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AN ANALYSIS OF THE IMPACT OF FOREIGN COLLABORATIONS ON PRODUCTION, EXPORTS AND IMPORTS IN INDIA

by

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ABSTRACT

An Analysis of The Impact of Foreign Collaborations on Production, Exports and Imports in India.

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This thesis examines at a micro-level the effect of foreign collaborations in India on trade and production. The data used is classified according to the Standard International Trade Classification (SITC). It is examined at both the one digit (sector) and the two digit (industry) levels. The results of the analysis are inconclusive. This is possibly due to the lack of availability of sufficient foreign collaborations data and the lack of sufficient disaggregation of data relating to domestic investment. With the availability of additional data on foreign collaborations and disaggregated data on domestic investment, it is hoped that this study would lead to stronger, more conclusive results under the adopted framework.

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Introduction

The last few years have been ones of intense economic debate in India. This debate has focused chiefly around India's economic policies and strategies. India has seemingly acknowledged the limitation of it's post independence economic strategy and is now aiming to move in a new direction[1]. The new policies are aimed at gradually moving the country out of the clutches of government controls and industrial regulations toward policies of import liberalization and export promotion.

While several observers have welcomed such a move by the government, attributing the apparently faster rate of growth of the economy in the 1980's to these changes, there have been others who fear that they would create more problems than they would solve.

Foreign trade has been an area most affected by the recent changes in government policy. There have been considerable differences of views on the emphasis placed on export promotion and import substitution in the development strategy to achieve industrialization. However, these two approaches are neither mutually exclusive nor completely alternative policies. Most developing countries rely on some mix of these two approaches.

Since independence the Indian approach has been dominated by import substitution policies. However new policies passed through policy resolution statements in 1980 and

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[1] See Chapter 1., Jalan *India's Economic Crisis.*

then again in 1991 aims at changing this approach, giving it more of an export promotion slant.

Another area affected by the changes in government policy since 1980 has been foreign investments and collaborations. Before the eighties, India did not draw many foreign investments and collaborations. With the reforms in industrial and trade policy in the early eighties, foreign investment and collaborations have increased rapidly for example, foreign investment in India during the period 1986-1990 amounted to a total of Rs. 900 crore[2]. Prior to that, foreign investment averaged roughly Rs. 10 crore per annum. Foreign collaborations have also increased rapidly since the early eighties[3].

The goal of this thesis is to examine at a micro level the effect of foreign collaborations in India on trade and production. Our focus here is on the question of whether sectors that have experienced more foreign collaborations than others, have more rapid growth in trade and production than sectors with less or no foreign collaborations.

The null hypothesis is that sectors experiencing increases in foreign collaborations have increases in production and net exports. By net exports, the reference is to exports minus imports (X-M). It is hypothesized that post 1980 increases in net exports would be driven more by increases in exports, while pre 1980 increases in net exports would be driven by decreases in imports.

The rationale behind this idea is that technology transfer accompanies almost all foreign collaborations. Thus industries that engage in large numbers of collaborations

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[2] A crore is a unit of measure that is equivalent of 10 million units(10,000,000).

[3] See Fig. III in the Appendix

should also experience gains in technology. This should translate to increases in production and in most cases, should help them be more competitive in world markets leading to increases in exports. Finally, with the emphasis on import substitution prior to 1980, increased production may have led to decreased imports in the aggregate during that period. However, with changes in government policies during the early eighties, the increased activity in global markets may lead to increased imports in the aggregate(post 1980). It is possible, however, that dominating the effect of foreign collaborations is growth via capital and labor accumulations. This idea serves as the alternative hypothesis.

Alternatively this may also be seen in terms of analyzing government policies with respect to their expectations about foreign collaborations, against what actually took place. In this setup, production is considered a function of foreign collaborations, labor and capital, taking the following form:

$$Y_i = A_i\, f_i(K_i, L_i)^4.$$

Our hypothesis looks at the assumption that increases in total factor productivity, proxyed by foreign collaborations (A in the above equation) is the driving force to increases in Y. The rejection of the hypothesis says that foreign collaborations have little or no effect.

The statistical section consists of regression and correlation analysis using data on production, imports, exports and foreign collaborations. The data has been classified as

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[4] Where Y represents production, A represents Foreign Collaboration, K represent Capital and L represents labor.

per the SITC[5] and is looked at at both the one digit(sector) and the two digit(industry) levels. The regressions run were of the following order:

$$X_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

$$M_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

$$P_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

where X_i is exports in the ith sector as a share of GNP, M_i is imports in the ith sector as a share of GNP, P_i is production in the ith sector, I/Y is total domestic investment over GNP, FC_i is foreign collaborations in the ith sector over the total number of foreign collaborations and ε is the random disturbance term.

Correlations were run between foreign collaborations and exports, imports and production. The results were analyzed for 10 broad sectors according to the SITC classification. The results were inconclusive and led to the further analysis of the data at the two digit (industry) level. The results at the two digit level allowed us to reach conclusions on our hypothesis for some of the industries. Overall however, the industry level results suggested a need for further data on foreign collaborations and for the disaggregation of domestic investment by sector (I_i/Y instead of I/Y), before decisive conclusions could be drawn for all industries and sectors. These results are discussed in detail in chapters VI through VIII.

The thesis is divided in 9 sections. Chapter I deals with trends in investment and technology import policy, and briefly sketches the evolution of these polices in India.

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[5] Standard International Trade Classification

Chapter II looks at developments that have taken place in the areas of industrial and trade policy in India. Chapter III discusses and reviews other significant work done in this area. Chapter IV deals with the process of data collection and disaggregation while Chapters V through VIII contain the statistical analysis. Chapter IX concludes this thesis.

Trends in the Investment and Technology Import Policy.

The Indian government has tried to regulate and direct technology related activities through a variety of policy instruments. These policies have mainly been concerned with two goals:

a). Control of technology entering the country and,

b). the promotion and protection of local technology available, irrespective of whether they were indigenously developed or previously imported technologies.

Import control was introduced in 1939 and the first case of technology import approvals can be traced back to 1946. Technology imports became frequent, and procedures to deal with them were formalized in the early fifties. However no attempt was made to formulate a policy until the mid-sixties.

During the fifties and early sixties, the procedures for technology import were relatively liberal though limited in scope. The years 1965-68 marked the beginning of a policy that was more selective and discriminatory against technology imports. During this period, a set of procedures for regulating the imports of technology was developed. This new policy in many ways represented a model policy for other industrializing nations in the Third world to follow[6].

The technology import policy formulated during 1965-68 was part of a new policy to regulate domestic competition. It sought to eliminate the advantage that the use of

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[6] Bell Martin & Scott-Kemmis Don "Technology Import Policy: Have the Problems Changed?"

imported technology and the associated prestige gave to a domestic firm, and to accelerate import substitution.

This policy came about as a response to the scarcity of foreign exchange as well as a necessary protective measure to shelter indigenous technological activities[7]. Although the policies may not have always fully achieved their objectives, the efforts to do so were consistently in the direction of the set goals. In addition, the objectives of these policies were also consistent with broad strategies in other areas.

Industries were identified according to the role foreign technology and foreign capital were expected to play in their development and the terms on which technology could be imported were regulated. Investment was generally allowed in areas of hi-technology, sophisticated technology and in areas of substantial exports. The normal ceiling for investment was 40 percent of the total equity capital. Higher percentages were considered in priority areas in the case of the technology being sophisticated and not available domestically or in the case of the venture being export-oriented.

What was observed in this case, was the ineffective channeling of Indian demand for industrial technology toward domestic sources of supply. Without creating the necessary environment for domestic technological development activities, the policy effectively restricted the availability of modern technology for Indian industry.

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[7] Alam Ghayur "India's Technology Policy and its influence on Technology Imports and Technology Development".

The government has recently brought forth a more liberalized foreign investment policy under the Statement on Industrial Policy in July 1991[8]. Although it is too early to expect a substantial inflow of foreign investment as a result of this new policy, the initial response has been encouraging[9].

[8] For details see Foreign Collaborations 1991 Dept. of Scientific & Industrial Research, Ministry of Science & Technology, New Delhi

[9] Economic Survey 1991-1992 Part II Sectoral Developments Govt. of India, Ministry of Finance

The Industrial Policy and the New Trade Policy Reforms.

The Industrial Policy of India, is based on the Industrial Policy Resolution of 1956 and the modifications and liberalizations made through the Industrial Policy Statement of 1980 and more recently through the Statement on Industrial Policy in July 1991[10].

The main objectives of the policy include the optimal utilization of installed capacity, high productivity, higher employment generation, correction of regional imbalances by means of development of industrially backward areas, faster promotion of export oriented and import substitution industries, the strengthening of the agro-based industries and consumer protection against high prices and bad quality.

The Industries Development and Regulation Act (IDRA) of 1951 has been the principal instrument for implementing the industrial policy. The IDRA provides for the licensing of industries listed in the first schedule of the Act. The objectives of the industrial licensing system include the regulation of industrial investment and production to conform to the priorities and targets set under the Five year plans, the protection and encouragement of industries in the small scale sector, the prevention of concentration of economic power and balanced regional development.

The licensing of industrial ventures was done in accordance with policy prerogatives as mentioned above. The role of large scale industrial units covered by the

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[10] A detailed discussion of new the trade policy can be found in the Industrial Policy:Foreign Investment and Technology Transfer Vol. I.

MRTP[11] and the FERA[12] were also defined in the pronouncements. According to these, MRTP and FERA companies were eligible to participate in certain specified industries. These included core industries important to the national economy such as steel and heavy machinery, as well as industries with long term export potential such as the electrical and electronics industries. These are industries viewed to be strategically important for the growth of the economy and require sophisticated technology.

To further stimulate production, the government from time to time announced various measures aimed at optimum utilization of installed capacities. Policies since the early eighties basically deal with the following areas:

1).The de-reservation of industries from the Public sector

2).The abolition of industrial licensing

3).The abolition of phased manufacturing programs

4).The removal of investment controls on large business houses

These interconnected set of measures aim at providing an environment of increased competition and freedom in operations in the private sector. The policies are aimed at recognizing the increased competence and diversified base of Indian firms and at making them competitive with rest of the world[13].

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[11] Monopoly and Restrictive Trade Practices Act

[12] Foreign Exchange Regulation Act

[13] For a further discussion see *Economic Survey 1991-1992 Sectoral Developments*, Ministry of Finance, Govt. of India.
Also see *Industrial Policy of the Govt. of India*, India Investment Center.

Literature Review.

There are several articles and books of interest written in the area of technology transfer and R&D with regard to India. Some of the research that is of interest to our study and their findings are briefly discussed below.

In Ghayur Alam in his paper, India's Technology Policy & It's influence on Technology Imports & Technology Development, shows the relative minor influence of government policy on technology imports and technology development activities in Indian firms.

He suggests that government policies can only be successful if an industrial environment conducive to innovative activity is simultaneously created. A modification in the technology policy without the necessary changes in the industrial policy would fail to introduce the necessary technological dynamism into Indian industry.

Robert Lucas in his paper, Liberalization of Indian Trade & Industrial Licensing, explores how India's manufactured sector responded to government policies between 1960-1980 and further to stimulate what might have occurred under certain alternate scenarios.

He addresses the question of whether, given the poor industrial performance a more liberal regime would have fared better. He concludes that liberalization is multifaceted and in the case of India, the primary obstacle to improved industrial performance has been the system of investment controls. Trade liberalization alone

would have achieved little. The realization of far larger potential long run gains would require liberalizing reform beyond commercial policy alone.

Bishwanath Goldar in his paper, Import Substitution, Industrial Concentration and Productivity Growth in Indian Manufacturing analyzes the role of total factor productivity (TFP) in industrial growth in India. He looks at growth in Indian manufacturing and attempts to account for the effects of import substitution and industrial concentration on TFP growth. He draws on a similar study conducted by Nishimizu and Robinson that examined the effect of trade policies on TFP growth for major industries in Japan, Korea, Turkey and Yugoslavia[14].

