons, the hatch carrying 700 tons is being used to best capacity.

There are, however, two important rules. The first is that each ship cannot load and unload in the same hatch simultaneously. The second is that each ship has to reach its destination and accomplish its operations.

Some of the variables can be worked out and determined in advance. For example, a contract can be computed as follows: (1) Number of days necessary to load the 40% quota (knowing the rate of loading) in the country of export (or import) and the number of days necessary for unloading the same shipment in the port of unloading; and (2) number of days necessary for the national fleet to move this contract from point of export to point of import. For example, assume a shipping distance of 2000 miles for a country with 14 ships of varying speeds that total 98 miles per hour; that is, 2000 ÷ 98 = 20.41 hours. Add this time to the time needed to load and unload to compute total time required for the contract. The summation of all time required must equal 365 days. If the theoretical ship's time is greater than 365 days, more shipping capacity is needed; if the number of days is less than 365 days, there is excess in capacity. Still, some variables such as the stowage factor and commodity characteristics are not solved. Further research is obviously required to expand the model to match and actual situation.

IV. The Need for a Solution

As presented in the review of literature and as shown in the statistical analysis, the overcapacity problem has a more significant international dimension than a local one. There seems to be a

strong relationship between a country's maritime transportation capacity and the international environment; consequently, there is need for an international solution. Individual actions to solve the problem have only served to worsen it.

In addition, solutions that have been proposed affect free enterprise countries more than communist or socialistic countries. As communist countries continue to increase their fleet size, most free world maritime countries are forced to reduce or subsidize their national fleets. If this development continues, the communist countries will monopolize the shipping industry since it will not be profitable for private sector shipping to compete with the state controlled fleets.

In many of the developing countries, governments are not profit oriented, and yet they desire a fair share of the shipping business affecting their trade. As a result, these governments have directed their efforts toward a long-range international solution similar to the United Nations Conference on Trade and Development for the Plenipotentiaries on a Code of Conduct for Liners in order to find a genuine solution. The suggested model in this research can serve as a basis and a guideline for such an international solution.

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APPENDICES

APPENDIX A

Table A-1

Changes on the National Level

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Argentina									
Merchant Shipping Fleet	3509	3388	3447	3583	3713	3965	4112	3985	4095
Goods and Services (Current Account)	132	-50	-226	-159	-386	-206	600	104	-1056
Change in Net Reserves of Balance of Payments	-542	-33	222	-134	397	13	-709	-63	890
Seaborne Cargo Loaded	12306	11751	13244	15237	14437	9979	14648	15662	11770
Seaborne Cargo Unloaded	8557	8234	11480	10867	11505	9725	11472	12178	12220
Belgium									
Merchant Shipping Fleet	2660	2640	2977	3006	3348	3373	3289	3439	3843
Goods and Services (Current Account)	196	28	74	715	842	1052	971	759	571
Change in Net Reserves of Balance of Payments	-240	403	-193	-462	-369	-388	-785	-309	-424
Seaborne Cargo Loaded	21948	26123	26423	29270	28324	30805	36801	40156	34935
Seaborne Cargo Unloaded	45763	54505	62626	71079	63055	56488	61468	63782	50444
Brazil									
Merchant Shipping Fleet	3693	3662	3908	4873	4899	5335	5952	6874	7616
Goods and Services (Current Account)	-276	-526	-336	-561	-1313	-1372	-1475	-5971	-5558
Change in Net Reserves of Balance of Payments	226	-98	-466	-574	-534	-2235	-1940	800	832
Seaborne Cargo Loaded	21129	23487	30205	39970	43824	45694	64059	78462	92975
Seaborne Cargo Unloaded	19045	23648	24621	28073	32923	38487	49769	54898	55605

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Colombia									
Merchant Shipping Fleet	555	592	583	6654	592	657	634	597	592
Goods and Services (Current Account)	-67	-160	-175	-293	-453	-175	-46	-291	-66
Change in Net Reserves of Balance of Payments	28	-69	-55	-36	2	-165	-144	76	-78
Seaborne Cargo Loaded	7620	5906	6957	5364	1829	1709	3022	2272	3374
Seaborne Cargo Unloaded	941	1626	2165	2461	1941	1620	3224	2553	2101
Cyprus									
Merchant Shipping Fleet	1022	1848	2179	3220	4239	5702	8309	9608	9115
Goods and Services (Current Account)	-2.6	-1.7	-9.4	-21.7	-15.0	-23.2	-65.6	-60.2	-30.7
Change in Net Reserves of Balance of Payments	-14.9	-50.7	-20.1	-31.9	-53.5	-28.9	12.2	34.8	26.5
Seaborne Cargo Loaded	1448	1560	1558	1551	1359	1255	1167	1013	1330
Seaborne Cargo Unloaded	1007	1034	1285	1441	1529	1809	2155	1404	1151
Denmark									
Merchant Shipping Fleet	8530	9067	9877	9379	9962	11377	11623	12622	12673
Goods and Services (Current Account)	-287	-216	-410	-544	-422	-58	-391	-814	-416
Change in Net Reserves of Balance of Payments	54	87	--	-38	-204	-112	-377	363	26
Seaborne Cargo Loaded	4958	5265	6204	6774	7373	8314	8313	7852	7531
Seaborne Cargo Unloaded	24637	25789	28687	31521	30589	32369	33284	31701	29657

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
				Egypt					
Merchant Shipping Fleet	668	708	676	674	682	688	761	705	852
Goods and Services (Current Account)	-164	6	-8	-154	-206	-157	65	-272	-1851
Change in Net Reserves of Balance of Payments	63	-52	35	43	87	-34	-98	125	1106
Seaborne Cargo Loaded	4454	6571	13020	12708	15911	8634	12681	3170	3192
Seaborne Cargo Unloaded	8142	6740	6385	6985	8061	6682	8630	6919	9624
				Finland					
Merchant Shipping Fleet	3011	3192	3764	3954	4163	4613	4375	4268	5666
Goods and Services (Current Account)	-142	64	21	-239	-339	-108	-327	-1014	-1793
Change in Net Reserves of Balance of Payments	62	-242	-2	-114	-212	-39	161	23	184
Seaborne Cargo Loaded	9861	10754	12033	12360	11248	11883	12792	11440	8217
Seaborne Cargo Unloaded	13902	15958	18419	20180	20506	21647	24400	25306	23175
				Germany (Fed. Rep.)					
Merchant Shipping Fleet	16952	18474	19886	22303	24562	24100	22400	22583	24103
Goods and Services (Current Account)	2501	2966	1898	848	781	689	3646	8076	3177
Change in Net Reserves of Balance of Payments	12	-1753	2686	-6188	-4778	-4725	-7958	548	706
Seaborne Cargo Loaded	19394	21305	21878	22493	21007	22460	27791	35507	27968
Seaborne Cargo Unloaded	78013	84888	92745	106332	101777	102019	110230	115119	99797

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Greece									
Merchant Shipping Fleet	21035	20987	24284	30994	36977	43381	54605	61578	63751
Goods and Services (Current Account)	-188	-234	-349	-405	-341	-345	-996	-1030	-814
Change in Net Reserves of Balance of Payments	-13	-36	7	23	-174	-491	6	140	74
Seaborne Cargo Loaded	3571	3920	5136	4158	4415	5929	8846	12179	14336
Seaborne Cargo Unloaded	9872	10507	12038	13391	14170	17772	25257	25284	23022
Italy									
Merchant Shipping Fleet	17600	18746	19918	21078	23033	23169	25094	26381	28688
Goods and Services (Current Account)	1599	2627	2339	762	1570	1851	-2109	6679	-446
Change in Net Reserves of Balance of Payments	-557	135	514	-496	-1065	654	187	3830	2238
Seaborne Cargo Loaded	29741	31629	32469	34799	34938	37212	37041	35920	29400
Seaborne Cargo Unloaded	144570	169115	182731	200916	209868	221930	237336	225515	198876
Korea (Rep. of)									
Merchant Shipping Fleet	866	1431	2171	2403	2660	2991	3124	3470	4596
Goods and Services (Current Account)	-192	-441	-549	-623	-846	-341	-258	-1686	-1531
Change in Net Reserves of Balance of Payments	-111	-35	-162	-57	42	-156	-293	143	-310
Seaborne Cargo Loaded	1786	2254	2891	3589	4192	6010	7994	8258	9985
Seaborne Cargo Unloaded	9737	13542	17109	18695	24257	24699	31798	33829	35142

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Libyan Arab Rep.									
Merchant Shipping Fleet	00	9	11	11	14	17	105	453	685
Goods and Services (Current Account)	44	252	328	645	781	219	55	1523	-57
Change in Net Reserves of Balance of Payments	-45	-154	-376	-685	-869	-380	888	-1434	1277
Seaborne Cargo Loaded	82873	124927	146927	158251	129380	109958	107300	75045	72974
Seaborne Cargo Unloaded	2629	3039	3009	2600	3004	5649	5051	6413	9619
Mexico									
Merchant Shipping Fleet	934	1143	1200	1078	1135	1180	1282	1458	1627
Goods and Services (Current Account)	-628	-744	-592	-1068	-835	-844	-1187	-2392	-3339
Change in Net Reserves of Balance of Payments	-72	-71	-5	-83	-176	-193	-121	-27	-135
Seaborne Cargo Loaded	9362	9324	8958	9705	9388	10157	11663	13268	31980
Seaborne Cargo Unloaded									
Netherlands									
Merchant Shipping Fleet	14498	14908	14872	14736	14911	14071	14232	15568	16072
Goods and Services (Current Account)	63	65	31	-519	-160	1188	1961	1714	1370
Change in Net Reserves of Balance of Payments	171	168	-64	-707	-236	-871	-636	-824	-277
Seaborne Cargo Loaded	37609	40489	47773	63935	67692	77219	88121	85120	80801
Seaborne Cargo Unloaded	132294	151492	172410	202729	208912	232800	261833	250916	242590

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Norway									
Merchant Shipping Fleet	52021	55658	55691	54752	61468	66525	66847	70334	74016
Goods and Services (Current Account)	-243	93	128	-242	-522	-54	-306	-929	-2005
Change in Net Reserves of Balance of Payments	-153	-25	-6	-96	-330	-153	-202	-268	-281
Seaborne Cargo Loaded	29641	36049	36833	35475	34766	39301	42499	40549	36478
Seaborne Cargo Unloaded	15112	17136	17543	20804	19112	20533	22325	22644	20044
Philippines									
Merchant Shipping Fleet	2038	2417	2629	2677	2677	2618	2680	2168	2488
Goods and Services (Current Account)	-25	-250	-234	-29	9	8	398	-172	-760
Change in Net Reserves of Balance of Payments	39	85	62	-83	-125	-186	-560	-491	-3
Seaborne Cargo Loaded	11858	13421	14408	15792	16148	15123	16768	12964	12943
Seaborne Cargo Unloaded	10388	11772	12580	12539	13462	13363	13928	13532	15051
Portugal									
Merchant Shipping Fleet	2137	2185	2335	2462	2621	5697	3600	3518	3424
Goods and Services (Current Account)	--	--	--	--	--	326	286	-690	-685
Change in Net Reserves of Balance of Payments	--	--	--	--	--	-328	-276	491	859
Seaborne Cargo Loaded	2790	2605	2677	4058	3080	3203	4154	5066	3950
Seaborne Cargo Unloaded	5650	6322	7510	9240	9284	10092	12904	15829	13799

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
				Spain					
Merchant Shipping Fleet	7276	7983	9053	9738	11133	12169	13677	14006	15375
Goods and Services (Current Account)	-456	243	-392	79	853	527	461	-2691	-2875
Change in Net Reserves of Balance of Payments	158	-38	657	-1223	-1562	-1443	-1129	587	674
Seaborne Cargo Loaded	11058	16836	14775	14517	16267	17278	17038	18031	17067
Seaborne Cargo Unloaded	41651	46023	50689	52917	65959	72276	71398	76569	74366
				Sweden					
Merchant Shipping Fleet	13117	13768	14232	13926	14088	15939	16043	17622	21183
Goods and Services (Current Account)	-36	-116	-197	-266	213	248	1015	-777	-1347
Change in Net Reserves of Balance of Payments	195	17	140	-41	-279	-434	-719	666	-1029
Seaborne Cargo Loaded	23555	27244	27663	26985	30153	33533	40126	41284	32419
Seaborne Cargo Unloaded	36443	41918	42454	46707	46780	47780	50487	55233	52151
				U.K.					
Merchant Shipping Fleet	61456	62036	67479	730845	77358	81009	85353	89332	93834
Goods and Services (Current Account)	-1123	-1254	1102	1760	2631	355	-1513	-6510	-3061
Change in Net Reserves of Balance of Payments	1483	2998	-991	-3045	-6404	3017	-222	2441	99
Seaborne Cargo Loaded	35152	41027	45001	50267	49558	508714	56157	53739	51290
Seaborne Cargo Unloaded	167548	179036	188620	200004	206519	206092	21085	213909	177220

Table A-1 (continued)

	1967	1968	1969	1970	1971	1972	1973	1974	1975
				U.S.A.					
Merchant Shipping Fleet	57542	55660	55327	52250	46033	42518	42201	40834	41281
Goods and Services (Current Account)	2374	357	180	2357	-1403	-5475	5740	956	14546
Change in Net Reserves of Balance of Payments	3418	-1641	-2739	9840	29668	9499	4841	7336	3816
Seaborne Cargo Loaded	171169	177264	181269	218256	185935	209958	250191	245518	245736
Seaborne Cargo Unloaded	249106	276442	281248	292786	306892	340961	422087	424878	409248
				Uruguay					
Merchant Shipping Fleet	357	371	317	399	461	405	405	368	371
Goods and Services (Current Account)	-4.2	23.4	-19.1	-45.1	-63.3	17.6	31.2	-110.3	-167.1
Change in Net Reserves of Balance of Payments	8.2	14.	-30.5	17.7	4.7	6.5	-30.7	43.3	41.0
Seaborne Cargo Loaded	1163	1395	1617	1631	1359	1237	695	938	947
Seaborne Cargo Unlcaded	2097	2543	2235	2412	2471	2718	2749	2764	2595
				Yugoslavia					
Merchant Shipping Fleet	3385	3586	4041	4290	4367	4494	4714	5032	5301
Goods and Services (Current Account)	-75	-95	-63	-348	-357	386	407	-986	-853
Change in Net Reserves of Balance of Payments	33	-65	-196	9	65	-513	-581	236	278
Seaborne Cargo Loaded	4246	4201	4064	3844	3336	3186	3947	3992	3481
Seaborne Cargo Unloaded	7938	8642	8826	11574	12707	11541	12333	14866	13980

[a] In thousand gross registered tons.