Both Nishimizu and Goldar's results are consistent with the notion of increased import substitution (import liberalization) leading to lower (higher) TFP, perhaps through reducing (increasing) competitive cost-reduction incentives. Goldar's results in the case of India showed that the import substitution strategy though it attained much in terms of rapid industrial growth, diversification and self reliance, was inimical to productivity growth[15].

Sanjaya Lall in his book *Learning to Industrialize: The Acquisition of Technological Capability by India*, deals with the acquisition of technological capabilities in India. He looks at issues such as the process of technological learning, the nature of the learning process, the limitations to the acquisition of technological

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[14] Nishimizu M. and Robinson S. "Trade Policies and Productivity Change In Semi Industrialized Countries.", Journal of Development Economics.

[15] Also see Goldar's article Import Liberalization and Industrial Efficiency, in *Economic Liberalization, Industrial Structure and Growth in India.*

capability in developing countries and the impact of government policies on technological development.

Lall observed that much technological effort went into coping with problems generated by the import substitution policies of the government. The regime created disincentives to the upgrading of technologies to international standards.

He suggested that an overwhelming portion of the blame for the failures of the technologies efforts in India could be traced back directly or indirectly to the economic policies pursued by the government. The results of protected industrialization in terms of income, employment, or foreign exchange generation did not justify the heavy investments and other costs that had been incurred. However he opined that it is quite possible that India's technological base was capable of responding vigorously to a different set of incentives that are geared toward greater efficiency and dynamism.

The papers Looked at as a part of the literature review do not explicitly deal with the issue of foreign collaborations. They deal more with the issues of technology transfer and R&D. In looking at these issues however, they implicitly look at the effects of foreign collaborations, since foreign collaborations are one of the means by which technology transfers occurs. My hypothesis considers foreign collaborations to be the driving force behind exports, imports and production.

Foreign collaborations play an important role in three ways- first, by supplementing domestic savings; second, by facilitating the import of scarce equipment and materials; and third, by bringing in modern technology and expertise. Thus foreign

collaborations implicitly imply increases and advancements in technology, and should be measured.

This brings us back to my hypothesis that industries with more foreign collaborations should have more growth, unless the Indian economy grows more through the accumulation of capital and labor. It seems that no one has attempted to study the situation in this proposed framework. What is hoped is that the resulting conclusions of this paper will add significantly to this area of economics and will shed light on the effectiveness of foreign collaborations in India vis-a-vis growth.

The Process of Data Collection.

The book, *India Database: The Economy (1990)*, provides much of the data for this study. Data on exports and imports has been accessed from tables 6.16 and 6.17 titled "Exports: Commodity Group-wise Data including Re-exports" and "Imports: Commodity Group-wise Data" respectively in the book, *India Database*. The source of information for this data was "Foreign Trade Statistics Vol. 1 & 2 (March issue), which is a publication of the Directorate General of Commercial Intelligence, Ministry of Commerce, Govt. of India. The data here is classified at the two digit level, as per the SITC Rev.2 classification that can be found in the publication *Commodity Indexes for the Standard International Trade Classification, Rev. 2* brought out by the United Nations in 1981. The data is for the years 1957-58 to 1986-87 and is dis-aggregated to 10 broad sectors and 68 sub-sectors.

The data on production was accessed from table 7.6 titled "Capacity and Production of Selected Industries" from the book the *India Database*. The source of information for this included the following:

1). The Directorate General of Technical Development, Ministry of Industry, Govt. of India.

2). Monthly Statistics of Production of Selected Industries, Central Statistical Organization, Ministry of Planning, Govt. of India.

3). Statistical Abstract of India, Central Statistical Organization Ministry of Planning, Govt. of India.

4). Monthly Abstract of Statistics, Central Statistical Organization, Ministry of Planning, Govt. of India.

5). Indian Minerals Yearbook, Indian Bureau of Mines, Govt. of India.

The data in this table contains information on 215 sectors of the economy from 1950-51 to 1986-87. It includes information on unit nos., installed capacity, production and value. The data used for purposes of this study was information on physical production, except in cases where there was either more data available in value terms, or when in the process of making the data compatible to the SITC classification, some industries under a common heading had no common unit of comparison other than Values.

The production data, as mentioned above, was classified into the same 10 broad sectors and 68 sub sectors at the two digit level, according to the SITC rev 2 classification which, allowed for conformity with the data for imports and exports. This classification was done by means of using the United Nations publications *Commodity Indexes for the Standard International Trade Classification Rev.2 Volumes 1 and 2.* This was further verified by the Government of India publication *Indian Trade Classification Revision 2* brought out by the Directorate General of Commercial Intelligence and Statistics, Calcutta, India.

It is important to note that the production data used here pertains to selected industries. While this could be considered a potential shortcoming, the data contained in the *India Handbook* represents 215 sectors that are in themselves

quite diverse and extensive and make a good representative for production in the economy.

Data on foreign investment is perhaps one of the hardest pieces of information to obtain in regard to the Indian economy. This has been strictly classified information. From a review of the papers written, data on foreign investment has either been substituted for by using foreign collaborations or by sample data through interviews of Indian firms or otherwise.

Accordingly the data used replaces foreign investment with data on foreign collaborations. This has been obtained from the Ministry of Industry, Govt. of India. The data is for the years 1970-71 to 1990-1991. It consists of 40 sectors and has been reclassified, to conform with the data on imports, exports and production, according to the SITC Rev. 2 classification.

The argument for the replacement of investment by collaboration is further suggested, by observing correlations obtained from data pertaining to collaborations and lumpsum foreign investment payments for the years 1981-1985[16]. The data here however is fairly aggregated and consists of 11 main sectors. This data was obtained from a publication of the Department of Scientific and Industrial Technology, a subdivision of the Ministry of Science and Technology, Govt. of India, called *Foreign Collaborations*. This data is a "Restricted Official use only Document" and has only started being published

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[16] Correlations were run by industry as well as by year. The results in all cases were strongly positive, with the coefficients being over 0.6 in all cases. Also see figures 46 to 51 in appendix.

recently. Anyhow, the level of useful dis-aggregation would not have been sufficient even if this publication had data for prior years.

Finally, the data on total investment in India was obtained from the *International Financial Statistics Yearbook* of 1992, published by IMF in Washington D.C..

Statistical Analysis for All SITC Sectors

The statistical analysis done in this section consists of regression and correlation analysis. The regressions run were of the following form:

$$X_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

$$M_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

$$P_i = \alpha_0 + \beta_0 I/Y + \beta_1 FC_i + \varepsilon$$

where X_i is exports in the ith sector as share of GNP, M_i is imports in the ith sector as a share of GNP, P_i is production in the ith sector, I/Y is total domestic investment over GNP, FC_i is foreign collaborations in the ith sector as a share of the total number of foreign collaborations and ε is the random disturbance term.

The foreign collaborations in these regressions are looked at in two forms. In one case they were considered as a moving sum of the following order:

$$FC = (FC_i / \Sigma_{j=1 \text{ to } n} FC)_t + \Sigma_{(x=t-1 \text{ to } t-4)} (FC_i)_x / \Sigma_{(x=t-1 \text{ to } t-4)} (\Sigma_{j=1 \text{ to } n} FC)_x$$

Where $(FC_i / \Sigma_{j=1 \text{ to } n} FC)_t$ is foreign collaborations in the ith sector in time period t (current year) over the total number of foreign collaborations in time period t (current year), and $\Sigma_{(x=t-1 \text{ to } t-4)} (FC_i)_x / \Sigma_{(x=t-1 \text{ to } t-4)} (\Sigma_{j=1 \text{ to } n} FC)_x$ is the sum of foreign collaborations in the ith sector in time periods t-1 to t-4, over the total number of foreign collaborations in time periods t-1 to t-4. Work involving

foreign collaborations to be in this form is also referred to as Data II in our statistical work.

In the second case, they were considered in the following form:

$$FC= (FC_i/\Sigma_{j=1 \text{ to } n}FC)_t$$

Where $(FC_i/\Sigma_{j=1 \text{ to } n}FC)_t$ is foreign collaborations in the ith sector in time period t (current year) over the total number of foreign collaborations in time period t (current year). Work involving foreign collaborations to be of this form is also referred to as Data I in our statistical work.

The variable I/Y is used to capture the general capital accumulation effect on exports, imports and production. What would have been more useful would have been investment in each particular sector under study ie: I_i, however data was not available in this form.

To repeat, the hypothesis of interest is whether with increases in foreign collaborations in India, production, exports and imports in the sectors where the collaborations take place go up or not. In the case of imports, it is expected that during the period prior to 1980 imports will decrease with increases in foreign collaborations, given India's import substitution approach to growth during that period. Since 1980 however, with a change in the government approach to the economy it is expected that Imports will grow along with growth in foreign collaborations. The alternative, is that factors other than foreign collaborations, were important in driving India's exports, imports and production patterns.

The correlation analysis consists of running correlations across all sectors for imports, exports and foreign collaborations. The data used for the correlation analysis is in the same form as that used for the regressions.[17]

The data is further broken into two different periods. Correlations are looked at for the period 1957-58 to 1987-88 (period A), for the period 1957-58 to 1979-80 (period B) and for the period 1980-81 to 1987-88 (period C). See the Tables listed below:

Table 1
Correlation Analysis for All Sectors
(In regard to For. Coll., Exports, and Imports)
(for Data II, Period A)[18]
Pearson Correlation Coefficient
Prob > |R| Under Ho: Rho=0/No. of Observations

	For.Coll & Exports	For.Coll & Imports	Exports & Imports
1.The Food & Live Animals	-0.23033	-0.24550	0.07600
Chiefly For Food Sector	0.4490	0.4188	0.6898
	13	13	30
2.Beverages & Tobacco Sector	-	-	-0.09955
	-	-	0.6007
	-	-	30
3.Crude Materials Inedible	0.13386	0.47279	0.38821
Except for Fuels	0.6628	0.1028	0.0340
	13	13	30
4.Minerals, Fuels,	0.50558	0.29965	0.48392
Lubricants & Related	0.0780	0.3199	0.0067
Materials	13	13	13
5.Animal & Vegetable	0.13438	0.32514	-0.41843
Oils, Fats & Waxes	0.6936	0.3293	0.0214
	11	11	30
6.Chemicals & Related	0.62798	-0.2247	-0.22238
Products	0.0162	0.4603	0.2375
	14	13	30

[17] See figures 1,2 & 3 in Appendix for a breakup of imports, exports and foreign collaborations

[18] The data on foreign collaborations here is the sum of collaborations in the given year as well as in the previous four years (referred to in the analysis as Data II).