[b] In '000,000 SDR's (Special Drawing Rights) issued by the International Monetary fund since 1970.

[c] In thousnds of metric tons.

Table A-2

Table of Changes on the International Level

		1967	1968	1969	1970	1971	1972	1973	1974	1975
World Seaborne Trade										
X_1	Crude Oil (Mil. Tons)	672	768	871	995	1068	1184	1365	1360	1259
X_2	Oil Products (Mil. Tons)	193	207	209	245	247	261	274	264	233
X_3	Iron Ore (Mil. Tons)	164	188	214	247	250	247	298	119	127
X_4	Coal (Mil. Tons)	67	73	83	101	94	96	104	130	137
X_5	Grain (Mil. Tons)	83	78	71	89	91	108	139	1045	995
X_6	Total World Seaborne Trade (Mil. Tons)									
X_7	Crude Oil (Mil. Ton Miles)	3400	4197	4853	5597	6554	7719	9206	9660	8882
X_8	Oil Products (Mil. Ton Miles)	730	750	760	890	900	930	1010	960	845
X_9	Iron Ore (Mil. Ton Miles)	651	310	385	481	434	444	1578	558	621
X_{10}	Coal (Mil. Ton Miles)	269	407	367	475	487	548	1471	695	734
X_{11}	Grain (Mil. Ton Miles)	464	467	367	475	487	548	1471	695	734
X_{12}	Total Ton-Miles in Trade	7230	8372	9374	10654	11729	13103	15403	16386	15363
World Fleet										
X_{13}	No. of oil Tankers	2911	2984	3008	3094	3206	3193	3293	3406	3439
X_{14}	No. of Combined Carriers	153	175	195	221	251	301	355	386	398
X_{15}	No. of Bulk Carriers	1498	1761	1964	2131	2345	2580	2781	2992	3197
X_{16}	Total No. of World Fleet	16964	17609	17887	18395	18894	19309	19878	20363	20868
X_{17}	Oil Tankers (Mil. dwt.)	104.1	116.1	131.5	151.0	171.0	188.9	215.6	254.3	290.9
X_{18}	Combined Carriers (Mil. dwt.)	7.8	10.4	12.4	15.6	21.1	29.0	37.4	42.1	44.2
X_{19}	Bulk Carriers (Mil. dwt.)	39.3	48.2	55.1	61.7	70.4	356.4	89.4	97.8	103.7
X_{20}	Total World Fleet (Mil. dwt.)	241.0	265.2	290.4	321.0	79.9	392.7	439.9	493.9	543.7

Table A-2 (continued)

		1967	1968	1969	1970	1971	1972	1973	1974	1975
World Order Book										
X_{21}	No. of Oil Tankers	307	349	400	476	533	817	1131	1020	515
X_{22}	No. of Combined Carriers	54	64	111	173	142	102	73	57	55
X_{23}	No. of Bulk Carriers	372	368	370	528	589	402	528	465	647
X_{24}	Total (including others)	1569	1783	1953	2261	2234	2018	2603	2581	2359
X_{25}	Oil Tankers (Mil. dwt.)	42116	53593	59288	80619	95830	119431	196915	189190	77327
X_{26}	Combined Carriers (Mil. dwt.)	4524	7018	14808	26781	21984	14849	10217	7480	6493
X_{27}	Bulk Carriers (Mil. dwt.)	12206	12612	14074	22367	25122	17848	23838	20762	26222
X_{28}	Total (including others)	66635	82708	100905	144239	154746	162537	242324	212160	127017
Tonnage Laid Up										
X_{29}	Tankers Laid Up (Mil. dwt.)	284	234	163	213	1240	1453	366	2256	43300
X_{30}	Dry Cargo Laid Up (Mil. dwt.)	833	488	345	396	3058	1646	528	447	6800
X_{31}	Total Laid Up (Mil. dwt.)	1117	722	508	609	4298	3099	894	2703	50100

APPENDIX B

Argentina

S T A T I S T I C A L A N A L Y S I S S Y S T E M 11:43 MONDAY, AUGUST 6, 1979 3

VARIABLE	N	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
MS	9	3755.22222222	287.54685609	33797.00000000	3388.00000000	4112.00000000
CA	9	-138.55555556	447.33743168	-1247.00000000	-1056.00000000	600.00000000
BP	9	4.55555556	476.76438392	41.00000000	-709.00000000	890.00000000
CL	9	13226.00000000	1506.93019778	119034.00000000	9979.00000000	15662.00000000
CU	9	10693.11111111	1499.95770311	96238.00000000	8234.00000000	12220.00000000
T	9	5.00000000	2.73861279	45.00000000	1.00000000	9.00000000

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T
MS	1.00000	-0.06303	0.11047	0.05838	0.59616	0.92812
	0.0000	0.8720	0.7772	0.8814	0.0902	0.0003
CA	-0.06303	1.00000	-0.94994	0.36215	-0.27368	-0.27396
	0.8720	0.0000	0.0001	0.3382	0.4761	0.4756
BP	0.11047	-0.94994	1.00000	-0.23859	0.42181	0.37557
	0.7772	0.0001	0.0000	0.5364	0.2581	0.3192
CL	0.05838	0.36215	-0.23859	1.00000	0.54939	0.17070
	0.8814	0.3382	0.5364	0.0000	0.1255	0.6606
CU	0.59616	-0.27368	0.42181	0.54939	1.00000	0.77067
	0.0902	0.4761	0.2581	0.1255	0.0000	0.0151
T	0.92812	-0.27396	0.37557	0.17070	0.77067	1.00000
	0.0003	0.4756	0.3192	0.6606	0.0151	0.0000

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE MS

STEP 1 VARIABLE CU ENTERED R SQUARE = 0.35540833

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	235090.36698680	235090.36698680	3.86	0.0902
ERROR	7	426375.18856876	60910.74122411		
TOTAL	8	661465.55555556			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2533.14826189				
CU	0.11428610	0.05817320	235090.36698680	3.86	0.0902

STEP 2 VARIABLE CL ENTERED R SQUARE = 0.45916023

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	303718.67854454	151859.33927227	2.55	0.1582
ERROR	6	357746.87701101	59624.47950184		
TOTAL	8	661465.55555556			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2867.01355973				
CL	-0.05806772	0.05412469	68628.31155774	1.15	0.3246
CU	0.15488591	0.06888211	301464.08784379	5.06	0.0656

STEP 3 VARIABLE CL REMOVED R SQUARE = 0.35540833

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	235090.36698680	235090.36698680	3.86	0.0902
ERROR	7	426375.18856876	60910.74122411		
TOTAL	8	661465.55555556			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2533.14826189				
CU	0.11428610	0.05817320	235090.36698680	3.86	0.0902

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
MS	1.00000 0.0000	-0.06303 0.8720	0.11047 0.7772	0.05838 0.8814	0.59616 0.0902	0.92812 0.0003	0.93184 0.0003	0.79097 0.0111	0.00113 0.9977	0.80291 0.0092	0.59562 0.0906	0.92352 0.0004	0.94647 0.0001
CA	-0.06303 0.8720	1.00000 0.0000	-0.94994 0.0001	0.36215 0.3382	-0.27368 0.4761	-0.27396 0.4756	-0.00867 0.9823	0.20801 0.5912	0.41797 0.2629	-0.37820 0.3156	-0.38620 0.3046	-0.04838 0.9016	-0.04794 0.9025
BP	0.11047 0.7772	-0.94994 0.0001	1.00000 0.0000	-0.23859 0.5364	0.42181 0.2581	0.37557 0.3192	0.13804 0.7232	-0.08905 0.8198	-0.39751 0.2894	0.45406 0.2195	0.45051 0.2236	0.17690 0.6489	0.17535 0.6518
CL	0.05838 0.8814	0.36215 0.3382	-0.23859 0.5364	1.00000 0.0000	0.54939 0.1255	0.17070 0.6606	0.29336 0.4436	0.36532 0.3337	0.10942 0.7793	0.28557 0.4563	0.16700 0.6676	0.31744 0.4052	0.24359 0.5277
CU	0.59616 0.0902	-0.27368 0.4761	0.42181 0.2581	0.54939 0.1255	1.00000 0.0000	0.77067 0.0151	0.74321 0.0217	0.57068 0.1086	-0.04746 0.9035	0.80425 0.0090	0.58095 0.1009	0.76800 0.0156	0.72674 0.0266
T	0.92812 0.0003	-0.27396 0.4756	0.37557 0.3192	0.17070 0.6606	0.77067 0.0151	1.00000 0.0000	0.95472 0.0001	0.76534 0.0162	-0.14003 0.7194	0.94762 0.0001	0.74826 0.0204	0.96918 0.0001	0.97162 0.0001
X1	0.93184 0.0003	-0.00867 0.9823	0.13804 0.7232	0.29336 0.4436	0.74321 0.0217	0.95472 0.0001	1.00000 0.0000	0.90591 0.0008	0.07323 0.8515	0.85778 0.0031	0.59490 0.0911	0.99464 0.0001	0.99212 0.0001
X2	0.79097 0.0111	0.20801 0.5912	-0.08905 0.8198	0.36532 0.3337	0.57068 0.1086	0.76534 0.0162	0.90591 0.0008	1.00000 0.0000	0.38113 0.3115	0.63560 0.0658	0.27520 0.4736	0.87129 0.0022	0.85666 0.0032
X3	0.00113 0.9977	0.41797 0.2629	-0.39751 0.2894	0.10942 0.7793	-0.04746 0.9035	-0.14003 0.7194	0.07323 0.8515	0.38113 0.3115	1.00000 0.0000	-0.33292 0.3813	-0.74705 0.0207	-0.01977 0.9597	-0.03583 0.9271

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
X4	0.80291	-0.37820	0.45406	0.28557	0.80425	0.94762	0.85776	0.63560	-0.33292	1.00000	0.86190	0.90029	0.88165
	0.0092	0.3156	0.2195	0.4563	0.0090	0.0001	0.0031	0.0658	0.3813	0.0000	0.0028	0.0009	0.0017
X5	0.59562	-0.38620	0.45051	0.16700	0.58095	0.74826	0.59490	0.27520	-0.74705	0.86190	1.00000	0.67046	0.67267
	0.0930	0.3046	0.2236	0.6676	0.1009	0.0204	0.0911	0.4736	0.0207	0.0028	0.0000	0.0481	0.0471
X6	0.92352	-0.04838	0.17690	0.31744	0.76800	0.96918	0.99464	0.87129	-0.01977	0.90029	0.67046	1.00000	0.99479
	0.0004	0.9016	0.6489	0.4052	0.0156	0.0001	0.0001	0.0022	0.9597	0.0009	0.0481	0.0000	0.0001
X7	0.94647	-0.04794	0.17535	0.24359	0.72674	0.97162	0.99212	0.85666	-0.03583	0.88165	0.67267	0.99479	1.00000
	0.0001	0.9025	0.6518	0.5277	0.0266	0.0001	0.0001	0.0032	0.9271	0.0017	0.0471	0.0001	0.0000
X8	0.79820	0.27390	-0.16227	0.42193	0.57185	0.74874	0.89977	0.99277	0.38768	0.61939	0.26864	0.86562	0.85085
	0.0099	0.4757	0.6766	0.2580	0.1077	0.0203	0.0010	0.0001	0.3026	0.0753	0.4846	0.0026	0.0036
X9	0.87961	-0.14501	0.28023	0.38344	0.83029	0.97245	0.97011	0.82540	-0.09422	0.94103	0.72792	0.98660	0.97329
	0.0018	0.7097	0.4652	0.3083	0.0056	0.0001	0.0001	0.0061	0.8095	0.0002	0.0262	0.0001	0.0001
X10	0.65400	0.45921	-0.38510	0.33956	0.41648	0.51906	0.66140	0.64275	0.47042	0.36015	0.07801	0.62430	0.62597
	0.0560	0.2137	0.3061	0.3713	0.2648	0.1522	0.0524	0.0619	0.2013	0.3411	0.8419	0.0723	0.0713
X11	0.73030	0.44819	-0.39109	0.28214	0.37913	0.56869	0.69046	0.63722	0.34092	0.40972	0.18875	0.66081	0.67481
	0.0255	0.2263	0.2980	0.4620	0.3143	0.1101	0.0395	0.0649	0.3693	0.2734	0.6267	0.0527	0.0461
X12	0.93773	-0.07331	0.19879	0.27051	0.74920	0.97809	0.98905	0.84267	-0.06889	0.90558	0.70289	0.99691	0.99828
	0.0002	0.8513	0.6081	0.4814	0.0201	0.0001	0.0001	0.0043	0.8602	0.0008	0.0347	0.0001	0.0001
X13	0.90345	-0.26946	0.38298	0.23994	0.77415	0.98966	0.93902	0.74541	-0.19915	0.95363	0.78880	0.96040	0.96172
	0.0008	0.4832	0.3090	0.5340	0.0143	0.0001	0.0002	0.0212	0.6075	0.0001	0.0115	0.0001	0.0001
X14	0.94948	-0.16959	0.26978	0.16998	0.72122	0.98845	0.95714	0.75752	-0.17503	0.92717	0.76852	0.97300	0.98241
	0.0001	0.6627	0.4827	0.6620	0.0283	0.0001	0.0001	0.0181	0.6524	0.0003	0.0155	0.0001	0.0001
X15	0.92398	-0.27341	0.38051	0.15922	0.76671	0.99949	0.95430	0.76212	-0.14140	0.94443	0.74788	0.96858	0.97198
	0.0004	0.4766	0.3124	0.6824	0.0159	0.0001	0.0001	0.0170	0.7167	0.0001	0.0205	0.0001	0.0001
X16	0.92229	-0.27491	0.37949	0.16958	0.75820	0.99878	0.94970	0.75457	-0.15678	0.94874	0.75972	0.96597	0.96940
	0.0004	0.4740	0.3138	0.6627	0.0179	0.0001	0.0001	0.0188	0.6871	0.0001	0.0175	0.0001	0.0001
X17	0.90193	-0.33943	0.41963	0.13941	0.74452	0.98286	0.89607	0.64924	-0.29764	0.96475	0.84087	0.92585	0.93209
	0.0009	0.3715	0.2609	0.7206	0.0214	0.0001	0.0011	0.0585	0.4366	0.0001	0.0045	0.0003	0.0003
X18	0.95247	-0.16337	0.25983	0.14751	0.69797	0.98167	0.94632	0.73749	-0.19903	0.91721	0.77774	0.96308	0.97665
	0.0001	0.6745	0.4996	0.7049	0.0365	0.0001	0.0001	0.0233	0.6077	0.0005	0.0136	0.0001	0.0001
X19	0.47589	-0.11386	0.09105	-0.56409	-0.05113	0.36287	0.39553	0.47429	0.19974	0.18599	0.01257	0.34615	0.38784
	0.1954	0.7705	0.8158	0.1136	0.8961	0.3371	0.2920	0.1971	0.6064	0.6319	0.9744	0.3615	0.3024
X20	0.70678	-0.08525	0.08393	-0.06724	0.41250	0.72331	-0.66350	0.41574	-0.36176	0.74432	0.72166	0.70002	0.70708
	0.0333	0.8274	0.8300	0.9640	0.2699	0.0276	0.0514	0.2658	0.3367	0.0214	0.0282	0.0358	0.0332
X21	0.78860	0.47565	-0.32595	0.40741	0.51238	0.70804	0.87119	0.87686	0.21718	0.56784	0.36582	0.84963	0.85320
	0.0116	0.1956	0.3920	0.2764	0.1584	0.0328	0.0022	0.0019	0.5746	0.1107	0.3329	0.0037	0.0034