7.Manufactured Goods	0.44407 0.1285 13	-0.83955 0.0003 13	0.22653 0.2287 30
8.Machinery & Transport Equipment	0.49643 0.0844 13	-0.29154 0.3338 13	-0.57657 0.0009 30
9.Misc.Manufactured Articles	0.15034 0.6240 30	0.55827 0.0474 13	0.55035 0.0016 30
10.Commodities & Transactions Not Classified According to Kind	-0.67635 0.0111 13	0.18716 0.5404 13	0.08243 0.6650 3

Table 2

Correlation Analysis for All Sectors

(Correlations between For. Coll, Exports, and Imports)

(For Data I, Period A)[19]

Pearson Correlation Coefficient

Prob > ¦R¦ Under Ho: Rho=0/No. of Observations

	For.Coll & Exports	**For.Coll & Imports**	**Exports & Imports**
The Food & Live Animals Chiefly For Food Sector	-0.11551 0.6589 17	0.06212 0.8128 17	0.07600 0.6898 30
2.Beverages & Tobacco Sector	- - -	- - -	-0.09955 0.6007 30
3.Crude Materials Inedible Except for Fuels	0.20913 0.4205 17	0.17705 0.4966 17	0.38821 0.0340 30
4.Minerals, Fuels, Lubricants & Related Materials	0.18012 0.5378 14	0.19499 0.5041 14	0.48392 0.0067 13
5.Animal & Vegetable Oils, Fats & Waxes	0.43079 0.1780 13	-0.29168 0.3841 11	-0.41843 0.0134 30
6.Chemicals & Related Products	0.31708 0.1998 18	-0.01749 0.9469 17	-0.22238 0.2375 30
7.Manufactured Goods	-0.11812 0.6516 17	-0.3823 0.1299 17	0.22653 0.2287 30

[19] Here the data uses foreign collaborations in each sector as a share of the total number of foreign collaborations in each particular year (referred to in the analysis as Data I)

8.Machinery & Transport Equipment	0.40972 0.1024 17	-0.31708 0.2150 17	-0.57657 0.0009 30
9.Misc.Manufactured Articles	0.07030 0.7886 17	0.41033 0.1019 17	0.55035 0.0016 30
10.Commodities & Transactions Not Classified According to Kind	-0.50281 0.0397 17	-0.17961 0.4903 17	0.08243 0.6650 30

Table 3

Correlation Analysis for All Sectors

(In regard to For. Coll, Exports, and Imports)

(For Data II, Period B)

Pearson Correlation Coefficient

Prob > |R| Under Ho: Rho=0/No. of Observations

	For.Coll & Exports	**For.Coll & Imports**	**Exports & Imports**
1.The Food & Live Animals Chiefly For Food Sector	0.36969 0.4707 6	-0.54098 0.2677 6	-0.06122 0.7814 23
2.Beverages & Tobacco Sector	- - -	- - -	-0.15259 0.4870 23
3.Crude Materials Inedible Except for Fuels	-0.58508 0.1676 7	0.80704 0.0282 7	0.45732 0.0246 24
4.Minerals, Fuels, Lubricants & Related Materials	-0.80664 0.0525 6	0.50062 0.3118 6	-0.27513 0.2039 23
5.Animal & Vegetable Oils, Fats & Waxes	-0.35133 0.6487 4	0.03157 0.9684 4	-0.27245 0.2085 23
6.Chemicals & Related Products	0.51767 0.2929 6	0.12986 0.8063 6	-0.12086 0.5828 23
7.Manufactured Goods	-0.47313 0.3433 6	-0.81551 0.0479 6	0.38310 0.0712 23
8.Machinery & Transport Equipment	0.68386 0.1341 6	0.33323 0.5187 6	-0.72325 0.0001 23
9.Misc.Manufactured Articles	-0.48958 0.3243 6	-0.46159 0.3568 6	0.13609 0.5358 23

10.Commodities &	-0.94073	-0.59051	-0.06553
Transactions Not Classified	0.0052	0.5404	0.7664
According to Kind	6	13	23

Table 4

Correlation Analysis for All Sectors

(Correlations between For. Coll, Exports, and Imports)

(For Data I, Period B)

Pearson Correlation Coefficient

Prob > |R| Under Ho: Rho=0/No. of Observations

	For.Coll & Exports	**For.Coll & Imports**	**Exports & Imports**
The Food & Live Animals	0.13401	0.28923	-0.06122
Chiefly For Food Sector	0.7121	0.4176	0.7814
	10	10	23
2.Beverages & Tobacco Sector	-	-	-0.15259
	-	-	0.4870
	-	-	23
3.Crude Materials Inedible	0.61814	0.15352	0.45829
Except for Fuels	0.0568	0.6720	0.0279
	10	10	23
4.Minerals, Fuels,	-0.45671	0.15454	-0.27513
Lubricants & Related	0.1845	0.6699	0.2039
Materials	10	10	23
5.Animal & Vegetable	0.07647	0.21344	-0.27245
Oils, Fats & Waxes	0.8337	0.5538	0.2085
	10	10	23
6.Chemicals & Related	0.20153	0.20439	-0.12086
Products	0.5766	0.5711	0.5828
	10	10	23
7.Manufactured Goods	-0.43073	-0.21731	0.38310
	0.2140	0.5464	0.0712
	10	10	23
8.Machinery & Transport	0.40446	0.26267	-0.72325
Equipment	0.2463	0.4634	0.0001
	10	10	23
9.Misc.Manufactured	-0.25554	-0.04739	0.13609
Articles	0.4761	0.8966	0.5358
	10	10	23
10.Commodities &	-0.40013	0.50820	-0.06553
Transactions Not Classified	0.2519	0.1337	0.7664
According to Kind	10	10	23

Table 5
Correlation Analysis for All Sectors
(In regard to For. Coll, Exports, and Imports)
(For Data II, Period C)
Pearson Correlation Coefficient
Prob > |R| Under Ho: Rho=0/No. of Observations

	For.Coll & Exports	**For.Coll & Imports**	**Exports & Imports**
1.The Food & Live Animals Chiefly For Food Sector	-0.68967 0.0864 7	-0.51246 0.2396 7	-0.04386 0.9256 7
2.Beverages & Tobacco Sector	- - -	- - -	-0.56254 0.1886 7
3.Crude Materials Inedible Except for Fuels	0.24877 0.5906 7	0.43549 0.3288 7	-0.60879 0.1468 7
4.Minerals, Fuels, Lubricants & Related Materials	-0.19181 0.6803 7	-0.66793 0.1011 7	-0.08669 0.8534 7
5.Animal & Vegetable Oils, Fats & Waxes	-0.54828 0.2026 7	0.49449 0.2593 7	0.26338 0.5682 7
6.Chemicals & Related Products	0.76985 0.0429 7	-0.62150 0.1878 7	-0.49772 0.2557 7
7.Manufactured Goods	-0.42378 0.3434 7	-0.20960 0.6519 7	0.29104 0.5266 7
8.Machinery & Transport Equipment	0.68617 0.0887 7	-0.87252 0.0104 7	-0.47359 0.2830 7
9.Misc.Manufactured Articles	0.46822 0.2893 7	0.92091 0.0032 7	0.26493 0.5659 7
10.Commodities & Transactions Not Classified According to Kind	-0.73411 0.0603 7	0.57831 0.1738 7	-0.22248 0.6316 30

Table 6
Correlation Analysis for All Sectors
(Correlations between For. Coll, Exports, and Imports)
(For Data I, Period C)

	For.Coll & Exports	For.Coll & Imports	Exports & Imports
The Food & Live Animals Chiefly For Food Sector	0.03833 0.9350 7	0.25243 0.5850 7	-0.04386 0.9256 7
2.Beverages & Tobacco Sector	- - -	- - -	-0.56254 0.1886 7
3.Crude Materials Inedible Except for Fuels	-0.96100 0.0006 7	0.64372 0.1187 7	-0.60879 0.1468 7
4.Minerals, Fuels, Lubricants & Related Materials	-0.10000 0.8311 7	0.10850 0.8169 7	-0.08669 0.8534 7
5.Animal & Vegetable Oils, Fats & Waxes	0.13721 0.7693 7	-0.25749 0.5772 7	0.26338 0.5682 7
6.Chemicals & Related Products	0.58536 0.1276 8	-0.25649 0.5787 7	-0.49772 0.2557 7
7.Manufactured Goods	-0.35302 0.4373 7	0.29104 0.5266 7	0.29104 0.5266 7
8.Machinery & Transport Equipment	0.60463 0.1504 7	-0.78354 0.0371 7	-0.47359 0.2830 7
9.Misc.Manufactured Articles	0.43957 0.3237 7	0.91838 0.0035 7	0.26493 0.5659 7
10.Commodities & Transactions Not Classified According to Kind	-0.72526 0.0651 7	-0.31293 0.4944 7	-0.22248 0.6316 7

From the tables above, the correlation results in the Food & Live Animals Chiefly for Food show foreign collaborations and imports are positively related in all three periods (A, B and C) using Data I. When the foreign collaboration's data is substituted with Data II, the correlation results in all three periods suggest

a negative relationship. The coefficient in Period C, however, is only marginally negative, indicating perhaps a movement toward a positive relationship between foreign collaborations and imports during the eighties. The results from the correlation analysis conform approximately to our hypothesis for imports.

The regression results on imports are listed below in Table 7. They indicate a negative relation between foreign collaborations and imports over the entire period (Period A).

The analysis results between exports and foreign collaborations are inconclusive.

Table 7

Dependent Variable: EXP1

F Value	0.099
Prob>F	0.9066
R-square	0.0139
Adj R-sq	-0.1270

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.354565	0.53639607	2.525	0.0243
INVGNP	1	0.205181	2.26955744	0.090	0.9292
FC1TS	1	-6.577838	14.82790786	-0.444	0.6641

Dependent Variable: EXP1

F Value	8.932
Prob>F	0.0060
R-square	0.6411
Adj R-sq	0.5693

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	3.904009	0.60987330	6.401	0.0001
INVGNP	1	-10.533309	2.60209315	-4.048	0.0023
FC1MS	1	2.859151	7.33650411	0.390	0.7049

Dependent Variable: IMP1

F Value	0.921
Prob>F	0.4208
R-square	0.1163
Adj R-sq	-0.0099

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.734130	0.91485883	1.896	0.0789
INVGNP	1	-5.166957	3.87087970	-1.335	0.2032
FC1TS	1	10.937630	25.28997357	0.432	0.6720

Dependent Variable: IMP1

F Value	2.511
Prob>F	0.1308
R-square	0.3343
Adj R-sq	0.2011

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	4.385667	1.69217950	2.592	0.0269
INVGNP	1	-14.647072	7.21987447	-2.029	0.0700
FC1MS	1	-2.481596	20.35616544	-0.122	0.9054

The Beverages and Tobacco sector had no foreign collaborations for our observed period. Regressions in this sector were run using only domestic investment. The results are listed below in Table 8.

Table 8

Dependent Variable: EXP2

F Value	0.043
Prob>F	0.8368
R-square	0.0018
Adj R-sq	-0.0398

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.104892	0.03188947	3.289	0.0031
INVGNP	1	0.030032	0.14423795	0.208	0.8368

Dependent Variable: IMP2

F Value	7.862
Prob>F	0.0098
R-square	0.2468
Adj R-sq	0.2154

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.010751	0.00301256	3.569	0.0016
INVGNP	1	-0.038206	0.01362600	-2.804	0.0098

In the Crude Materials, Inedible Except for Fuels sector, the correlation analysis results suggest a positive relation between imports(M) and foreign collaborations(FC) with both Data I and Data II. The coefficients are particularly strong in Period C (1980-88), showing the effect of the change in government policy. The regression results are listed in Table 9. They suggest a positive

relation between FC and M for both sets of data. The results from our regression and correlation analysis on exports were inconclusive and did not allow for a clear confirmation/rejection of our hypothesis.

Table 9

Dependent Variable: EXP3

F Value	2.386
Prob>F	0.1283
R-square	0.2542
Adj R-sq	0.1477

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.852333	0.17048080	5.000	0.0002
INVGNP	1	-1.420059	0.71443786	-1.988	0.0668
FC3TS	1	7.834655	6.55996561	1.194	0.2522

Dependent Variable: EXP3

F Value	3.412
Prob>F	0.0742
R-square	0.4056
Adj R-sq	0.2867

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.404269	0.37678305	3.727	0.0039
INVGNP	1	-3.323808	1.30148719	-2.554	0.0287
FC3MS	1	0.154517	3.18100145	0.049	0.9622

Dependent Variable: IMP3

F Value	2.460
Prob>F	0.1214
R-square	0.2601
Adj R-sq	0.1544

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.043999	0.20924250	0.210	0.8365
INVGNP	1	1.824113	0.87687742	2.080	0.0564
FC3TS	1	3.614874	8.05148505	0.449	0.6603

Dependent Variable: IMP3

F Value	5.109
Prob>F	0.0296
R-square	0.5054
Adj R-sq	0.4065

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.633896	0.38793200	-1.634	0.1333
INVGNP	1	3.198833	1.33999798	2.387	0.0381
FC3MS	1	8.334032	3.27512676	2.545	0.0291

The statistical analysis on the Minerals, Fuels, Lubricants and Related Materials sector also yielded mixed results. The regression results for this sector are listed below in table 10.