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
X22	-0.27959	-0.11537	0.10761	0.31948	0.16855	-0.17460	-0.09152	0.19146	0.59327	-0.13173	-0.48540	-0.12794	-0.19946
	0.4662	0.7676	0.7829	0.4020	0.6647	0.6532	0.8149	0.6217	0.0922	0.7355	0.1853	0.7429	0.6069
X23	0.59939	-0.46416	0.47664	0.33990	0.69379	0.69730	0.60547	0.48881	0.02965	0.72019	0.45507	0.61899	0.59279
	0.0880	0.2082	0.1946	0.3708	0.0382	0.0368	0.0840	0.1818	0.9396	0.0286	0.2184	0.0755	0.0925
X24	0.76891	0.04843	0.10299	0.60085	0.83605	0.86104	0.92323	0.85528	0.11665	0.83551	0.54990	0.92995	0.89577
	0.0155	0.9015	0.7920	0.0871	0.0050	0.0029	0.0004	0.0033	0.7650	0.0050	0.1251	0.0003	0.0011
X25	0.77010	0.48905	-0.33608	0.43496	0.50739	0.68812	0.86395	0.90013	0.28719	0.53984	0.30811	0.83651	0.83715
	0.0152	0.1815	0.3766	0.2420	0.1632	0.0404	0.0027	0.0009	0.4537	0.1336	0.4199	0.0049	0.0049
X26	-0.17744	-0.11129	0.11971	0.35499	0.23882	-0.07059	0.01942	0.29998	0.60614	-0.04136	-0.42414	-0.01844	-0.08958
	0.6479	0.7756	0.7590	0.3485	0.5360	0.8560	0.9605	0.4329	0.0836	0.9159	0.2552	0.9624	0.8187
X27	0.71987	-0.31248	0.36663	0.41071	0.77032	0.79872	0.77340	0.71353	0.16591	0.77747	0.43737	0.77227	0.74315
	0.0288	0.4130	0.3318	0.2722	0.0151	0.0098	0.0145	0.0309	0.6697	0.0137	0.2391	0.0147	0.0218
X28	0.77718	0.37866	-0.22821	0.50443	0.61318	0.73614	0.90130	0.95528	0.34487	0.60868	0.30475	0.87363	0.85951
	0.0137	0.3149	0.5548	0.1661	0.0791	0.0237	0.0009	0.0001	0.3634	0.0819	0.4252	0.0021	0.0030
X29	0.47078	-0.77241	0.70688	-0.27875	0.40121	0.57813	0.32530	-0.02286	-0.50212	0.64529	0.66733	0.37427	0.39136
	0.2009	0.0147	0.0332	0.4676	0.2845	0.1030	0.3930	0.9534	0.1684	0.0605	0.0496	0.3210	0.2976
X30	0.45977	-0.83439	0.78252	-0.31842	0.37879	0.54198	0.30415	0.03437	-0.33629	0.54850	0.51075	0.32999	0.35605
	0.2131	0.0052	0.0127	0.4037	0.3148	0.1317	0.4262	0.9301	0.3762	0.1262	0.1600	0.3858	0.3470
X31	0.47384	-0.78801	0.72365	-0.28667	0.40210	0.57891	0.32563	-0.01552	-0.48504	0.63871	0.65306	0.37202	0.39046
	0.1976	0.0117	0.0275	0.4545	0.2833	0.1024	0.3925	0.9684	0.1857	0.0641	0.0565	0.3242	0.2988

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE MS

STEP 4 VARIABLE X24 REMOVED R SQUARE = 0.96051870

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	635350.03425162	317675.01712581	72.99	0.0001
ERROR	6	26115.52130393	4352.58688399		
TOTAL	8	661465.55555556			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	3217.16311131				
X5	-0.25831381	0.09074186	35271.77355944	8.10	0.0293
X18	25.18054985	2.62444900	400683.62385001	92.06	0.0001

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE MS

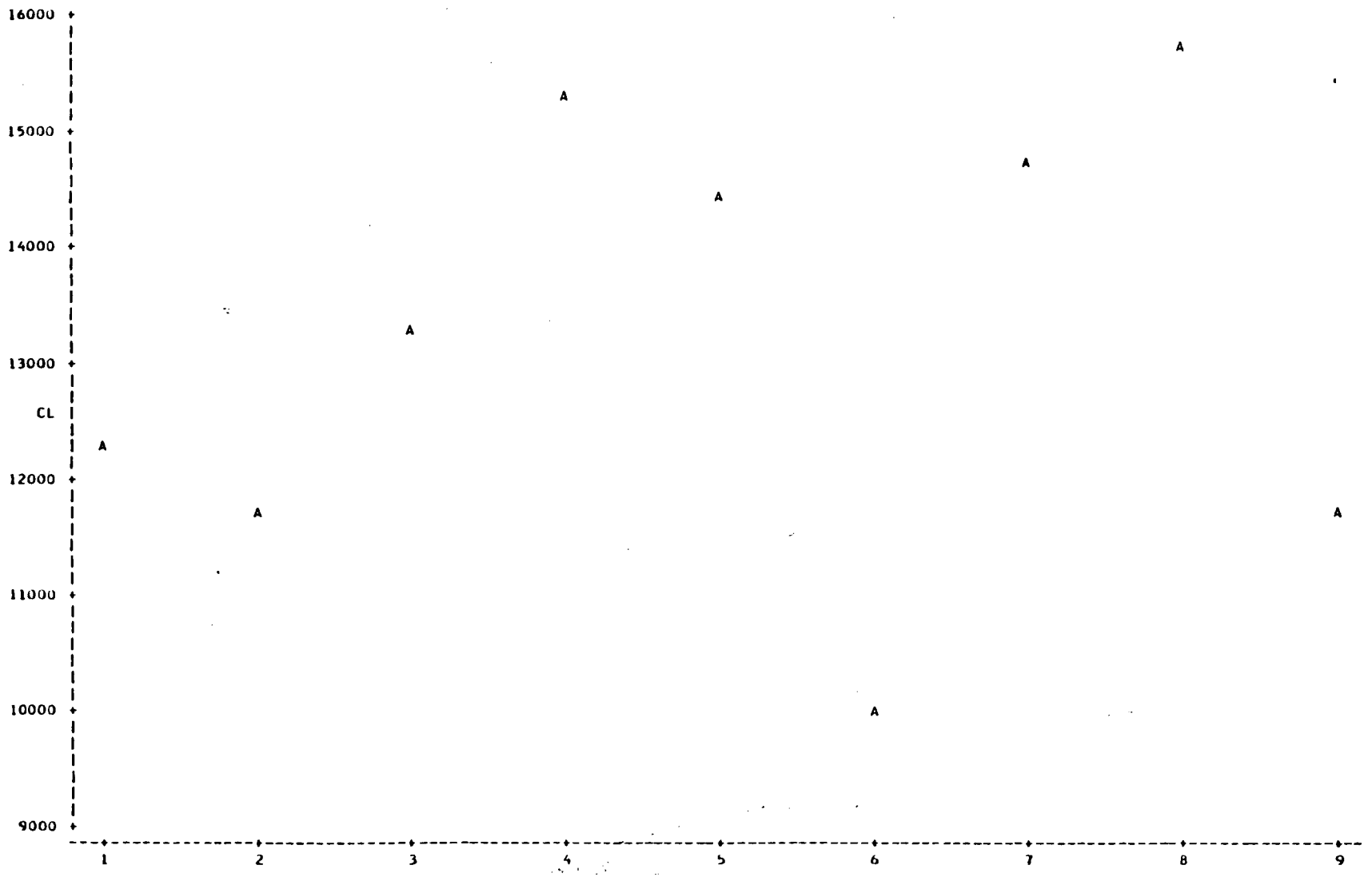
STEP 4 X18 REPLACED BY X14 R SQUARE = 0.99039617

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	655112.95005562	163778.23751390	103.13	0.0003
ERROR	4	6352.60549994	1588.15137498		
TOTAL	8	661465.55555556			

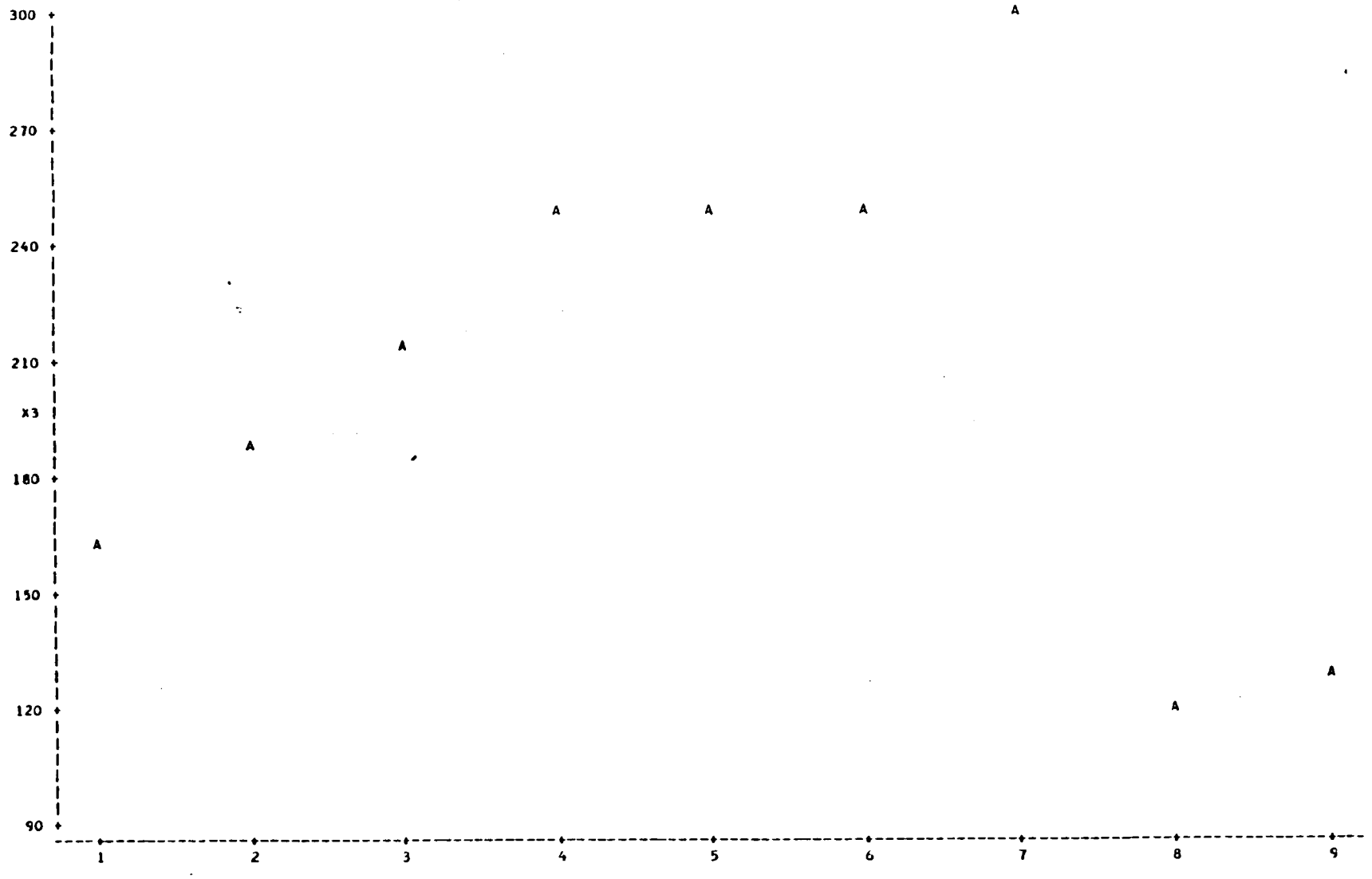
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2999.08402130				
CL	0.07827416	0.02443951	16290.85362738	10.26	0.0328
X3	2.38282855	0.42207779	50616.54443945	31.87	0.0048
X14	6.84852802	0.89652008	92675.79710465	58.35	0.0016
X24	-1.21925377	0.28796291	28471.27990687	17.93	0.0133

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

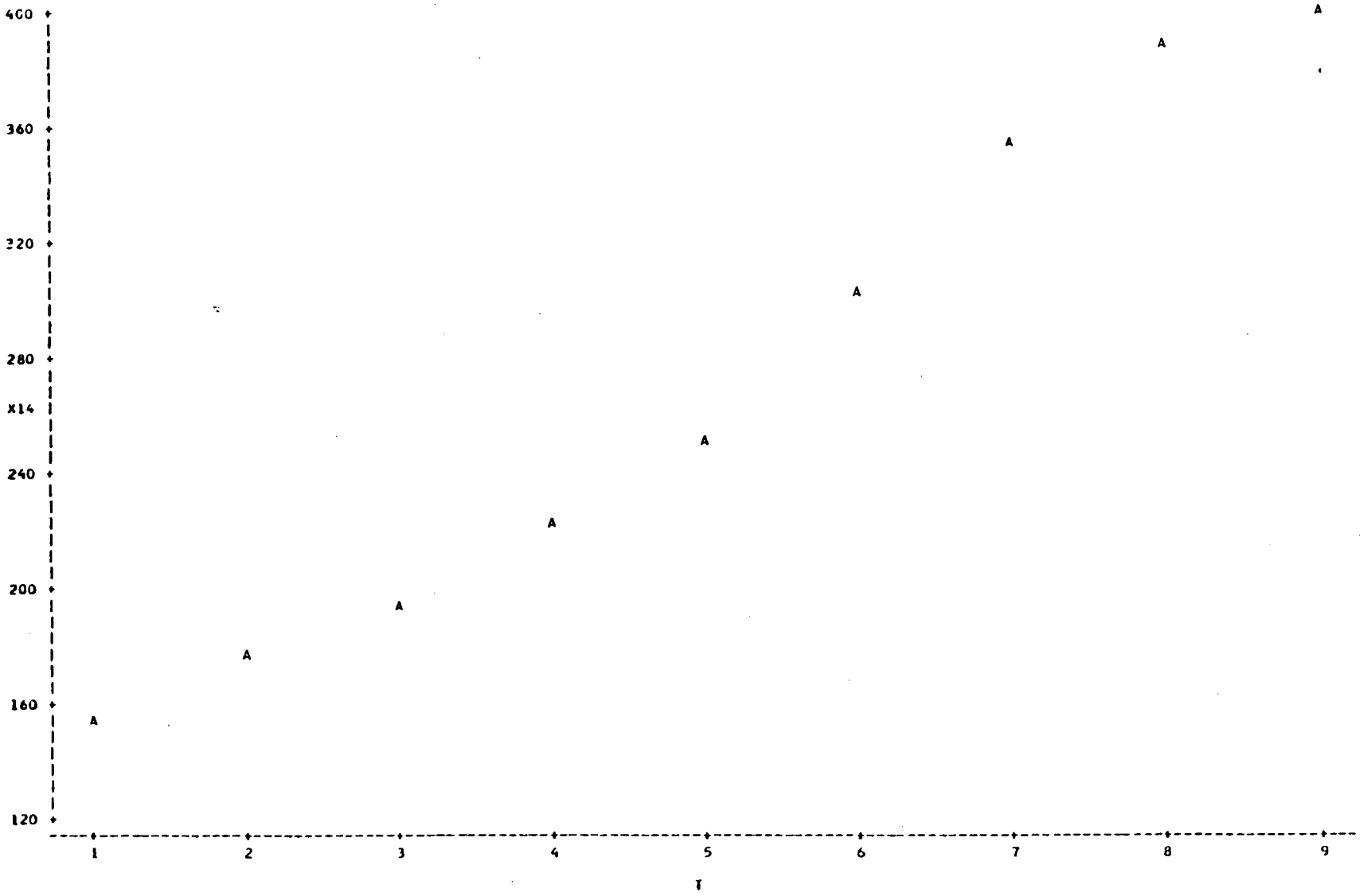
PLOT OF CL*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



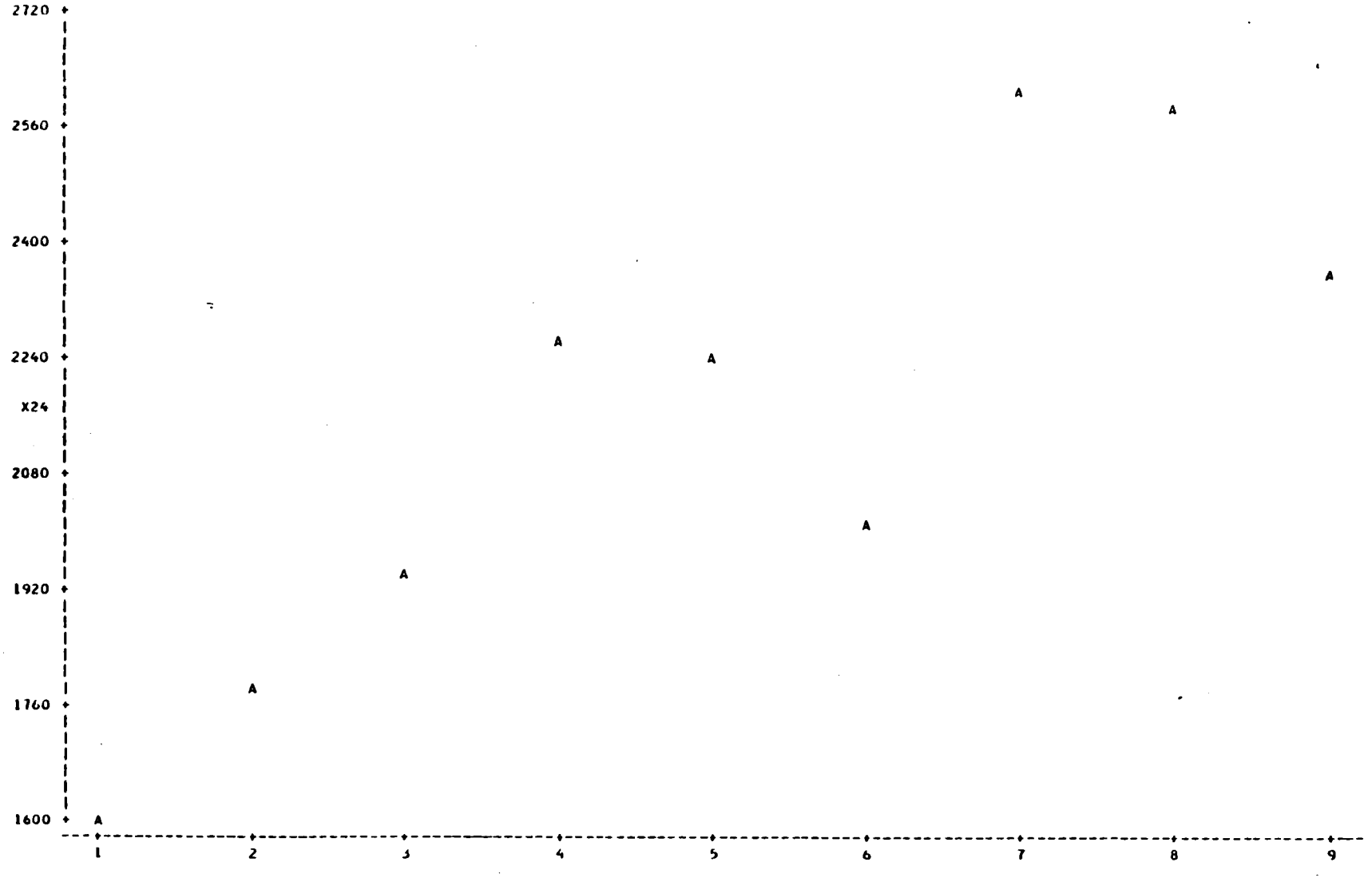
PLOT OF X3*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X14*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X24*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



VARIABLE	N	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
MS	9	61923.55555556	7827.65662748	557312.00000000	52021.00000000	74016.00000000
CA	9	-453.33333333	665.69024328	-4080.00000000	-2005.00000000	128.00000000
BP	9	-168.22222222	113.18986017	-1514.00000000	-330.00000000	-6.00000000
CL	9	36843.44444444	3717.93713338	331591.00000000	29641.00000000	42499.00000000
CU	9	19472.55555556	2493.62828581	175253.00000000	15112.00000000	22644.00000000
T	9	5.00000000	2.73861279	45.00000000	1.00000000	9.00000000

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T
MS	1.00000	-0.73920	-0.67756	0.65726	0.72345	0.96850
	0.0000	0.0229	0.0449	0.0544	0.0276	0.0001
CA	-0.73920	1.00000	0.70618	-0.07487	-0.34344	-0.74010
	0.0229	0.0000	0.0335	0.8482	0.3655	0.0226
BP	-0.67756	0.70618	1.00000	-0.13960	-0.45201	-0.68149
	0.0449	0.0335	0.0000	0.7202	0.2219	0.0432
CL	0.65726	-0.07487	-0.13960	1.00000	0.84255	0.68756
	0.0544	0.8482	0.7202	0.0000	0.0044	0.0407
CU	0.72345	-0.34344	-0.45201	0.84255	1.00000	0.83366
	0.0276	0.3655	0.2219	0.0044	0.0000	0.0052
T	0.96850	-0.74010	-0.68149	0.68756	0.83366	1.00000
	0.0001	0.0226	0.0432	0.0407	0.0052	0.0000

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE MS

STEP 4 VARIABLE BP REMOVED R SQUARE = 0.91076079

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	446434597.90432756	223217298.95216378	30.62	0.0007
ERROR	6	43743068.31789471	7290511.38631578		
TOTAL	8	490177666.22222230			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	11271.35550061				
CA	-8.15910724	1.43807842	234681112.29919598	32.19	0.0013
CL	1.27440323	0.25748547	178593762.22636850	24.50	0.0026

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
MS	1.00000 0.0000	-0.73920 0.0229	-0.67756 0.0449	0.65726 0.0544	0.72345 0.0276	0.96850 0.0001	0.90194 0.0009	0.67788 0.0448	-0.23071 0.5503	0.88217 0.0016	0.76418 0.0165	0.91530 0.0005	0.94180 0.0001
CA	-0.73920 0.0229	1.00000 0.0000	0.70618 0.0335	-0.07487 0.8482	-0.34344 0.3655	-0.74010 0.0226	-0.53519 0.1376	-0.21465 0.5792	0.57150 0.1079	-0.82795 0.0059	-0.85566 0.0033	-0.59475 0.0912	-0.59992 0.0877
BP	-0.67756 0.0449	0.70618 0.0335	1.00000 0.0000	-0.13960 0.7202	-0.45201 0.2219	-0.68149 0.0432	-0.63257 0.0675	-0.53091 0.1414	0.16360 0.6741	-0.63174 0.0680	-0.55056 0.1245	-0.64223 0.0622	-0.65770 0.0542
CL	0.65726 0.0544	-0.07487 0.8482	-0.13960 0.7202	1.00000 0.0000	0.84255 0.0044	0.68756 0.0407	0.81845 0.0070	0.80255 0.0092	0.27400 0.4756	0.54474 0.1294	0.29506 0.4408	0.79348 0.0107	0.79275 0.0108
CU	0.72345 0.0276	-0.34344 0.3655	-0.45201 0.2219	0.84255 0.0044	1.00000 0.0000	0.83366 0.0052	0.93282 0.0002	0.94691 0.0001	0.19189 0.6209	0.78211 0.0128	0.46559 0.2066	0.92553 0.0003	0.89564 0.0011
T	0.96850 0.0001	-0.74010 0.0226	-0.68149 0.0432	0.68756 0.0407	0.83366 0.0052	1.00000 0.0000	0.95472 0.0001	0.76534 0.0162	-0.14003 0.7194	0.94762 0.0001	0.74826 0.0204	0.96918 0.0001	0.97162 0.0001
X1	0.90194 0.0009	-0.53519 0.1376	-0.63257 0.0675	0.81845 0.0070	0.93282 0.0002	0.95472 0.0001	1.00000 0.0000	0.90591 0.0008	0.07323 0.8515	0.85778 0.0031	0.59490 0.0911	0.99464 0.0001	0.99212 0.0001
X2	0.67788 0.0448	-0.21465 0.5792	-0.53091 0.1414	0.80255 0.0092	0.94691 0.0001	0.76534 0.0162	0.90591 0.0008	1.00000 0.0000	0.38113 0.3115	0.63560 0.0658	0.27520 0.4736	0.87129 0.0022	0.85666 0.0032
X3	-0.23071 0.5503	0.57150 0.1079	0.16360 0.6741	0.27400 0.4756	0.19189 0.6209	-0.14003 0.7194	0.07323 0.8515	0.38113 0.3115	1.00000 0.0000	-0.33292 0.3813	-0.74705 0.0207	-0.01977 0.9597	-0.03583 0.9271