Table 10

Dependent Variable: EXP4

F Value	2.344
Prob>F	0.1324
R-square	0.2509
Adj R-sq	0.1439

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.893087	0.56352940	-1.585	0.1353
INVGNP	1	4.617329	2.47636567	1.865	0.0833
FC4TS	1	3.108724	13.45550797	0.231	0.8206

Dependent Variable: EXP4

F Value	1.722
Prob>F	0.2277
R-square	0.2562
Adj R-sq	0.1074

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.228622	2.01576363	-0.113	0.9119
INVGNP	1	0.825529	9.28772802	0.089	0.9309
FC4MS	1	12.165810	15.08231137	0.807	0.4386

Dependent Variable: IMP4

F Value	6.630
Prob>F	0.0094
R-square	0.4864
Adj R-sq	0.4131

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-3.698132	1.78460175	-2.072	0.0572
INVGNP	1	23.973634	7.84222885	3.057	0.0085
FC4TS	1	22.870217	42.61130491	0.537	0.5999

Dependent Variable: IMP4

F Value	0.507
Prob>F	0.6171
R-square	0.0920
Adj R-sq	-0.0895

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.009495	6.21967372	0.162	0.8743
INVGNP	1	4.511349	28.65744622	0.157	0.8780
FC4MS	1	15.649370	46.53673382	0.336	0.7436

The correlation analysis for the Animal & Vegetable Oils, Fats and Waxes sector again yields mixed results. The results indicate a positive relation between foreign collaborations(FC) and exports(X) across all periods using Data I. With Data II however, while the coefficient in period A is positive, the relation in periods B and C are negative. The regression results on exports, listed in Table 11, also show ambiguous results.

Similarly, the relationship between imports(M) and FC inconclusive. Using Data II, there is a positive correlation across all three periods, while with Data I there is a positive relationship in period B and a negative relationship in period C, which is contrary to our hypothesis. Our regression results on FC and M indicate a positive relation for both sets of data.

Table 11

Dependent Variable: EXP5

F Value	1.779
Prob>F	0.2048
R-square	0.2027
Adj R-sq	0.0888

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.090107	0.03348437	2.691	0.0176
INVGNP	1	-0.250730	0.14130212	-1.774	0.0977
FC5TS	1	2.677294	3.84805679	0.696	0.4980

Dependent Variable: EXP5

F Value	2.557
Prob>F	0.1268
R-square	0.3384
Adj R-sq	0.2060

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.156210	0.05706986	2.737	0.0209
INVGNP	1	-0.481436	0.22632521	-2.127	0.0593
FC5MS	1	-1.630404	1.95203537	-0.835	0.4231

Dependent Variable: IMP5

F Value	2.383
Prob>F	0.1286
R-square	0.2540
Adj R-sq	0.1474

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.557249	0.40630019	-1.372	0.1918
INVGNP	1	3.665294	1.71456337	2.138	0.0507
FC5TS	1	17.576493	46.69241557	0.376	0.7122

Dependent Variable: IMP5

F Value	2.821
Prob>F	0.1068
R-square	0.3607
Adj R-sq	0.2328

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.201032	0.70270618	-0.286	0.7807
INVGNP	1	1.623005	2.78676204	0.582	0.5732
FC5MS	1	55.765471	24.03558177	2.320	0.0428

In the Chemicals & Related Products sector, the correlation results between X and FC are positive across all three periods with both Data I and Data II. The relationship is particularly strong in Period C (1980-88), perhaps because of the changes in the government policy to this effect. The results of our regressions on X and M in this sector are in Table 12.

The regression results on X and FC show a negative relationship. This implies that increases in foreign collaborations lead to decreases in exports which is contrary to our results from the correlation analysis and our hypothesis. A possible explanation for this is that it was more profitable for firms in this sector to cater to the domestic market and compete with imports, rather than export part of their production. The sign reversal also suggests that FC may be proxying for investment in the correlation analysis.

Table 12

Dependent Variable: EXP6

F Value	18.056
Prob>F	0.0001
R-square	0.7206
Adj R-sq	0.6807

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.132774	0.06657907	-1.994	0.0660
INVGNP	1	1.354292	0.23312861	5.809	0.0001
FCTTL6TS	1	-0.205739	0.27402602	-0.751	0.4652

Dependent Variable: EXP6

F Value	2.986
Prob>F	0.0962
R-square	0.3739
Adj R-sq	0.2487

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.135725	0.37243375	0.364	0.7231
INVGNP	1	0.671697	0.78792466	0.852	0.4139
FCTTL6MS	1	-0.211781	0.34611532	-0.612	0.5543

Dependent Variable: IMP6

F Value	5.706
Prob>F	0.0154
R-square	0.4491
Adj R-sq	0.3704

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.462653	0.44372547	-1.043	0.3148
INVGNP	1	5.246996	1.55371810	3.377	0.0045
FCTTL6TS	1	0.661618	1.82628458	0.362	0.7226

Dependent Variable: IMP6

F Value	0.435
Prob>F	0.6591
R-square	0.0800
Adj R-sq	-0.1040

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.145595	2.47344696	0.059	0.9542
INVGNP	1	2.961508	5.23284977	0.566	0.5839
FCTTL6MS	1	0.091740	2.29865821	0.040	0.9690

The Manufactured Goods sector is a high priority and a strategic sector in the Indian economy. Correlations between exports and foreign collaborations have a negative relation across all periods for Data I. The correlation results from Data II, show the relationship in period A to be positive while the relationship in periods B and C are negative. The coefficients on foreign collaborations in the

export's regressions have the same relationship as the correlation coefficients. The results suggest the need to further look at this sector before deciding to accept or reject our hypothesis. The regression results are listed in Table 13.

The correlations between M and FC with Data I conform to the null. With Data II, the correlation is negative across all periods. The relationship between FC and M from the regression analysis give opposing implications from Data I to II. This makes it hard for us to accept/reject our hypothesis for imports.

Table 13

Dependent Variable: EXP7

F Value	0.143
Prob>F	0.8681
R-square	0.0200
Adj R-sq	-0.1200

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	2.548802	1.43916976	1.771	0.0983
INVGNP	1	-1.153061	3.92360748	-0.294	0.7732
FC7TS	1	-2.016052	3.77981894	-0.533	0.6021

Dependent Variable: EXP7

F Value	8.171
Prob>F	0.0079
R-square	0.6204
Adj R-sq	0.5444

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.657415	1.64442829	0.400	0.6977
INVGNP	1	0.058073	5.19101598	0.011	0.9913
FC7MS	1	1.685966	0.58110283	2.901	0.0158

Dependent Variable: IMP7

F Value	10.254
Prob>F	0.0018
R-square	0.5943
Adj R-sq	0.5363

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-1.331171	0.96774597	-1.376	0.1906
INVGNP	1	10.375264	2.63836515	3.932	0.0015
FC7TS	1	1.465650	2.54167691	0.577	0.5733

Dependent Variable: IMP7

F Value	4.844
Prob>F	0.0338
R-square	0.4921
Adj R-sq	0.3905

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.044562	1.73815270	0.601	0.5612
INVGNP	1	4.767161	5.48687863	0.869	0.4053
FC7MS	1	-0.941383	0.61422286	-1.533	0.1564

The Machinery & Transport Equipment sector is another key sector of the Indian economy. Looking at the correlations between X and FC, we observe a positive relation across all three periods (A, B and C) for both Data I and Data II. The coefficients are particularly strong in period C (1980-88) and conform to the null hypothesis for exports. This is further evidenced by the regression results (Table 14) which indicate a positive relationship between FC and X.

The results from the correlation analysis involving imports and foreign collaborations are contrary to our null hypothesis. The relationship is positive in period B and negative in period C for both Data I and Data II. Further from the results in Table 14, the coefficients on foreign collaboration in the imports regressions are also negative.

Table 14

Dependent Variable: EXP8

F Value	6.318
Prob>F	0.0111
R-square	0.4744
Adj R-sq	0.3993

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.310842	0.19086529	-1.629	0.1257
INVGNP	1	1.504169	0.55445245	2.713	0.0168
FC8ST	1	0.519415	0.30447121	1.706	0.1101

Dependent Variable: EXP8

F Value	3.044
Prob>F	0.0928
R-square	0.3784
Adj R-sq	0.2541

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.021853	0.32579995	-0.067	0.9478
INVGNP	1	-1.206550	0.64792066	-1.862	0.0922
FC8MS	1	0.246981	0.11872599	2.080	0.0642

Dependent Variable: IMP8

F Value	21.757
Prob>F	0.0001
R-square	0.7566
Adj R-sq	0.7218

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.500174	0.49878875	1.003	0.3330
INVGNP	1	9.255446	1.44895200	6.388	0.0001
FC8ST	1	-2.303466	0.79567540	-2.895	0.0118

Dependent Variable: IMP8

F Value	10.855
Prob>F	0.0031
R-square	0.6846
Adj R-sq	0.6216

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.976381	1.50633521	0.648	0.5315
INVGNP	1	13.836267	2.99565944	4.619	0.0010
FC8MS	1	-1.042351	0.54892928	-1.899	0.0868

The results of analysis on the Misc. Manufactured Articles sector show that the relationship between imports and foreign collaborations follows our hypothesis. Both the regression coefficients on foreign collaborations (in Table 15 below) are positive across Period A (1957-87) for both Data I and Data II. The results for exports are inconclusive.

Table 15

Dependent Variable: EXP9

F Value	24.055
Prob>F	0.0001
R-square	0.7746
Adj R-sq	0.7424

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.949107	0.23642074	-4.014	0.0013
INVGNP	1	6.594326	1.09965145	5.997	0.0001
FCTL9TS	1	-0.160720	0.11432448	-1.406	0.1816

Dependent Variable: EXP9

F Value	3.030
Prob>F	0.0936
R-square	0.3774
Adj R-sq	0.2528

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.467395	0.53073956	-0.881	0.3992
INVGNP	1	4.679122	2.37401559	1.971	0.0770
FCTL9MS	1	-0.041827	0.05975460	-0.700	0.4999

Dependent Variable: IMP9

F Value	35.745
Prob>F	0.0001
R-square	0.8362
Adj R-sq	0.8128

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.171182	0.05963807	-2.870	0.0123
INVGNP	1	1.239525	0.27739144	4.469	0.0005
FCTL9TS	1	0.068174	0.02883880	2.364	0.0331

Dependent Variable: IMP9

F Value	13.699
Prob>F	0.0014
R-square	0.7326
Adj R-sq	0.6791

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.309690	0.16395141	-1.889	0.0882
INVGNP	1	1.820038	0.73336010	2.482	0.0324
FCTL9MS	1	0.014057	0.01845887	0.762	0.4639

The last sector of analysis is the Commodities and Transactions Not Classified According to Kind sector. The correlation results between X and FC here do not conform to our hypothesis. There is an extreme negative correlation for all three periods for both Data I and Data II. The regression results in Table 16 between X and FC also suggest a negative relationship for both forms of data and further confirms the rejection of our hypothesis for exports. The results for imports are inconclusive.