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
X4	0.88217	-0.82795	-0.63174	0.54474	0.78211	0.94762	0.85778	0.63560	-0.33292	1.00000	0.86190	0.90029	0.88165
	0.0016	0.0059	0.0680	0.1294	0.0128	0.0001	0.0031	0.0658	0.3813	0.0000	0.0028	0.0009	0.0017
X5	0.76418	-0.85566	-0.55056	0.29506	0.46559	0.74826	0.59490	0.27520	-0.74705	0.86190	1.00000	0.67046	0.67267
	0.0165	0.0033	0.1245	0.4408	0.2066	0.0204	0.0911	0.4736	0.0207	0.0028	0.0000	0.0481	0.0471
X6	0.91530	-0.59475	-0.64223	0.79348	0.92553	0.96918	0.99464	0.87129	-0.01977	0.90029	0.67046	1.00000	0.99479
	0.0005	0.0912	0.0622	0.0107	0.0003	0.0001	0.0001	0.0022	0.9597	0.0009	0.0481	0.0000	0.0001
X7	0.94180	-0.59992	-0.65770	0.79275	0.89564	0.97162	0.99212	0.85666	-0.03583	0.88165	0.67267	0.99479	1.00000
	0.0001	0.0877	0.0542	0.0108	0.0011	0.0001	0.0001	0.0032	0.9271	0.0017	0.0471	0.0001	0.0000
X8	0.65677	-0.21962	-0.56177	0.77720	0.93481	0.74874	0.89977	0.99277	0.38768	0.61939	0.26864	0.86562	0.85085
	0.0546	0.5702	0.1155	0.0137	0.0002	0.0203	0.0010	0.0001	0.3026	0.0753	0.4846	0.0026	0.0036
X9	0.90525	-0.66854	-0.68638	0.72438	0.90149	0.97245	0.97011	0.82540	-0.09422	0.94103	0.72792	0.98660	0.97329
	0.0008	0.0490	0.0412	0.0273	0.0009	0.0001	0.0001	0.0061	0.8095	0.0002	0.0262	0.0001	0.0001
X10	0.45841	-0.14119	-0.27002	0.68880	0.62568	0.51906	0.66140	0.64275	0.47042	0.36015	0.07801	0.62430	0.62597
	0.2146	0.7171	0.4822	0.0402	0.0715	0.1522	0.0524	0.0619	0.2013	0.3411	0.8419	0.0723	0.0713
X11	0.53801	-0.24016	-0.36820	0.65857	0.61718	0.56869	0.69046	0.63722	0.34092	0.40972	0.18875	0.66081	0.67481
	0.1351	0.5337	0.3296	0.0538	0.0766	0.1101	0.0395	0.0649	0.3693	0.2734	0.6267	0.0527	0.0461
X12	0.94115	-0.63065	-0.66140	0.77690	0.89702	0.97809	0.98905	0.84267	-0.06889	0.90558	0.70289	0.99691	0.99828
	0.0002	0.0686	0.0524	0.0138	0.0010	0.0001	0.0001	0.0043	0.8602	0.0008	0.0347	0.0001	0.0001
X13	0.95973	-0.77580	-0.74469	0.64350	0.81639	0.98966	0.93902	0.74541	-0.19915	0.95363	0.78880	0.96040	0.96172
	0.0001	0.0140	0.0213	0.0615	0.0073	0.0001	0.0002	0.0212	0.6075	0.0001	0.0115	0.0001	0.0001
X14	0.97337	-0.72329	-0.67039	0.71088	0.82770	0.98845	0.95714	0.75752	-0.17503	0.92717	0.76852	0.97300	0.98241
	0.0001	0.0276	0.0481	0.0318	0.0059	0.0001	0.0001	0.0181	0.6524	0.0003	0.0155	0.0001	0.0001
X15	0.97151	-0.73119	-0.66475	0.70218	0.83294	0.99949	0.95430	0.76212	-0.14140	0.94443	0.74788	0.96858	0.97198
	0.0001	0.0252	0.0508	0.0350	0.0053	0.0001	0.0001	0.0170	0.7167	0.0001	0.0205	0.0001	0.0001
X16	0.97151	-0.74969	-0.67937	0.68835	0.82841	0.99878	0.94970	0.75457	-0.15678	0.94874	0.75972	0.96597	0.96940
	0.0001	0.0200	0.0441	0.0404	0.0058	0.0001	0.0001	0.0188	0.6871	0.0001	0.0175	0.0001	0.0001
X17	0.96745	-0.83713	-0.69192	0.58976	0.74846	0.98286	0.89607	0.64924	-0.29764	0.96475	0.84087	0.92585	0.93209
	0.0001	0.0049	0.0389	0.0946	0.0203	0.0001	0.0011	0.0585	0.4366	0.0001	0.0045	0.0003	0.0003
X18	0.97690	-0.73227	-0.67750	0.69643	0.80525	0.98167	0.94632	0.73749	-0.19903	0.91721	0.77774	0.96308	0.97665
	0.0001	0.0249	0.0450	0.0371	0.0088	0.0001	0.0001	0.0233	0.6077	0.0005	0.0136	0.0001	0.0001
X19	0.43614	0.03800	-0.11026	0.39616	0.34332	0.36287	0.39553	0.47429	0.19974	0.18599	0.01257	0.34615	0.38784
	0.2406	0.9227	0.7777	0.2912	0.3657	0.3371	0.2920	0.1971	0.6064	0.6319	0.9744	0.3615	0.3024
X20	0.72588	-0.56452	-0.15786	0.59435	0.60120	0.72331	0.66350	0.41574	-0.36176	0.74432	0.72166	0.70002	0.70708
	0.0268	0.1133	0.6850	0.0914	0.0868	0.0276	0.0514	0.2658	0.3387	0.0214	0.0282	0.0358	0.0332
X21	0.66993	-0.17875	-0.44976	0.86001	0.86022	0.70804	0.87119	0.87686	0.21718	0.56784	0.36582	0.84963	0.85320
	0.0484	0.6454	0.2245	0.0029	0.0029	0.0328	0.0022	0.0019	0.5746	0.1107	0.3329	0.0037	0.0034

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
X22	-0.35746	0.33591	0.12142	-0.09256	0.12692	-0.17460	-0.09152	0.19146	0.59327	-0.13173	-0.48540	-0.12794	-0.19946
	0.3449	0.3768	0.7557	0.8128	0.7449	0.6532	0.8149	0.6217	0.0922	0.7355	0.1853	0.7429	0.6069
X23	0.59207	-0.76260	-0.74425	0.17772	0.52068	0.69730	0.60547	0.48881	0.02965	0.72019	0.45507	0.61899	0.59279
	0.0930	0.0169	0.0215	0.6474	0.1507	0.0368	0.0840	0.1818	0.9396	0.0286	0.2184	0.0755	0.0925
X24	0.73918	-0.50089	-0.57612	0.75888	0.93364	0.86104	0.92323	0.85528	0.11665	0.83551	0.54990	0.92995	0.89577
	0.0229	0.1696	0.1045	0.0177	0.0002	0.0029	0.0004	0.0033	0.7650	0.0050	0.1251	0.0003	0.0011
X25	0.64051	-0.14371	-0.46065	0.85347	0.86594	0.68812	0.86395	0.90013	0.28719	0.53984	0.30811	0.83651	0.83715
	0.0631	0.7122	0.2121	0.0034	0.0025	0.0404	0.0027	0.0009	0.4537	0.1336	0.4199	0.0049	0.0049
X26	-0.25792	0.27957	0.03712	-0.00447	0.23256	-0.07099	0.01942	0.29998	0.60614	-0.04136	-0.42414	-0.01844	-0.08958
	0.5028	0.4663	0.9245	0.9909	0.5471	0.8560	0.9605	0.4329	0.0836	0.9159	0.2552	0.9624	0.8187
X27	0.67780	-0.66373	-0.75602	0.40107	0.72198	0.79872	0.77340	0.71353	0.16591	0.77747	0.43737	0.77227	0.74315
	0.0448	0.0513	0.0184	0.2847	0.0281	0.0098	0.0145	0.0309	0.6697	0.0137	0.2391	0.0147	0.0218
X28	0.64991	-0.19412	-0.50873	0.84107	0.92632	0.73614	0.90130	0.95528	0.34487	0.60868	0.30475	0.87363	0.85951
	0.0581	0.6167	0.1619	0.0045	0.0003	0.0237	0.0009	0.0001	0.3634	0.0819	0.4252	0.0021	0.0030
X29	0.61169	-0.89147	-0.40612	-0.01640	0.11379	0.57813	0.32530	-0.02286	-0.50212	0.64529	0.66733	0.37427	0.39136
	0.0800	0.0012	0.2781	0.9666	0.7707	0.1030	0.3930	0.9534	0.1684	0.0605	0.0496	0.3210	0.2976
X30	0.58672	-0.83634	-0.58523	-0.11150	0.05965	0.54198	0.30415	0.03437	-0.33629	0.54850	0.51075	0.32999	0.35605
	0.0968	0.0050	0.0978	0.7752	0.8788	0.1317	0.4262	0.9301	0.3762	0.1262	0.1600	0.3858	0.3470
X31	0.61427	-0.89275	-0.43367	-0.02912	0.10774	0.57891	0.32563	-0.01552	-0.48504	0.63871	0.65306	0.37202	0.39046
	0.0784	0.0012	0.2435	0.9407	0.7826	0.1024	0.3925	0.9684	0.1857	0.0641	0.0565	0.3242	0.2988

STEP 3 VARIABLE X24 REMOVED R SQUARE = 0.95433822

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	467795281.16005970	467795281.16005970	146.30	0.0001
ERROR	7	22382385.06216257	3197483.58030894		
TOTAL	8	490177666.22222230			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	48703.45766602				
X18	540.82218884	44.71268445	467795281.16005940	146.30	0.0001

NO OTHER VARIABLES MEI THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE MS

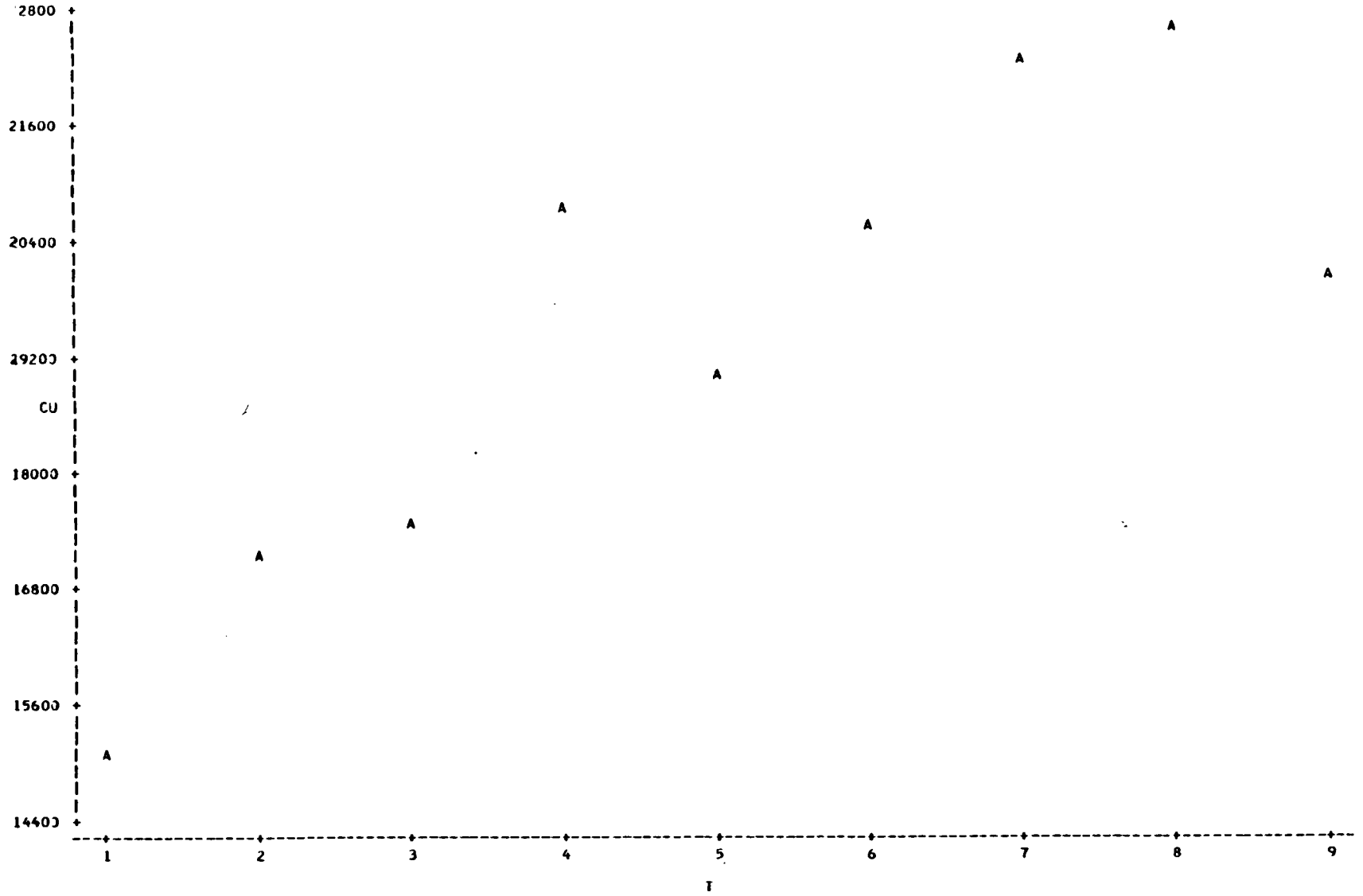
STEP 4 X24 REPLACED BY X9 R SQUARE = 0.99827952

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	489334327.31966030	122333581.82991509	580.23	0.0001
ERROR	4	843338.90256194	210834.72564049		
TOTAL	8	490177666.22222230			

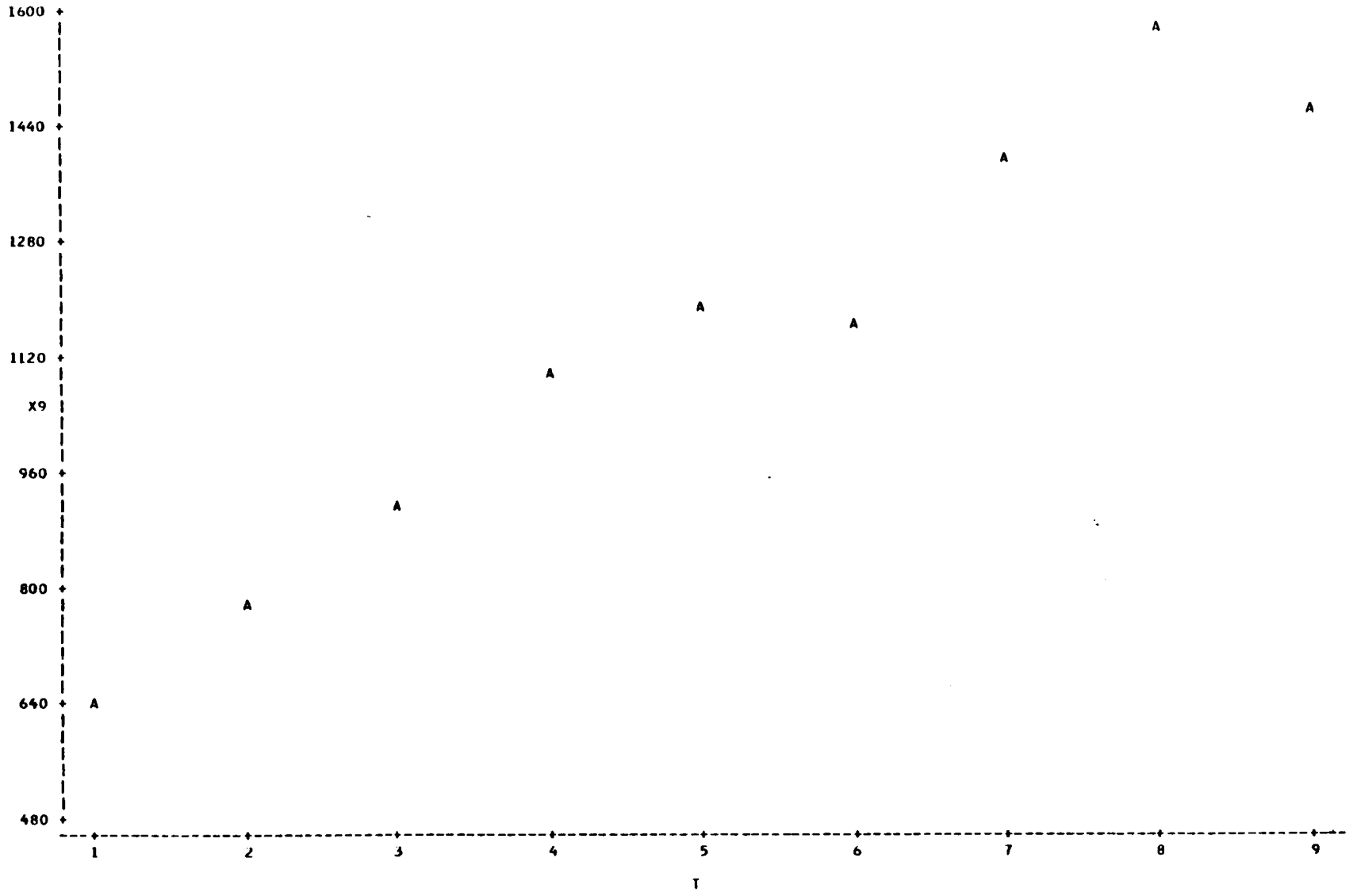
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-155030.97110289				
CU	-1.54284636	0.22455789	9952469.56050780	47.21	0.0024
X9	-20.42170693	3.30990321	8025934.92983801	38.07	0.0035
X16	14.36384687	0.88153715	55976074.11238514	265.50	0.0001
X31	-0.19424141	0.02434489	13421778.89267025	63.66	0.0013