Table 16

Dependent Variable: EXP10

F Value	2.959
Prob>F	0.0848
R-square	0.2971
Adj R-sq	0.1967

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.026586	0.00808161	3.290	0.0054
INVGNP	1	-0.030937	0.03293759	-0.939	0.3635
FC10TS	1	-0.247743	0.10649868	-2.326	0.0355

Dependent Variable: EXP10

F Value	5.563
Prob>F	0.0238
R-square	0.5266
Adj R-sq	0.4320

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.044501	0.01366927	3.256	0.0086
INVGNP	1	-0.067091	0.05548939	-1.209	0.2544
FC10MS	1	-0.184022	0.06547380	-2.811	0.0185

Dependent Variable: IMP10

F Value	1.236
Prob>F	0.3203
R-square	0.1501
Adj R-sq	0.0287

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.052635	0.02897371	1.817	0.0907
INVGNP	1	-0.164513	0.11808584	-1.393	0.1853
FC10TS	1	0.224085	0.38181263	0.587	0.5666

Dependent Variable: IMP10

F Value	0.224
Prob>F	0.8033
R-square	0.0429
Adj R-sq	-0.1486

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.006560	0.04278723	-0.153	0.8812
INVGNP	1	0.049672	0.17369156	0.286	0.7807
FC10MS	1	0.110056	0.20494452	0.537	0.6030

Putting our statistical analysis across the ten broad SITC sectors in perspective, the observed results have shown no clear-cut pattern and have been quite mixed. In some sectors our hypothesis can be accepted and/or rejected either in part or as a whole, ie: only for exports or imports. However, this is the case

in only a few sectors- four in the case of imports and two in the case of exports. On the whole the results have not allowed us to either accept or to reject our hypothesis for exports and imports with any degree of confidence.

The relationship between foreign collaborations and production for the aggregate sectors was unable to be established here. This was due to the lack of conformity in production data for the various component industries that made up the different aggregate sectors. This is a problem that stems from the inadequate availibility of data and needs to be addressed in further studies of this sort.

Our above results ask us to look further at the ten sectors and analyze some of the ones that have a high degree of activity in terms of exports, imports, and foreign collaborations. This will be our focus in the following sections. We will look at the Food and Live Animals Chiefly for Food, the Manufactured Goods and the Machinery and Transport Equipment sectors.

Tea, Coffee, Cocoa and Spices

According to the SITC[20] listing, the Tea, Coffee, Cocoa and Spices industry is part of the Food and Live Animals chiefly for Food sector. The Food and Live Animals chiefly for Food sector consist of the following industries:

Live Animals Chiefly for Food
Meat And Meat Preparations
Dairy Products and Birds and Eggs
Fish, Crustaceans and Molluscs
Cereals and Cereal Preparations
Vegetables and Fruits
Sugar and Sugar Preparations
Coffee, Tea Cocoa and Spices
Feeding Stuff for Animals
Misc. Edible Products and Preparations

This sector draws the sixth most foreign collaborations and imports and is the second leading exporting sector after the Manufactured Goods sector.

The Coffee, Tea Cocoa and Spices industry makes up close to 50% of all exports in this sector[21]. Also, from 1957-58 to 1976-77 imports in the Cereals and Cereal Preparations industry accounted for close to 90% of all imports in this sector.[22]

Foreign collaborations increased rapidly during the eighties and reached a high of 23 collaborations during 1987-88. Prior to this, they averaged roughly six collaborations per annum. Unfortunately the composition of collaborations in this

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[20] Standard International Trade Classification

[21] See Figure 4 in Appendix

[22] Refer to Figure 5 in the Appendix

sector made it hard to break collaborations down by industry since in most cases they encompassed more than one industry within this sector.

The data for production was available for the Cereals and Cereal Preparations, Sugar and Sugar Preparations, and the Coffee, Tea Cocoa and Spices industries.

Given the high degree of exports in the Coffee, Tea Cocoa and Spices industry, we will key our analysis on this sub-sector.

A look at the trends from the graphs in the Appendix[23] lead to the following results. Production in the Tea, Coffee, Cocoa and Spices industry rose from 18,389 tons in 1951-52 to a little over 162,706 tons in 1986-87, an increase of 885%.

An analysis of the Tea industry reveals India to be the world's largest producer, consumer and exporter of Tea. From a production figure of 285 million kgs. in 1951-52, Tea production in India reached 572 million kgs in 1980-81. The industry, in the eighties, has been faced with the challenge of maintaining its position of preeminence as the world's largest producer and exporter of Tea. From a world tea market share of 45% in the fifties, it has come down to 27.7% in 1979-80 and then further to 14.4% in 1986-87.

Production in coffee has increased from about 69,000 tons in 1970-71 to 162,700 tons in 1986-87, an increase of 236%. Productivity has also increased over the same period from 550 Kgs. per hectare to 763 Kgs. per hectare, an

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[23] See Figures 13,14,15 & 16 in Appendix

increase of about 28%. Exports over the same period went up from 32,000 tons to 86,000 tons, an increase of 186%. To further stimulate production during the early eighties, the Coffee board disbursed over Rs.14 crore toward loans under various departmental schemes for intensive and extensive cultivation, supply of machinery and equipment, replantation etc.

Exports in the Coffee, Tea Cocoa and Spices industry between 1957-58 and 1986-87 grew from Rs.13,967 Lakh to Rs. 115,330 Lakh. In terms of percentage of GNP, exports have averaged between 0.16% and 0.2% of GNP during this period. During the same period, imports grew from Rs 334 Lakh to Rs 3338 Lakhs.

Correlations and regressions were run between production, exports, imports and foreign collaborations. This was performed in a similar manner to that done for the aggregate sectors. See the tables 17 through 19 listed below:

Table 17

Correlation Analysis for the Tea, Coffee, Cocoa and Spices Industry

Pearson Correlation Coefficient for Data I

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.32083	0.00362	0.2189	-0.6505	0.46403	0.16075
0.1943	0.9890	0.3986	0.0004	0.0098	0.3961
18	17	17	30	30	30

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.41210	0.24447	0.2892	-0.48304	-0.22361	-0.32929
0.2367	0.4961	0.4176	0.0196	0.5346	0.1249
10	10	10	23	10	23

For Years 1957-58 to 1980-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.73877	0.01341	0.6650	-0.32515	-0.28148	-0.44046
0.0363	0.9772	0.1031	0.4767	0.5408	0.3226
8	7	7	7	7	7

Table 18

Correlation Analysis for theTea. Coffee. Cocoa and Spices Industry

Pearson Correlation Coefficient for Data II

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. F.C.	Exports & F.C.	Imports & F.C.
-0.4210	0.19218	-0.01122
0.1338	0.5293	0.9710
14	13	13

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.40824	0.78065	0.58068
0.4217	0.0669	0.2269
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.56428	0.10086	-0.38889
0.1451	0.8296	0.3886
8	7	7

Table 19

Dependent Variable: PROD1H

F Value	2.945
Prob>F	0.0834
R-square	0.2819
Adj R-sq	0.1862

Parameter Estimates for Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	13758	62255.223572	0.221	0.8281
INVGNP	1	532389	275329.33521	1.934	0.0723
FC1TS	1	-3163536	1531722.7386	-2.065	0.0566

Dependent Variable: PROD1H

F Value	2.197
Prob>F	0.1574
R-square	0.2855
Adj R-sq	0.1555

Parameter Estimates for Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	64153	117619.09459	0.545	0.5963
INVGNP	1	731605	566826.79876	1.291	0.2233
FC1MS	1	-2802028	1337279.8891	-2.095	0.0601

Dependent Variable: EXP1H

F Value	0.003
Prob>F	0.9975
R-square	0.0004
Adj R-sq	-0.1424

Parameter Estimates for Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.535091	0.29942411	1.787	0.0956
INVGNP	1	0.087955	1.26690004	0.069	0.9456
FC1TS	1	0.030318	8.27715430	0.004	0.9971

Dependent Variable: EXP1H

F Value	1.916
Prob>F	0.1975
R-square	0.2770
Adj R-sq	0.1324

Parameter Estimates for Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.213739	0.53347776	2.275	0.0462
INVGNP	1	-4.147674	2.27614298	-1.822	0.0984
FC1MS	1	8.634946	6.41749981	1.346	0.2082

Dependent Variable: IMP1H

F Value	8.745
Prob>F	0.0034
R-square	0.5554
Adj R-sq	0.4919

Parameter Estimates for Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.025859	0.00859852	-3.007	0.0094
INVGNP	1	0.145436	0.03638139	3.998	0.0013
FC1TS	1	0.155494	0.23769388	0.654	0.5236

Dependent Variable: IMP1H

F Value	2.529
Prob>F	0.1291
R-square	0.3359
Adj R-sq	0.2031

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.023089	0.01838990	-1.256	0.2378
INVGNP	1	0.176438	0.07846257	2.249	0.0483
FC1MS	1	-0.195349	0.22122226	-0.883	0.3979

From the correlation and regression results, there is a negative relation between foreign collaborations(FC) and production(P) with Data II. The Data I results suggest a positive correlation in period B and a negative correlation in periods A and C. The

regression results from Table 19 between FC and P suggest a negative relation for both Data I and Data II. The results refute our hypothesis for production.

The export results from both the correlation and regression analysis conform to our hypothesis for both forms of data ie: Data I and Data II. This can also be seen, in part, as being aided by government policies implemented during the early eighties, such as concessions in excise duty that benefitted both exporters and producers of Tea- there was a reduction on excise and customs duty paid on packaging material used in the export of Tea.

Imports and foreign collaborations agree with our hypothesis for Data I. With Data II, the correlation is positive across all periods. The regression results have varying coefficients in terms of signs on foreign collaborations between Data I and Data II and lead to mixed conclusions.

The other correlations between exports(X)/production(P), imports(M)/production, and exports/imports do not conform to our hypothesis. If there were conformity with our hypothesis, then increases in FC would imply increases in X, P and M(post 1980). This would imply a positive correlation between X/P, M/P (period C), X/M (period C) and negative correlations between M/P (period B) and X/M (period B). On the other hand, if for example, X/P are positively related, but X/FC and P/FC are not, this implies that something other than FC is the driving force behind X and P.

What is observed in the Tea, Coffee, Cocoa and Spices industry was a negative correlation between P/FC and a positive correlation between X/FC. The correlation between X/P was negative. This implies that FC is a positive driving force for X, while

it is a negative driving force for P. In the case of P, this implies decreases in P with increases in FC. This conforms to our regression and correlation analysis between FC and P that led us to reject the null for P.

The results between I/FC suggest a positive correlation, while the correlation between I/P is positive for period A and negative for periods' B and C. Our hypothesis suggests that increases in FC should lead to increases in M (post 1980- period C) and increases in P. In addition, increases in FC pre 1980- period B, should lead to decreases in M pre 1980. The results between I/P conform to the hypothesis for period C, however given the previous conclusions between FC/P, the results are ambiguous for periods' A and B and suggest the existence of other drivers that influence P and M. Our conclusions to the relationship between X/M also suggest factors other than FC to be influencing this relationship. In the case of X, this further shows that FC is not the leading driver influencing X.

This is not observed to be the case and impies that foreign collaborations are not the important driving force behind these variables. Some of the other influencing factors possibly include export incentives and high excise and customs duties. These are issues that have been recently addressed and liberalized by the Government.

The results from this industry help shed light on the composition of the Food and Live Animals chiefly for Food sector and seem to suggest that foreign collaborations are possibly not the most important driving force in this industry. There are other important forces that differ from industry to industry, although high excise tariffs and customs duties could possibly be an important driving force across all industries in this sector.

The Manufactured Goods Sector

The Manufactured Goods sector consists of the following subsectors:

Leather, Leather Manufactures and Dressed Furskins
Cork And Wood Manufactures
Paper, paperboard and articles of paperpulp
Textile yarn, Fabrics and Made up Articles
Non-Metallic Mineral Manufactures
Iron And Steel
Non Ferrous Metals
Manufactures of Metal

The Manufactured Goods sector is the leading exporting sector and accounts for the second largest number of foreign collaborations and imports.

Exports averaged 2.6% of total GNP, during 1976-77 to 1979-80. A breakdown by industry in terms of exports shows the Textile yarn, Fabrics and Made up Articles industry to be the leading exporting industry with the Non-Metallic Mineral Manufactures industry making rapid strides in exports since the mid seventies.