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

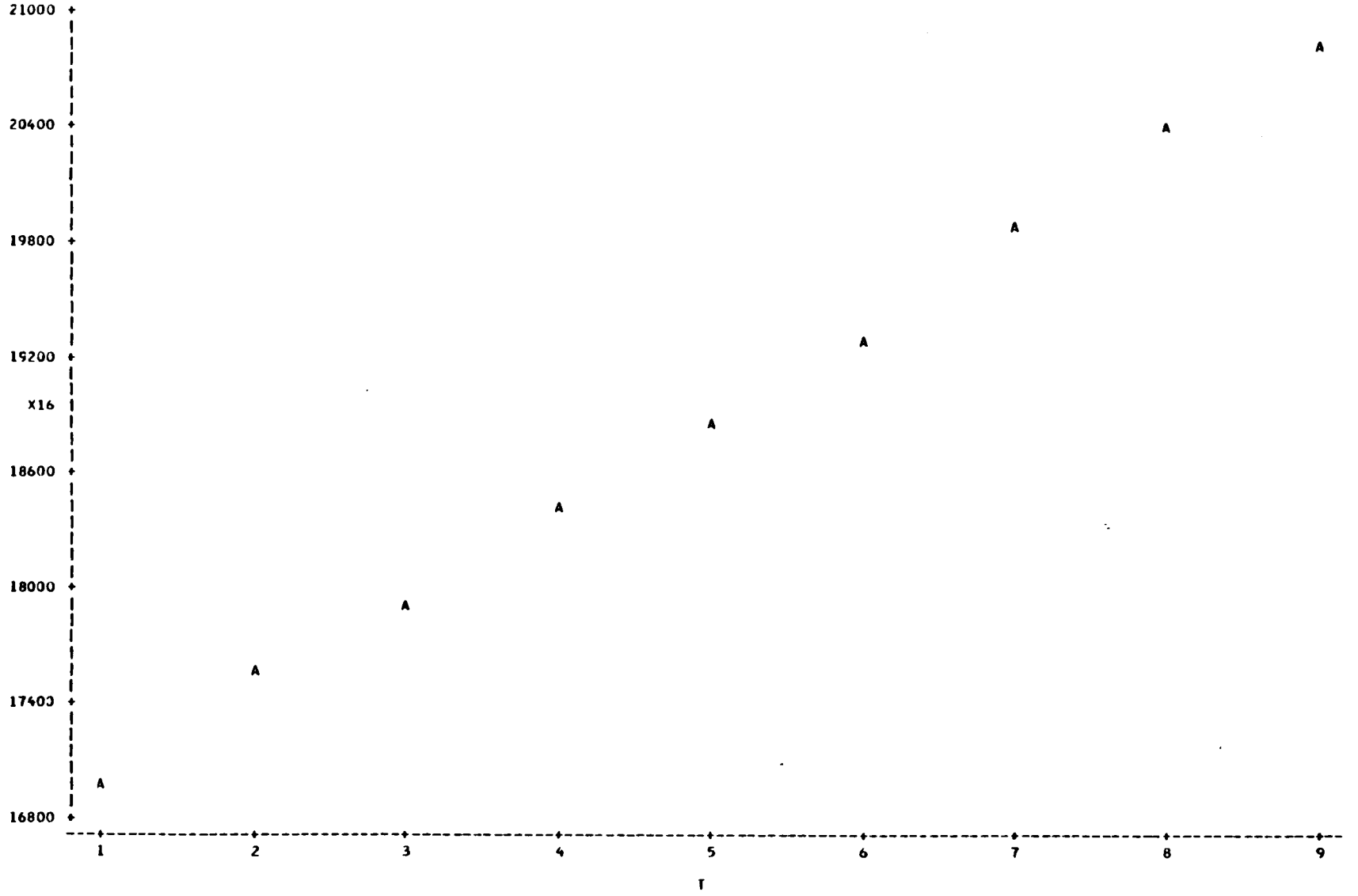
PLOT OF CU*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



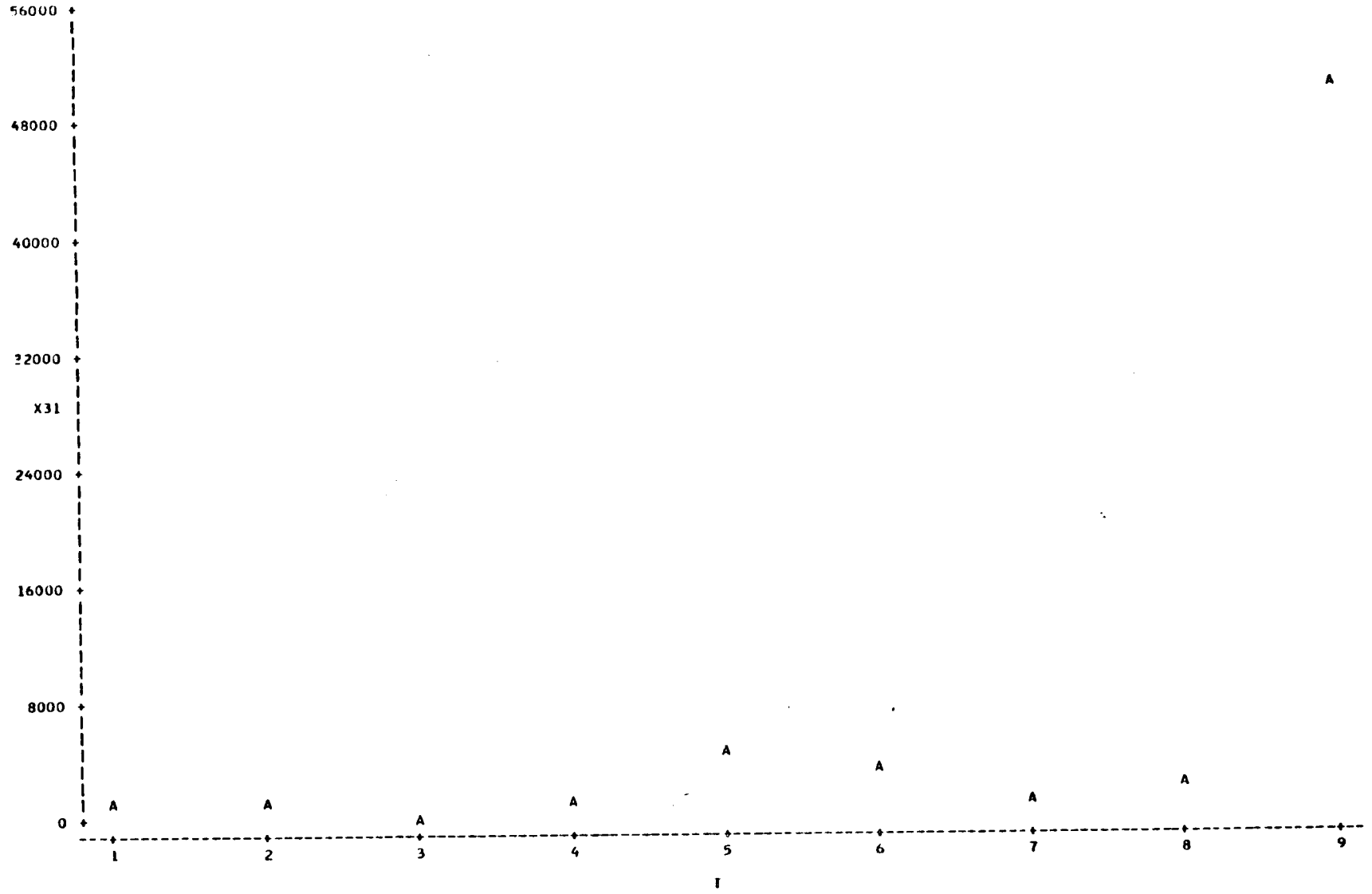
PLOT OF X9*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X16*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X31*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



VARIABLE	N	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
MS	9	4356.66666667	626.16371661	39210.00000000	3385.00000000	5301.00000000
CA	9	-220.44444444	480.13802992	-1984.00000000	-986.00000000	407.00000000
BP	9	-81.55555556	300.39228981	-734.00000000	-581.00000000	278.00000000
CL	9	3810.77777778	384.51748263	34297.00000000	3186.00000000	4246.00000000
CU	9	11378.55555556	2437.00113414	102407.00000000	7938.00000000	14866.00000000
T	9	5.00000000	2.73861279	45.00000000	1.00000000	9.00000000

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T
MS	1.00000 0.0000	-0.45214 0.2218	0.14874 0.7025	-0.53829 0.1349	0.93660 0.0002	0.98786 0.0001
CA	-0.45214 0.2218	1.00000 0.0000	-0.93290 0.0002	.00734 0.9851	-0.54161 0.1320	-0.39081 0.2984
BP	0.14874 0.7025	-0.93290 0.0002	1.00000 0.0000	0.10958 0.7790	0.26656 0.4881	0.08980 0.8183
CL	-0.53829 0.1349	-0.00734 0.9851	0.10958 0.7790	1.00000 0.0000	-0.53801 0.1351	-0.54354 0.1304
CU	0.93660 0.0002	-0.54161 0.1320	0.26656 0.4881	-0.53801 0.1351	1.00000 0.0000	0.93312 0.0002
T	0.98786 0.0001	-0.39081 0.2984	0.08980 0.8183	-0.54354 0.1304	0.93312 0.0002	1.00000 0.0000

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE MS

STEP 1 VARIABLE CU ENTERED R SQUARE = 0.87721280

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	2751507.76963312	2751507.76963312	50.01	0.0002
ERROR	7	385140.23036688	55020.03290955		
TOTAL	8	3136648.00000000			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1618.42495843				
CU	0.24064932	0.03402982	2751507.76963312	50.01	0.0002

STEP 2 VARIABLE BP ENTERED R SQUARE = 0.88817824

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	2785902.49961285	1392951.24980643	23.83	0.0014
ERROR	6	350745.50038715	58457.58339786		
TOTAL	8	3136648.00000000			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1515.28291732				
BP	-0.22647355	0.29525140	34394.72997974	0.59	0.4721
CU	0.24805068	0.03639360	2716512.54567503	46.47	0.0005

STEP 3 VARIABLE BP REMOVED R SQUARE = 0.87721280

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	2751507.76963312	2751507.76963312	50.01	0.0002
ERROR	7	385140.23036688	55020.03290955		
TOTAL	8	3136648.00000000			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1618.42495843				
CU	0.24064932	0.03402982	2751507.76963312	50.01	0.0002

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
MS	1.00000	-0.45214	0.14874	-0.53829	0.93660	0.98786	0.93156	0.73863	-0.14729	0.96981	0.75258	0.95234	0.94126
	0.0000	0.2218	0.7025	0.1349	0.0002	0.0001	0.0003	0.0230	0.7053	0.0001	0.0193	0.0001	0.0002
CA	-0.45214	1.00000	-0.93290	-0.00734	-0.54161	-0.39081	-0.21017	0.02446	0.77229	-0.62533	-0.80688	-0.33180	-0.26839
	0.2218	0.0000	0.0002	0.9851	0.1320	0.2984	0.5873	0.9502	0.0147	0.0717	0.0086	0.4299	0.4850
BP	0.14874	-0.93290	1.00000	0.10958	0.26656	0.08980	-0.11720	-0.31949	-0.78872	0.34500	0.60815	-0.02666	-0.05337
	0.7025	0.0002	0.0000	0.7790	0.4881	0.8183	0.7640	0.4020	0.0115	0.3632	0.0823	0.9457	0.8915
CL	-0.53829	-0.00734	0.10958	1.00000	-0.53801	-0.54354	-0.49232	-0.52762	-0.24321	-0.41549	-0.11368	-0.45327	-0.46839
	0.1349	0.9851	0.7790	0.0000	0.1351	0.1304	0.1782	0.1443	0.5283	0.2661	0.7709	0.2234	0.2035
CU	0.93660	-0.54161	0.26656	-0.53801	1.00000	0.98312	0.90865	0.79834	-0.14696	0.93198	0.73263	0.92992	0.91236
	0.0002	0.1320	0.4881	0.1351	0.0000	0.0002	0.0007	0.0099	0.7059	0.0003	0.0248	0.0003	0.0006
T	0.98786	-0.39081	0.08980	-0.54354	0.98312	1.00000	0.95472	0.76534	-0.14083	0.94762	0.74826	0.96918	0.97162
	0.0001	0.2984	0.8183	0.1304	0.0002	0.0000	0.0001	0.0162	0.7194	0.0001	0.0204	0.0001	0.0001
X1	0.93156	-0.21017	-0.11720	-0.49232	0.90865	0.95472	1.00000	0.90591	0.87323	0.85778	0.59490	0.99464	0.99212
	0.0003	0.5873	0.7640	0.1782	0.0007	0.0001	0.0000	0.0008	0.0015	0.0031	0.0911	0.0001	0.0001
X2	0.73863	0.02446	-0.31949	-0.52762	0.79834	0.76534	0.90591	1.00000	0.38113	0.63560	0.27520	0.87129	0.85566
	0.0230	0.9502	0.4020	0.1443	0.0099	0.0162	0.0008	0.0000	0.3115	0.0658	0.4736	0.0022	0.0032
X3	-0.14729	0.77229	-0.78872	-0.24321	-0.14696	-0.14083	0.07323	0.38113	1.00000	-0.33292	-0.74705	-0.01977	-0.03583
	0.7053	0.0147	0.0115	0.5283	0.7059	0.7194	0.8515	0.3115	0.0000	0.3813	0.0207	0.9597	0.9271