Imports in the Manufactured Goods sector made up close to 2.5% of GNP in 1957-58. Since then, it has dropped dramatically. They have however increased since 1978-79, reaching close to 1.75% of total GNP in 1986-87. Similarly, foreign collaborations have increased during the early eighties, and accounted for 158 collaborations during 1985-86. Data on imports and foreign collaborations show the Iron And Steel and the Non Ferrous Metals industries are the leading industries in these areas. Non-Metallic Mineral Manufactures account for the next most number of foreign collaborations and imports[24].

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[24] See Figures 7,8 & 9 in Appendix

We will focus our analysis on the Leather, Leather Manufactures and Dressed Furskins, Non-Metallic Mineral Manufactures, Iron And Steel and the Non Ferrous Metals industries.

Leather, Leather Manufactures and Dressed Furskins

Leather and Leather Products occupy an important position in India's foreign trade in terms of actual foreign exchange earnings and in their potential for future growth. With a cattle population of 423 million heads in 1985[25] India has the foremost cattle resources in the world. Hence, the motivation for selecting this industry as an industry of focus for purposes of this study.

A series of export promotion measures were taken by the Government during the early eighties to revive exports in the Leather industry. A sustained growth in exports seems possible only with a strong and stable domestic industrial base, supported by necessary infrastructural facilities. Modern infrastructural facilities along with effective delivery mechanisms need to be evolved[26].

In terms of performance, this industry accounted for the third most volume of exports. Exports have been increasing since 1957-58 when they made up 0.2% of total GNP (Rs 27036 Lakh). In 1986-87 they accounted for 0.26% of total GNP (Rs 73121 Lakh). In terms of the world market, this industry made-up roughly 5.8% to 6% of the world market during the eighties.

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[25] FAO Yearbook 1989

[26] See Mukherjee Chapter 5

The Leather, Leather Manufactures and Dressed Furskins industry, had the fewest imports in the Manufactured Goods sector. Imports have been minimal although they have been increasing since 1979-80.

The industry also accounted for the sixth most number of foreign collaborations within the sector. While collaborations have been minimal during the seventies, they have picked up during the early eighties, accounting for 19 in 1986-87[27].

The correlation and regression results for production, foreign collaborations, imports and exports are listed in tables 20 through 22 below:

Table 20

Correlation Analysis for the Leather, Leather Manufactures & the Dressed Furskin Industry

Pearson Correlation Coefficient for Data I

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.10397	0.12413	-0.0105	0.4932	-0.05406	0.4536
0.6913	0.6350	0.9680	0.0056	0.7766	0.0118
17	17	17	30	30	30

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.32773	-0.19481	0.67009	0.6918	-0.26501	-0.19817
0.3553	0.5897	0.0340	0.0003	0.2217	0.3547
10	10	10	23	23	23

For Years 1980-81 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.41793	-0.35302	-0.54392	0.6806	0.29104	0.80693
0.3508	0.4373	0.2069	0.0924	0.5266	0.0283
7	7	7	7	7	7

[27] See Figures 28 to 31 in Appendix

Table 21

Correlation Analysis for the Leather, Leather Manufactures & the Dressed Furskin Industry

Pearson Correlation Coefficient for Data II

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.14736	0.5272	-0.3716
0.6309	0.0641	0.2111
13	13	13

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.83653	0.75134	-0.3964
0.0379	0.0851	0.4366
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.04588	0.1601	-0.49999
0.9222	0.7316	0.2532
7	7	7

Table 22

Dependent Variable: PROD7A

F Value	27.122
Prob>F	0.0001
R-square	0.8067
Adj R-sq	0.7769

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-73411	12900.746348	-5.690	0.0001
INVGNP	1	389579	52897.368505	7.365	0.0001
FC7ATS	1	-47467	303790.43089	-0.156	0.8782

Dependent Variable: PROD7A

F Value	19.626
Prob>F	0.0003
R-square	0.7970
Adj R-sq	0.7564

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-117076	23422.277113	-4.998	0.0005
INVGNP	1	532077	85358.707021	6.233	0.0001
FC7AMS	1	196920	138874.55571	1.418	0.1866

Dependent Variable: EXP7A

F Value	0.054
Prob>F	0.9478
R-square	0.0082
Adj R-sq	-0.1444

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.342252	0.14721270	2.325	0.0369
INVGNP	1	-0.192631	0.60362123	-0.319	0.7547
FC7ATS	1	-0.251536	3.46660636	-0.073	0.9433

Dependent Variable: EXP7A

F Value	6.888
Prob>F	0.0132
R-square	0.5794
Adj R-sq	0.4953

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.016317	0.19122004	-0.085	0.9337
INVGNP	1	0.632953	0.69687054	0.908	0.3851
FC7AMS	1	4.194118	1.13377522	3.699	0.0041

Dependent Variable: IMP7A

F Value	10.089
Prob>F	0.0023
R-square	0.6082
Adj R-sq	0.5479

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.009489	0.00261383	-3.630	0.0031
INVGNP	1	0.047856	0.01071758	4.465	0.0006
FC7ATS	1	-0.033969	0.06155121	-0.552	0.5904

Dependent Variable: IMP7A

F Value	17.906
Prob>F	0.0005
R-square	0.7817
Adj R-sq	0.7381

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.015893	0.00405297	-3.921	0.0029
INVGNP	1	0.075860	0.01477040	5.136	0.0004
FC7AMS	1	-0.029973	0.02403074	-1.247	0.2407

The results from our regression and correlation analysis have the following implications in the case of production and foreign collaborations.

While the correlation results suggest FC and P are positively related, the regression results give the opposite implication. This makes it hard for us to account for a pattern between foreign collaborations and production in this industry. The X and FC and the M and FC correlations also show mixed results that are not consistent with our hypothesis.

The results suggest other forces as perhaps influencing our variables under study. Some possible other driving forces include infrastructural capability and capacity and high tariffs and excise duties on imports in this industry.

Iron & Steel

The Iron and Steel industry is a mature industry that is highly prized by newly industrializing countries. It is a basic industry that provides crucial inputs for practically all forms of industrial development.

The production of Iron and Steel in India has been dramatically increasing, from producing 5.55 million tons in 1951-52, production has risen close to 110.7 million tons in 1986-87[28]. This is an industry that along with Non Ferrous Metals accounts for the largest number of foreign collaborations and imports in the Manufacturing sector. It is for these reasons that we chose to focus our attention on this sector.

From the trends in exports in the Iron & Steel industry, we observe that exports have not been extensive. In 1957-58 they accounted for Rs 37 Lakh (barely 0.003% of total GNP). They have since risen since to close to Rs 5605 Lakh in 1986-87(0.022% of total GNP)[29].

Imports in this sector reached a high of 1.25% of total GNP (Rs 14698 Lakhs) in 1957-58. Since then, imports have averaged roughly 0.6% of total GNP (Rs 155,636

[28] See Figure 21 in Appendix

[29] See Figure 23 in Appendix

Lakh)1986-87. Imports have followed a downward trend since the late fifties, picking up somewhat since 1979-80 and then going back down during the mid eighties[30].

Foreign collaborations due to difficulties of disaggregation have been lumped together with collaborations in the Non-Ferrous Metals industry. These two industries together account for over a third of all foreign collaborations in the Manufacturing Goods sector. Collaborations have been increasing since 1970-71 and totaled 29 in 1988-89. A high in terms of collaborations occurred in 1985-86 with 56 foreign collaborations.

The correlations run for this industry between production, exports, imports and foreign collaborations are listed below in tables 23 and 24:

Table 23

Correlation Analysis for the Iron & Steel Industry

Pearson Correlation Coefficient for Data I
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.07854	-0.07069	0.1451	0.20817	-0.57634	0.01622
0.7567	0.7875	0.5784	0.2696	0.0009	0.9322
18	17	17	30	30	30

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.01141	-0.23535	0.18639	0.64202	-0.57303	-0.20657
0.9750	0.5128	0.6062	0.0010	0.0043	0.3443
10	10	10	23	23	23

For Years 1980-81 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.27263	-0.09338	0.26248	-0.59525	0.56778	0.00577
0.5136	0.8422	0.5696	0.1585	0.1836	0.9902
8	7	10	7	7	7

[30] See Figure 24 in the Appendix

Table 24

Correlation Analysis for the Iron & Steel Industry
Pearson Correlation Coefficient for Data II
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.3522	0.4895	-0.3903
0.2168	0.0895	0.1874
14	13	13

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.19022	0.43220	-0.48270
0.7181	0.3921	0.3322
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.65417	-0.46393	-0.05368
0.0784	0.2944	0.9090
8	7	7

The results of our regression analysis with production, exports and imports as the dependent variables are listed below:

Table 25

Dependent Variable: PROD7G

F Value	0.833
Prob>F	0.4538
R-square	0.1000
Adj R-sq	-0.0200

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	154101702	73386817.372	2.100	0.0531
INVGNP	1	-306791135	261595429.83	-1.173	0.2592
FC7GTS	1	-433410955	573653668.80	-0.756	0.4616

Dependent Variable: PROD7G

F Value	2.314
Prob>F	0.1449
R-square	0.2961
Adj R-sq	0.1682

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	232060285	171677668.93	1.352	0.2036
INVGNP	1	-767928287	516457929.52	-1.487	0.1651
FC7GHMS	1	105365941	272193803.39	0.387	0.7061

Dependent Variable: EXP7G

F Value	1.018
Prob>F	0.3864
R-square	0.1270
Adj R-sq	0.0023

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.522300	0.27914509	1.871	0.0824
INVGNP	1	-1.460485	1.04411504	-1.399	0.1836
FC7GHTS	1	-0.933398	2.14099761	-0.436	0.6695

Dependent Variable: EXP7G

F Value	7.972
Prob>F	0.0085
R-square	0.6146
Adj R-sq	0.5375

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.134731	0.58163612	0.232	0.8215
INVGNP	1	-1.707533	1.81269433	-0.942	0.3684
FC7GHMS	1	1.959176	0.82024398	2.389	0.0381

Dependent Variable: IMP7G

F Value	2.140
Prob>F	0.1545
R-square	0.2341
Adj R-sq	0.1247

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.122495	0.32888270	-0.372	0.7151
INVGNP	1	2.427836	1.23015373	1.974	0.0685
FC7GHTS	1	2.105751	2.52247701	0.835	0.4179

Dependent Variable: IMP7G

F Value	1.492
Prob>F	0.2710
R-square	0.2298
Adj R-sq	0.0758

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.626906	0.98923315	0.634	0.5405
INVGNP	1	1.102979	3.08298827	0.358	0.7280
FC7GHMS	1	-1.497877	1.39505185	-1.074	0.3082

The correlation results indicate that P and FC are positively related across periods A (1957-1987) and C (1980-88) and negatively related in period B. This is observed for both sets of data. The regression results further add to the ambiguity, given that the

coefficients on foreign collaborations under Data I and Data II have opposing implications.

Exports and foreign collaborations are negatively related across all periods with Data I. This conforms with our coefficient on foreign collaborations from the regression results on exports. This suggests that increases in production helped meet the domestic demand requirement thereby reducing the volume of exports especially during the eighties. The results from Data II are more ambiguous.

The correlation results between FC and M show a positive relation across all periods in the case of Data I. The regression coefficient on FC is also positive for Data I. Compare this to the results obtained from Data II. Data II's results show negative correlations across all three periods along with a negative coefficient on foreign collaborations from the regression results. This suggests that while increases foreign collaborations led to increases in imports in the year of the collaboration, the impact of all ongoing foreign collaborations (over a five year period) actually led to decreases in imports. This fits with an import substitution policy. It lends validity to our null hypothesis on imports[31].

The analysis results indicate the possibility of other important factors that play a decisive role in this industry. Perhaps a clearer picture can be obtained given the availability of more data, especially on foreign collaborations in this sector.

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[31] The correlation coefficient in Period B is -0.4827 while the coefficient in Period C has gone down to -0.05368 using Data II.

Non-Ferrous Metals

The Non Ferrous Metals industry plays a key role in the industrial growth of the country. It provides the basic raw materials and components for the power generation, capital goods, engineering and the electrical industries. Production has steadily increased in this industry, from 11,107 tons in 1951-52 to 490,100 tons in 1986-87[32]. With the increasing pace of industrialization, consumption of the principal non ferrous metals have increased substantially. This increase in demand has created a substantial demand gap since the mid seventies. This gap has been met by increases in imports.

Imports have averaged between 0.15% and 0.35% of total GNP between 1951-1988. They accounted for close to Rs 51,676 Lakh in 1987-88. Exports have been marginal, except for a period between 1974 and 1979 when they were close to 0.28% of Total GNP and an average value of Rs 33,606 lakh[33].

While India ranks among the foremost nations along with Australia, Guinea and Brazil in terms of bauxite resources, it's resources of ore for non ferrous metals- copper, zinc, lead and nickel are limited. This has led to a need for intensifying the search and discovery of additional reserves.

Foreign collaborations in the Non-Ferrous Metals industry along with the Iron and Steel industry are the highest in the Manufacturing sector. From 11 collaborations in

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[32] See Figure 25 in the Appendix

[33] See Figures 26 and 27 in the Appendix

1970-71, collaborations have increased during the eighties and have averaged over thirty collaborations per annum.[34]

These factors have led us to consider analyzing the Non Ferrous Metals industry as one of our industries of choice.

The regression and correlation's results are listed below in tables 26 through 28:

Table 26

Correlation Analysis for the Non-Ferrous Metals Industry

Pearson Correlation Coefficient for Data I
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp. & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.3630	0.23775	0.0363	-0.04142	-0.22303	-0.46926
0.1387	0.3582	0.8901	0.8279	0.2361	0.0089
18	17	17	30	30	30

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.5664	0.33565	-0.10647	0.15467	-0.35718	-0.49281
0.0878	0.3430	0.7697	0.4810	0.0943	0.0169
10	10	10	23	23	23

For Years 1980-81 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.18157	0.68595	-0.10647	0.15253	0.05010	-0.53900
0.6670	0.0889	0.7697	0.7441	0.9151	0.2119
8	7	10	7	7	7

[34] See Figures 25, 26 & 27 in Appendix

Table 27

Correlation Analysis for the Non-Ferrous Metals Industry

Pearson Correlation Coefficient for Data II
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.4112	0.6444	-0.4177
0.1441	0.0174	0.1555
14	13	13

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.05224	0.87093	-0.65995
0.9217	0.0239	0.1538
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.15791	-0.34062	-0.38288
0.7088	0.4547	0.3966
8	7	7

Table 28

Dependent Variable: PROD7H

F Value	6.662
Prob>F	0.0085
R-square	0.4704
Adj R-sq	0.3998

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	193798	94591.626146	2.049	0.0584
INVGNP	1	1044253	337182.31674	3.097	0.0074
FC7GHTS	1	-960262	739408.45672	-1.299	0.2137

Dependent Variable: PROD7H

F Value	9.173
Prob>F	0.0045
R-square	0.6252
Adj R-sq	0.5570

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-305806	207790.45993	-1.472	0.1691
INVGNP	1	2501560	625096.03829	4.002	0.0021
FC7GHMS	1	365832	329450.39357	1.110	0.2905

Dependent Variable: EXP7H

F Value	0.688
Prob>F	0.5190
R-square	0.0894
Adj R-sq	-0.0406

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.123896	0.19066804	0.650	0.5263
INVGNP	1	-0.507307	0.71317524	-0.711	0.4886
FC7GHTS	1	1.239991	1.46239296	0.848	0.4107

Dependent Variable: EXP7H

F Value	10.960
Prob>F	0.0030
R-square	0.6867
Adj R-sq	0.6241

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.500465	0.34607055	1.446	0.1787
INVGNP	1	-2.429020	1.07854397	-2.252	0.0480
FC7GHMS	1	0.842301	0.48804103	1.726	0.1151

Dependent Variable: IMP7H

F Value	0.019
Prob>F	0.9810
R-square	0.0027
Adj R-sq	-0.1397

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.257506	0.13189921	1.952	0.0712
INVGNP	1	-0.069721	0.49335615	-0.141	0.8896
FC7GHTS	1	0.120840	1.01164555	0.119	0.9066

Dependent Variable: IMP7H

F Value	0.771
Prob>F	0.4883
R-square	0.1336
Adj R-sq	-0.0397

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.558864	0.38249555	1.461	0.1747
INVGNP	1	-0.694835	1.19206408	-0.583	0.5729
FC7GHMS	1	-0.656037	0.53940886	-1.216	0.2518

The correlation results indicate that FC and P are negatively related across both Data I and Data II, for all periods. This is contrary to our null hypothesis. The results from our regressions using Data I show FC to be negatively related with P. The Data II results show a positive relationship between the two. This leads to ambiguity in reaching a conclusion for our hypothesis on production. It also suggests the need for reviewing these results with more foreign collaboration's data.

The correlation coefficients on exports and foreign collaborations follow our hypothesis closely except for the coefficient in period C with Data II. The regression results indicate FC and X are positively related for both Data I and Data II. Additional data on foreign collaborations post 1980, would give a clearer picture of the correlation trends for Data II and would perhaps reverse the negative trend currently observed in Period C.

The correlation result between M and FC is negative across all three periods. The coefficients between periods B and C however show the relationship to be decreasing in magnitude. Data I shows periods B and C with a negative relationship between FC and M, again with the coefficient in period C being smaller in magnitude. The relationship is positive in period A for both sets of data. The regression results are mixed. This unfortunately again makes it difficult to draw clear-cut implications.

Non-Metallic Mineral Manufactures

From the sectoral breakdown of Manufactured Goods, the Non-Metallic Mineral Manufacturing industry accounts for the third largest number of Imports in terms of volume, and the third largest number of foreign collaborations. Both imports and foreign collaborations in this sector have been rapidly growing over the last 10 years. This rapid increase in growth has led us to look more closely at this industry.

The share of imports of Non-Metallic Manufactures in the Manufactured Goods sector has rapidly risen since 1977. This coincides closely with the increase in share of foreign collaborations of Non-Metallic Manufactures industry, although foreign

collaborations really took off more in the early eighties, reaching a total of 38 in 1984-85. Imports made up less than 0.1% of GNP from 1957 to 1969. Following this, they increased in the seventies and have accounted for over 0.4% of total GNP ever since 1978[35].

Exports of Non-Metallic Mineral Manufactures have also been increasing since 1975 and have accounted for larger shares of exports in the Manufactured Goods sector. It is the second leading exporting industry in the Manufactured Goods sector today after the Textile yarn, Fabric and Made-up Articles industry.

Production within the industry has followed an upward trend since 1951 when it stood at 87,246,321 tons. Production peaked in 1979-80 at 781,676,742 tons and then went into a slight slump in the early eighties, although figures from 1985-86 show production to be recovering.

Correlations were run for this industry for production, imports, exports and foreign collaborations. The results are listed below.

Table 29

Correlation Analysis for theNon-Metallic Mineral Manufactures Industry

Pearson Correlation Coefficient for Data I

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.17550	0.23213	0.3798	0.62518	0.96121	0.5820
0.4861	0.3700	0.1327	0.0002	0.0001	0.0007
18	17	17	30	30	30

[35] See Figures 17, 18 , 19 & 20 in Appendix

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.15324	-0.06154	-0.12632	0.80846	0.96510	0.74103
0.6725	0.8659	0.7280	0.0001	0.0001	0.0001
10	10	10	23	23	23

For Years 1980-81 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.20684	0.24703	-0.69555	-0.89523	0.73140	-0.48611
0.6231	0.5933	0.0827	0.00064	0.0618	0.2687
8	7	7	7	7	7

Table 30

Correlation Analysis for theNon-Metallic Mineral Manufacturing Industry

Pearson Correlation Coefficient for Data II

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.4667	0.4698	0.5765
0.0925	0.1053	0.0392
14	13	13

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.23017	0.54502	0.38921
0.6608	0.2634	0.4457
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.53189	-0.66032	0.73572
0.1748	0.1065	0.0595
8	7	7

The regression results for Production, Exports and Imports are listed below in table 31:

Table 31

Dependent Variable: PROD7F

F Value	0.302
Prob>F	0.7437
R-square	0.0387
Adj R-sq	-0.0895

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	489085122	373464730.28	1.310	0.2100
INVGNP	1	-564117623	1605162182.9	-0.351	0.7301
FC7FTS	1	4446859423	5793586299.5	0.768	0.4547

Dependent Variable: PROD7F

F Value	2.802
Prob>F	0.1039
R-square	0.3375
Adj R-sq	0.2171

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1735961338	620162064.35	2.799	0.0173
INVGNP	1	-2826523953	2409885442.4	-1.173	0.2656
FC7FMS	1	-3547297741	1983116495.2	-1.789	0.1012

Dependent Variable: EXP7F

F Value	10.353
Prob>F	0.0017
R-square	0.5966
Adj R-sq	0.5390

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.851900	0.29707065	-2.868	0.0124
INVGNP	1	5.781056	1.33201485	4.340	0.0007
FC7FTS	1	-1.049071	4.37811546	-0.240	0.8141

Dependent Variable: EXP7F

F Value	2.204
Prob>F	0.1611
R-square	0.3059
Adj R-sq	0.1671

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.709035	0.62112467	-1.142	0.2802
INVGNP	1	3.939322	2.27173683	1.734	0.1136
FC7FMS	1	2.129084	1.74965163	1.217	0.2516

Dependent Variable: IMP7F

F Value	12.322
Prob>F	0.0008
R-square	0.6377
Adj R-sq	0.5860

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.896093	0.25500277	-3.514	0.0034
INVGNP	1	4.993066	1.14338954	4.367	0.0006
FC7FTS	1	2.560898	3.75813486	0.681	0.5067

Dependent Variable: IMP7F

F Value	2.992
Prob>F	0.0959
R-square	0.3744
Adj R-sq	0.2492

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.997119	0.59594365	-1.673	0.1252
INVGNP	1	5.199193	2.17963832	2.385	0.0383
FC7FMS	1	0.987240	1.67871898	0.588	0.5695

The correlation results show FC and P are positively related for Data I across all periods. The Data I regression also show FC and P to be positively related. This conforms with our null hypothesis prediction. The correlation results for Data II are uncertain and when looked at along with the regression results are inconclusive.

The correlation and regression results between X and FC are inconclusive for both sets of data- Data I and Data II. This makes it hard to draw implications with any degree of confidence.

The correlation results between M and FC indicate a positive relationship across all periods with Data II. With Data I the relationship is positive in period A while it is negative in periods B and C. The regression results show FC and M also to be positively related for both Data I and Data II. This leads us to accept our hypothesis for imports in this industry.

The results from the SITC sector analysis on the Manufacturing Goods sector earlier, indicated mixed results for exports and the acceptance of the null for imports. These factors in addition to the strategic importance of the Manufacturing Goods sector prompted us to look more closely at this sector.

In this section we analyzed four of the eight major industries that made up the Manufacturing Goods sector. The results of this analysis have again been mixed. In the correlations between production and foreign collaborations, there was the acceptance of the null only for the Non-Metallic Mineral Manufactures industry while the evidence was inconclusive for the other three industries. One might pose the question here as to why regressions were not run for production across the entire sector. The reason that this was not possible was due to the lack of conformity of production measures across this sector.

Our analysis for exports also yielded mixed results. The null could only be accepted for the Non-Ferrous Metals industry with the evidence being ambiguous in the case of the others.

Results on imports in the industry analysis agree with the results of our broad sector analysis- acceptance of the null. Here both Iron and Steel and the Non-Metallic Mineral Manufactures industries conform to the null.