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CU	T	X1	X2	X3	X4	X5	X6	X7
X4	0.96981 0.0001	-0.62533 0.0717	0.34500 0.3632	-0.41549 0.2661	0.93198 0.0003	0.94762 0.0001	0.85778 0.0031	0.63560 0.0658	-0.33292 0.3813	1.00000 0.0000	0.86190 0.0028	0.90329 0.0009	0.88165 0.0017
X5	0.75298 0.0193	-0.60688 0.0806	0.60815 0.0823	-0.11368 0.7709	0.73263 0.0248	0.74826 0.0204	0.59496 0.0911	0.27520 0.4736	-0.74705 0.0207	0.86190 0.0028	1.00000 0.0000	0.67046 0.0481	0.67267 0.0471
X6	0.95204 0.0001	-0.30180 0.4299	-0.02666 0.9457	-0.45327 0.2264	0.92992 0.0003	0.96918 0.0001	0.99064 0.0001	0.87129 0.0022	-0.01977 0.9597	0.90329 0.0009	0.67046 0.0481	1.00000 0.0000	0.99479 0.0001
X7	0.94126 0.0002	-0.26839 0.4850	-0.05337 0.8915	-0.46839 0.2035	0.91236 0.0006	0.97162 0.0001	0.99212 0.0001	0.85666 0.0032	-0.03583 0.9271	0.88165 0.0017	0.67267 0.0471	0.99479 0.0001	1.00000 0.0000
X8	0.71853 0.0292	0.03081 0.9373	-0.31595 0.4075	-0.46801 0.2039	0.78814 0.0116	0.74874 0.0203	0.89977 0.0010	0.99277 0.0001	0.38768 0.3026	0.61939 0.0753	0.26864 0.4846	0.86562 0.0026	0.85085 0.0036
X9	0.97142 0.0001	-0.43395 0.2432	0.11616 0.7660	-0.45290 0.2269	0.96633 0.0001	0.97245 0.0001	0.97011 0.0001	0.82540 0.0061	-0.09422 0.8095	0.94103 0.0002	0.72792 0.0262	0.98660 0.0001	0.97329 0.0001
X10	0.47346 0.1980	0.30085 0.4315	-0.50481 0.1657	-0.01696 0.9655	0.39574 0.2917	0.51906 0.1522	0.66140 0.0524	0.64275 0.0619	0.47042 0.2013	0.36015 0.3411	0.07801 0.8419	0.62430 0.0723	0.62597 0.0713
X11	0.50416 0.1654	0.23660 0.5399	-0.43468 0.2423	-0.01902 0.9613	0.44154 0.2341	0.56869 0.1101	0.69046 0.0395	0.63722 0.0649	0.34092 0.3693	0.40972 0.2734	0.18875 0.6267	0.66081 0.0527	0.67481 0.0461
X12	0.95401 0.0001	-0.31665 0.4064	-0.00515 0.9895	-0.45204 0.2219	0.92611 0.0003	0.97869 0.0001	0.98905 0.0001	0.84267 0.0043	-0.06889 0.8602	0.90558 0.0008	0.70289 0.0347	0.99691 0.0001	0.99828 0.0001
X13	0.97552 0.0001	-0.47624 0.1950	0.18837 0.6274	-0.50421 0.1663	0.95922 0.0001	0.98966 0.0001	0.93902 0.0002	0.74541 0.0212	-0.19915 0.6075	0.95363 0.0001	0.78880 0.0115	0.98640 0.0001	0.96172 0.0001
X14	0.96102 0.0001	-0.36280 0.3373	0.06007 0.8780	-0.44964 0.2246	0.90652 0.0007	0.98845 0.0001	0.95714 0.0001	0.75752 0.0181	-0.17533 0.6524	0.92717 0.0003	0.76852 0.0155	0.97300 0.0001	0.98241 0.0001
X15	0.98652 0.0001	-0.38422 0.3073	0.07986 0.8382	-0.53863 0.1346	0.92647 0.0003	0.99949 0.0001	0.95430 0.0001	0.76212 0.0170	-0.14140 0.7167	0.94443 0.0001	0.74788 0.0205	0.96858 0.0001	0.97198 0.0001
X16	0.98400 0.0001	-0.40409 0.2807	0.10552 0.7870	-0.52485 0.1468	0.93206 0.0003	0.99878 0.0001	0.94970 0.0001	0.75457 0.0188	-0.15678 0.6871	0.94874 0.0001	0.75972 0.0175	0.96597 0.0001	0.96940 0.0001
X17	0.97102 0.0001	-0.49614 0.1763	0.22077 0.5681	-0.46445 0.2078	0.90855 0.0007	0.98286 0.0001	0.89607 0.0011	0.64924 0.0585	-0.23764 0.4366	0.96475 0.0001	0.84087 0.0045	0.92585 0.0003	0.93209 0.0003
X18	0.94860 0.0001	-0.36117 0.3396	0.06539 0.8673	-0.43401 0.2431	0.89365 0.0012	0.98167 0.0001	0.94632 0.0001	0.73749 0.0233	-0.19953 0.6077	0.91721 0.0005	0.77774 0.0136	0.96338 0.0001	0.97665 0.0001
X19	0.30742 0.4210	0.35517 0.3483	-0.48688 0.1838	-0.69500 0.0377	0.23967 0.5345	0.36287 0.3371	0.39553 0.2920	0.47429 0.1971	0.19974 0.6064	0.18599 0.6319	0.01257 0.9744	0.34615 0.3615	0.38784 0.3024
X20	0.70775 0.0329	-0.26508 0.4906	0.00799 0.9837	-0.04675 0.9049	0.53528 0.1375	0.72331 0.0276	0.66350 0.0514	0.41574 0.2658	-0.36176 0.3387	0.74432 0.0214	0.72166 0.0282	0.70302 0.0358	0.70708 0.0332
X21	0.65227 0.0569	0.05002 0.8943	-0.35359 0.3506	-0.16148 0.6781	0.67547 0.0458	0.70804 0.0328	0.87119 0.0022	0.87686 0.0019	0.21713 0.5746	0.56784 0.1107	0.36582 0.3329	0.84963 0.0037	0.85320 0.0034

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 9

	MS	CA	BP	CL	CC	T	X1	X2	X3	X4	X5	X6	X7
X22	-0.07623	0.12834	-0.11231	-0.35395	0.00753	-0.17460	-0.09152	0.19146	0.59327	-0.13173	-0.48540	-0.12794	-0.19946
	0.8454	0.7421	0.7736	0.3500	0.9847	0.6552	0.8159	0.6217	0.0922	0.7355	0.1853	0.7429	0.6069
X23	0.72876	-0.45455	0.33824	-0.53316	0.75835	0.69730	0.60547	0.48881	0.02965	0.72019	0.45507	0.61899	0.59279
	0.0259	0.2190	0.3733	0.1394	0.0179	0.0368	0.0846	0.1818	0.9396	0.0286	0.2184	0.0755	0.0925
X24	0.87452	-0.33071	0.01780	-0.30500	0.89240	0.86104	0.92323	0.85528	0.11665	0.83551	0.54990	0.92995	0.89577
	0.0026	0.3847	0.9637	0.4248	0.0012	0.0029	0.0004	0.0033	0.7650	0.0050	0.1251	0.0003	0.0011
X25	0.63339	0.08608	-0.37619	-0.19071	0.67395	0.68812	0.86395	0.90013	0.28719	0.53984	0.30811	0.83651	0.83715
	0.0671	0.8377	0.3184	0.6231	0.0465	0.0404	0.0027	0.0009	0.4537	0.1336	0.4199	0.0049	0.0049
X26	0.02190	0.10364	-0.12082	-0.41642	0.11450	-0.07099	0.01942	0.25998	0.60614	-0.04136	-0.42414	-0.01844	-0.08958
	0.9554	0.7907	0.7568	0.2649	0.7693	0.8560	0.9605	0.4329	0.0836	0.9159	0.2552	0.9624	0.8187
X27	0.82286	-0.35409	0.16221	-0.60535	0.86071	0.79872	0.77340	0.71353	0.16591	0.77747	0.43737	0.77227	0.74315
	0.0064	0.3498	0.6767	0.0841	0.0029	0.0098	0.0145	0.0309	0.6697	0.0137	0.2391	0.0147	0.0218
X28	0.70470	0.01927	-0.32377	-0.36314	0.75402	0.73614	0.90130	0.95528	0.34487	0.60368	0.30475	0.87363	0.85951
	0.0340	0.9608	0.3954	0.4278	0.0189	0.0237	0.0009	0.0001	0.3634	0.0819	0.4252	0.0021	0.0030
X29	0.59402	-0.51554	0.46012	-0.34479	0.43637	0.57813	0.32530	-0.02286	-0.50212	0.64529	0.66733	0.37427	0.39136
	0.0917	0.1555	0.2127	0.3635	0.2403	0.1030	0.3930	0.9534	0.1684	0.0605	0.0496	0.3210	0.2976
X30	0.54668	-0.43217	0.42105	-0.59609	0.45816	0.54198	0.30415	0.03437	-0.33629	0.54850	0.51075	0.32999	0.35605
	0.1277	0.2454	0.2591	0.0903	0.2149	0.1317	0.4262	0.9301	0.3762	0.1262	0.1600	0.3858	0.3470
X31	0.59347	-0.50948	0.45938	-0.38129	0.44344	0.57891	0.32563	-0.01552	-0.48504	0.63871	0.65306	0.37202	0.39046
	0.0920	0.1612	0.2135	0.3113	0.2319	0.1024	0.3925	0.9664	0.1857	0.0641	0.0565	0.3242	0.2988

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE MS

STEP 4 VARIABLE X26 ENTERED R SQUARE = 0.99828212

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	3131259.63054311	782814.90763578	581.11	0.0001
ERROR	4	5388.36945689	1347.09236422		
TOTAL	8	3136648.00000000			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	922.67483479				
X4	6.22332865	1.88407964	14697.52921787	10.91	0.0298
X15	0.98486726	0.10699692	114118.82210312	84.71	0.0008
X22	18.08754712	6.28914686	11142.25908306	8.27	0.0452
X26	-0.09249470	0.03479210	9520.71805930	7.07	0.0565

STEP 4 X4 REPLACED BY X9 R SQUARE = 0.99889690

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	3133187.95561096	783296.98890274	905.53	0.0001
ERROR	4	3460.04438904	865.01109726		
TOTAL	8	3136648.00000000			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	298.42994934				
X9	0.74446876	0.16981081	16625.85428571	19.22	0.0118
X15	0.97975128	0.08274998	121260.00474223	140.18	0.0003
X22	37.70264536	5.10298448	47219.00494333	54.59	0.0018
X26	-0.20357097	0.02863522	43717.19034552	50.54	0.0021

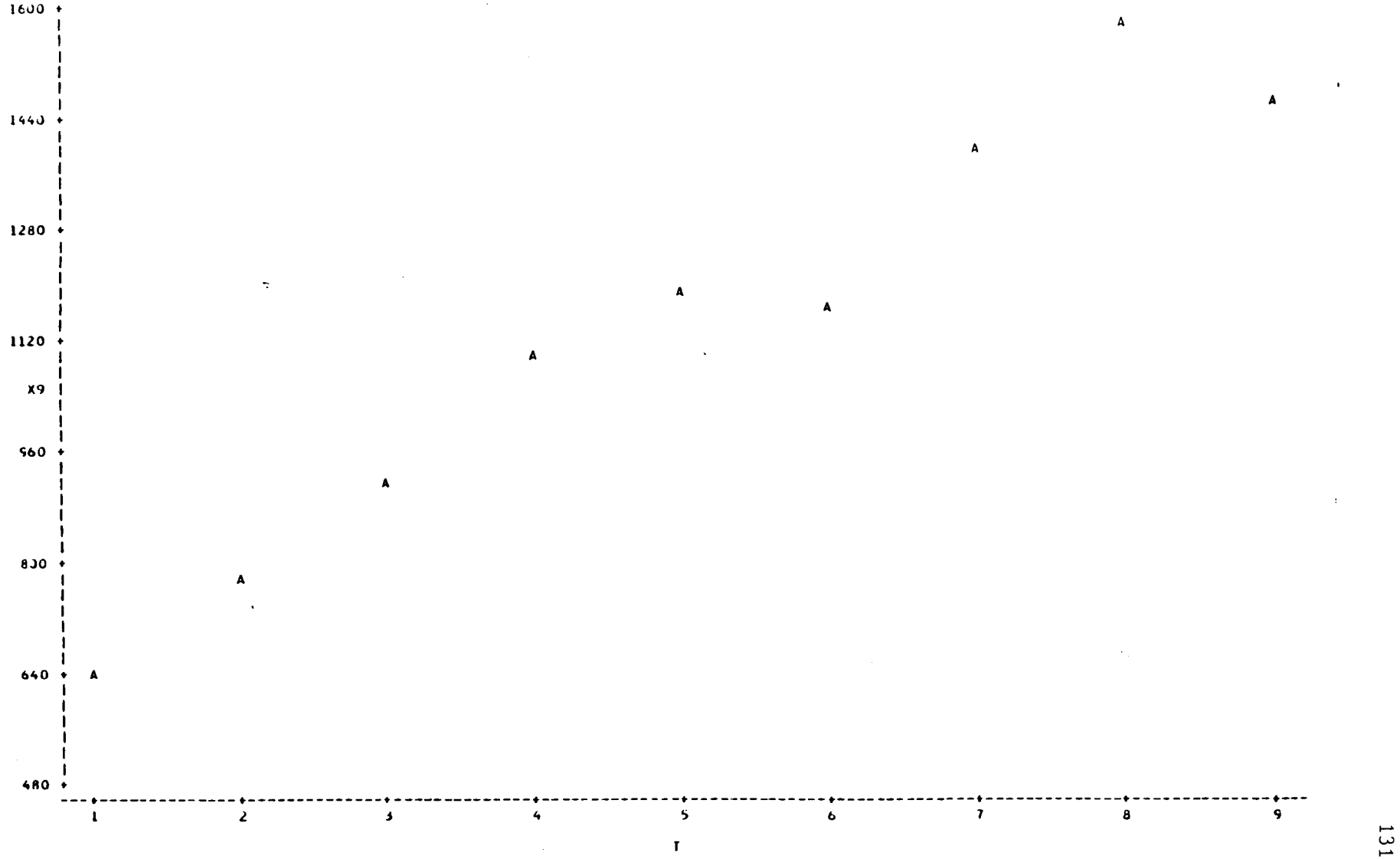
STEP 4 X15 REPLACED BY X16 R SQUARE = 0.99946995

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	3134985.41842661	783746.35460665	1885.61	0.0001
ERROR	4	1662.58157339	415.64539335		
TOTAL	8	3136648.00000000			

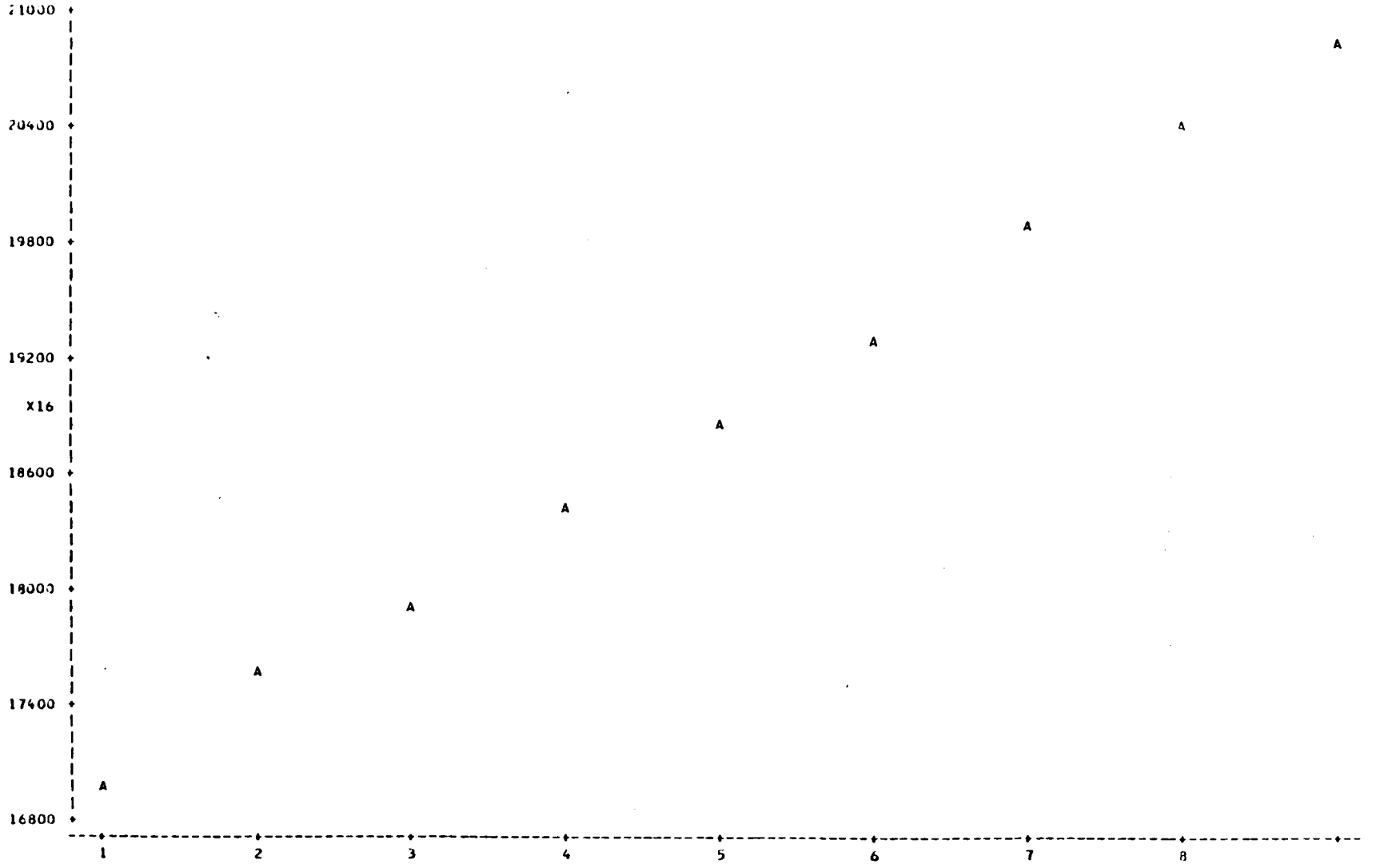
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-5919.48643924				
X9	0.70536200	0.11904289	14592.85245632	35.11	0.0041
X16	0.44889124	0.02608847	123057.46755788	296.06	0.0001
X22	40.99097640	3.53664738	55836.21583925	134.34	0.0003
X26	-0.22055847	0.01982209	51460.19503649	123.81	0.0004

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

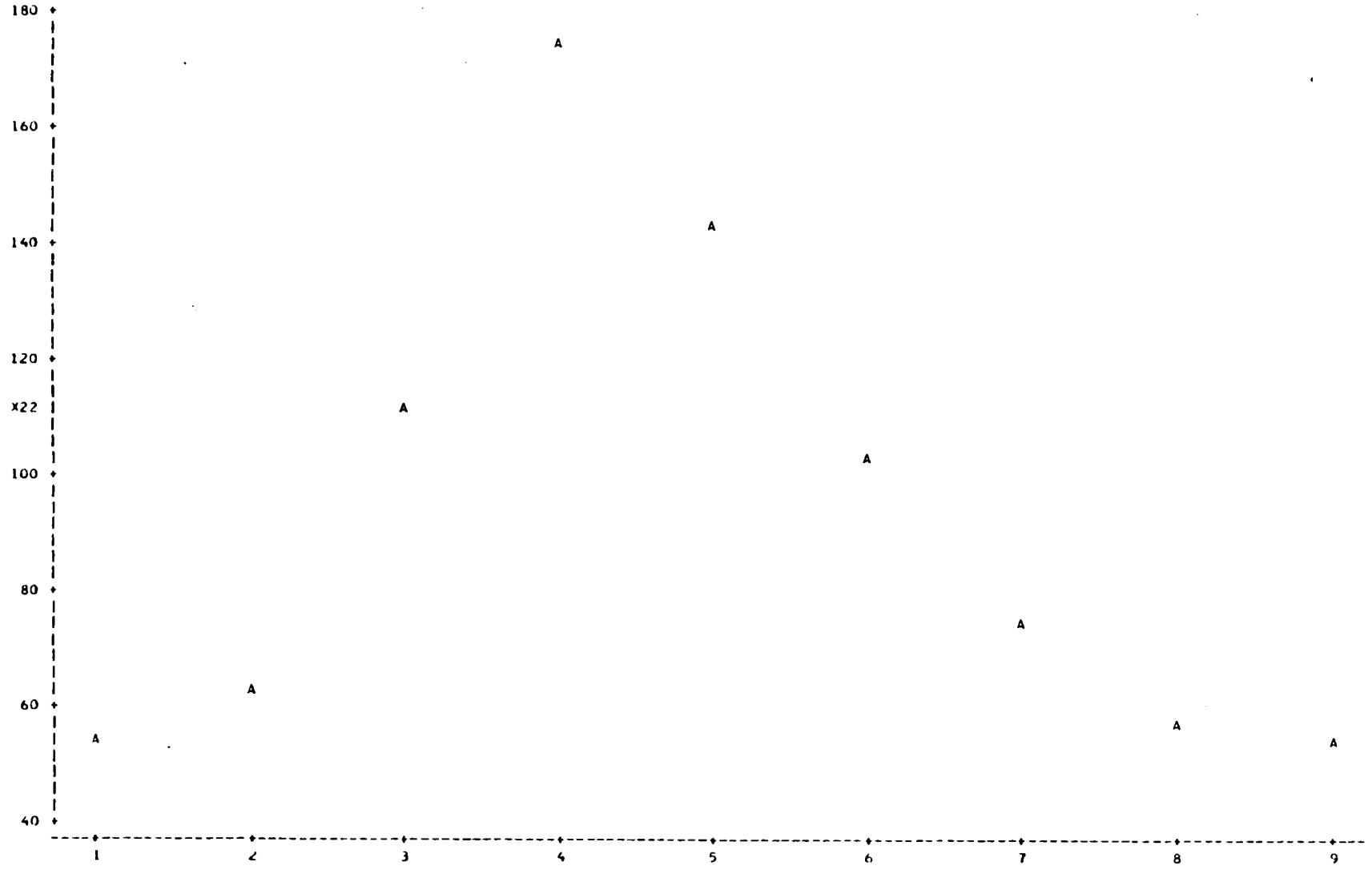
PLOT OF X9*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



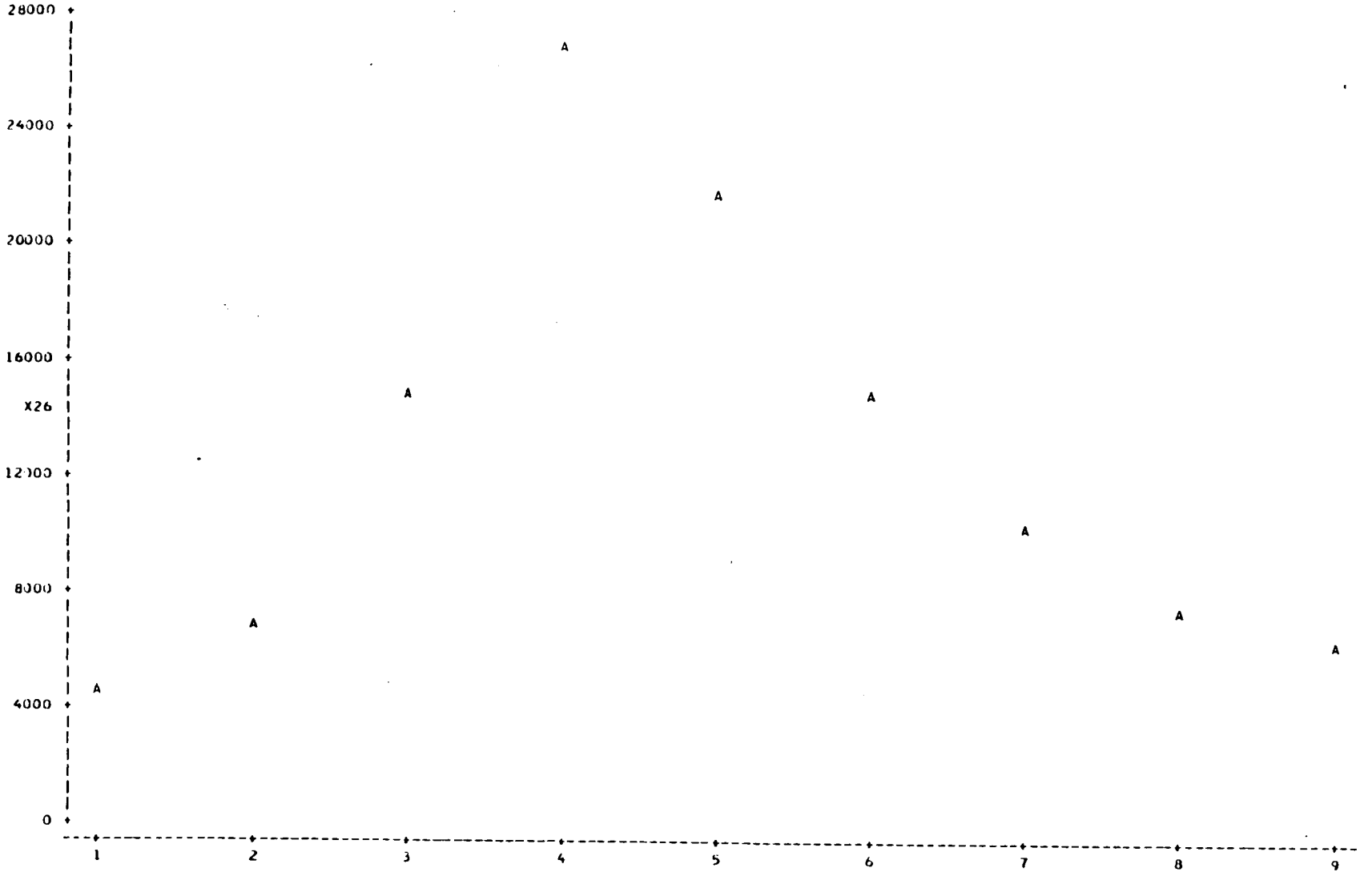
PLOT OF X16*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X22*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



PLOT OF X26*T LEGEND: A = 1 OBS, B = 2 OBS, ETC.



VITA

Ali Albadawy is married with one child, a girl. He has worked in the field of business and in the field of maritime transportation since 1967 and worked as an instructor, then in the Department of Business Administration at Western Kentucky University at Bowling Green, Kentucky, where he is presently on a leave of absence in order to complete his D.B.A. from The University of Tennessee, Knoxville.

He received a B.S. degree from Ain-Shams University, Cairo, Egypt, in 1964; a Graduate Diploma in Business Administration from Kuwait University, State of Kuwait; an M.B.A. degree in Business Administration from Middle Tennessee State University, Murfreesboro, Tennessee; and a D.B.A. in Transportation and Marketing from The University of Tennessee Knoxville, in 1979.