One of the reasons for ambiguity in results is the lack of sufficient data. This is also seen in the presence of multicollinearity in our results. While this poses problems in conducting tests, in no way does its presence affect the directional signs on the coefficients. Given the sources of data available it seems that the data used here though limited was the best available. Data in either monthly or quarterly form, would give more data points and allow for stronger and more clear-cut results not only in this sector but, also in the other sectors. Unfortunately data is presently not available in this form.

Machinery And Transport Equipment

The Machinery and Transport Equipment sector consists of the following sub-sectors:

Power Generating Machinery and Equipment
Metal Working Machinery
General Industrial Machinery and Equipment
Office Machines and Data Processing Equipment
Telecommunications and Sound Recording Equipment
Electrical Machinery and Apparatus
Road Vehicles
Other Transport Equipment

This sector accounts for the largest number of foreign collaborations and imports. It also accounts for the fifth largest volume of exports in value terms[36].

Breaking down this sector in terms of imports, exports and foreign collaborations we observed that the Road Vehicles industry is the leading exporting industry, closely followed by the Electrical Machinery and Apparatus industry.

Imports are dominated by the General Industrial Machinery and Equipment industry although, since 1976, imports in the Machinery Specialized for particular industries sector have rapidly increased. Other industries in this sector with a high volume of imports include the Electrical Machinery and Apparatus and the Other Transport Machinery industry.

A dis-aggregation of foreign collaborations shows the Electrical Machinery and Apparatus industry to consistently draw the largest number of foreign collaborations. They are closely followed by the General Industrial Machinery and Equipment industry.

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[36] Figures 10, 11 & 12 in Appendix

We will concern ourselves with the analysis of the Electrical Machinery and Apparatus, General Industrial Machinery and Equipment and the Telecommunications and Sound Recording Equipment industries in this sector. The reason for choosing to look more in-depth at the Telecommunications and Sound Recording Equipment industry along with the other industries, was the fact that it was a hi-technology area that has major implications particularly with the increasing emphasis on global communication systems and technology.

Electrical Machinery and Apparatus Industry

The Electrical Machinery and Apparatus industry accounts for the largest number of foreign collaborations, as well as is the second leading exporting industry in this sector. These factors make this an industry of interest for the purposes of this study.

The value of production in this industry has gone up from Rs 3568 lakh in 1960-61 to Rs 39619 lakh in 1985-86. Tracking production as a percentage of GNP, the share of production increased from 0.23% of GNP in 1960-61 to close to 0.47% of total GNP in 1982-83. Production however took a sharp downturn in the mid-eighties, averaging less than 0.18% of GNP during the years 1983-86.

Foreign collaborations have been increasing in this industry, going up from 22 collaborations in 1970-71 to 205 in 1985-86. During the eighties, collaborations have averaged close to 142 collaborations a year.

Imports have been decreasing since 1957-58 when they made-up over 0.5% of total GNP at a value of Rs 6114 lakhs. The period from 1957 onwards saw a gradual decline in imports, reaching a low of close to 0.12% of total GNP in 1976-77. Imports

have slowly picked up during the eighties and are now back to 0.34% of GNP in 1986-87 (Rs 24,938 Lakhs).

The exports volume in this sector is the second largest in all industries in the Machinery and Transport Equipment sector. During 1957-63, exports were almost negligible with no exports taking place during 1961-63. Since then exports have increased rapidly, accounting for a little over 0.09% of total GNP in 1977-78 and for consistently over 0.055% since 1973-74[37].

The results of our correlation and regression analysis between foreign collaborations, production, imports and exports are listed in the tables below:

Table 32

Correlation Analysis for theElectrical Machinery, Appliances & Apparatus Industry

Pearson Correlation Coefficient for Data I

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.3557	0.35632	-0.22103	0.66329	-0.78889	-0.50585
0.2565	0.2321	0.4680	0.0002	0.0001	0.0084
14	13	13	26	30	26

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.30362	0.49089	-0.09316	0.90835	-0.80574	-0.70798
0.3937	0.1498	0.7980	0.0001	0.0001	0.0005
10	10	10	20	23	20

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.54634	-0.57624	0.03424	0.96788	-0.24280	-0.77558
0.2620	0.1757	0.9419	0.0015	0.5998	0.0699
6	7	7	6	7	6

[37] Figures 40 to 43 in Appendix

Table 33

Correlation Analysis for theElectrical Machinery, Appliances & Apparatus Industry

Pearson Correlation Coefficient for Data II

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.00643	0.33132	-0.0425
0.8130	0.1939	0.8713
16	17	17

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.48833	0.15644	-0.5614
0.3257	0.7672	0.2464
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.22359	0.23090	0.17580
0.6702	0.6184	0.7061
6	7	7

Table 34

Dependent Variable: PROD8G

F Value	0.181
Prob>F	0.8368
R-square	0.0270
Adj R-sq	-0.1226

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.511544	0.25972198	1.970	0.0706
INVGNP	1	-0.569907	1.03000415	-0.553	0.5894
FC8GST	1	-0.071155	0.96281516	-0.074	0.9422

Dependent Variable: PROD8G

F Value	1.472
Prob>F	0.2798
R-square	0.2465
Adj R-sq	0.0791

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.419213	0.88619665	0.473	0.6474
INVGNP	1	-2.368251	1.97829749	-1.197	0.2618
FC8GMS	1	0.552027	0.64075007	0.862	0.4113

Dependent Variable: EXP8G

F Value	0.975
Prob>F	0.4016
R-square	0.1222
Adj R-sq	-0.0032

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.019242	0.06290378	0.306	0.7642
INVGNP	1	0.322935	0.23411341	1.379	0.1894
FC8GST	1	-0.025822	0.23686485	-0.109	0.9147

Dependent Variable: EXP8G

F Value	3.3032
Prob>F	0.0935
R-square	0.3775
Adj R-sq	0.2529

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.066554	0.15473022	-0.430	0.6762
INVGNP	1	-0.270524	0.32018873	-0.845	0.4179
FC8GMS	1	0.241529	0.11842883	2.039	0.0687

Dependent Variable: IMP8G

F Value	0.343
Prob>F	0.7155
R-square	0.0467
Adj R-sq	-0.0895

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.137440	0.10648902	1.291	0.2177
INVGNP	1	0.321788	0.39632762	0.812	0.4304
FC8GST	1	-0.138694	0.40098549	-0.346	0.7346

Dependent Variable: IMP8G

F Value	1.457
Prob>F	0.2784
R-square	0.2257
Adj R-sq	0.0708

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.022541	0.33954924	0.066	0.9484
INVGNP	1	1.061768	0.70264127	1.511	0.1617
FC8GMS	1	-0.105197	0.25988729	-0.405	0.6942

The correlation and regression results from the above tables are inconclusive for all the variables involved- X, M and P. More data especially on foreign collaborations would perhaps allow for a clearer analysis in this industry.

A look at other possible factors influencing production, exports and imports in this industry would be of interest. This would involve a close study of the overall

infrastructure of the economy and in particular the infrastructure of this industry. This is however beyond the scope of this thesis.

Telecommunication and Sound Recording

Production in the Telecommunication and Sound Recording was at 83,000 units in 1951-52. It increased rapidly in the late sixties, and reached a high of 2,215,241 units during 1979-80. Foreign collaborations in this industry have increased tremendously since 1985-86, averaging close to 29 collaborations during the period 1985-1989. Prior to that foreign collaborations between 1971-84 averaged close to five collaborations per annum.

Exports have been increasing since the mid-seventies. During the eighties exports have averaged over Rs 1000 lakh per year. Similarly, imports have rapidly increased during the eighties- imports reached a high of 0.1% of total GNP in 1986-87 for a rupee value of 24,938 lakh[38]. This has been in part, due to the liberalized import policies accentuated by reductions in import duties.

The correlation and regression results in this section are listed below in tables 35 through 37:

[38] See Figures 36 to 39 in Appendix

Table 35

Correlation Analysis for theTelecommunication& Sound Equipment Industry
Pearson Correlation Coefficient for Data I
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.68149	-0.7721	0.73772	0.70963	-0.13256	-0.11162
0.0073	0.0020	0.0040	0.0001	0.5465	0.6121
14	13	13	23	23	23

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.00119	-0.45932	-0.91576	0.76700	0.24654	0.13591
0.9974	0.1817	0.0002	0.0005	0.3573	0.6157
10	10	10	16	16	16

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
-0.03860	-0.08142	0.36775	0.47515	-0.60319	-0.86624
0.9277	0.8622	0.4170	0.2812	0.1516	0.0117
8	7	7	7	7	7

Table 36

Correlation Analysis for theTelecommunication& Sound Recording Industry
Pearson Correlation Coefficient for Data II
Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.39326	-0.50598	0.36232
0.1064	0.0367	0.1530
18	17	17

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.68680	-0.51231	0.07159
0.1318	0.2988	0.8928
10	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
-0.70210	-0.43948	-0.89963
0.0522	0.3238	0.0058
8	7	7

Table 37

Dependent Variable: PROD8F

F Value	2.852
Prob>F	0.0892
R-square	0.2755
Adj R-sq	0.1789

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	2675100	538571.35173	4.967	0.0002
INVGNP	1	-3791873	2397469.1201	-1.582	0.1346
FC8FST	1	-3829734	6356333.2772	-0.603	0.5558

Dependent Variable: PROD8F

F Value	4.769
Prob>F	0.0322
R-square	0.4644
Adj R-sq	0.3670

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1967989	1547192.4824	1.272	0.2296
INVGNP	1	18322	6797805.4395	0.003	0.9979
FC8FMS	1	-5917959	4128179.9214	-1.434	0.1795

Dependent Variable: EXP8F

F Value	2.540
Prob>F	0.1145
R-square	0.2663
Adj R-sq	0.1615

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.011051	0.00585013	1.889	0.0798
INVGNP	1	-0.009317	0.02624015	-0.355	0.7278
FC8FST	1	-0.106253	0.06401750	-1.660	0.1192

Dependent Variable: EXP8F

F Value	9.070
Prob>F	0.0057
R-square	0.6446
Adj R-sq	0.5736

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.027079	0.01377376	1.966	0.0777
INVGNP	1	-0.070417	0.06026692	-1.168	0.2697
FC8FMS	1	-0.039146	0.03498098	-1.119	0.2893

Dependent Variable: IMP8F

F Value	2.849
Prob>F	0.0916
R-square	0.2893
Adj R-sq	0.1877

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.005719	0.03106951	-0.184	0.8566
INVGNP	1	0.245877	0.13935895	1.764	0.0995
FC8FST	1	0.124527	0.33999086	0.366	0.7196

Dependent Variable: IMP8F

F Value	6.047
Prob>F	0.0190
R-square	0.5474
Adj R-sq	0.4569

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.061270	0.07691844	0.797	0.4442
INVGNP	1	-0.088779	0.33655574	-0.264	0.7973
FC8FMS	1	0.394553	0.19534847	2.020	0.0710

The results of the analysis between P and FC indicate a rejection of our hypothesis for production. The correlation results suggest that FC and P are negatively related in periods A and C and positively related in period B for both Data I and Data II. We should have expected a positive trend in period C given the liberalization in government policies during this period. The regression results indicate that FC and P are negatively related for both Data I and Data II. These negative coefficient results are perhaps the result of the pre-1980 restrictive government policies. With more post-1980 data becoming available, this situation will perhaps be reversed.

The correlations between X and P show a strong, positive relationship across all three periods. This when compared to the results above suggests that foreign collaborations are not the driving force behind production and as also further observed in the next paragraph, behind exports.

The relationship between X and FC rejects our hypothesis with both types of data. Evidence of this is seen not only from the positive correlations between X and P, but also from the regression and correlation analysis results. The correlation results between X and FC show a negative relationship across all periods for both Data I and Data II. In addition, the regression results on FC and X also shows a negative relationship. This

implies that increases in foreign collaboration actually lead to decreases in exports and not increases, as hypothesized in the null. Results between M and FC are inconclusive.

Again other factors that possibly influence production, exports and imports in the Telecommunication and Sound Recording industry requires further analysis that is beyond the scope of this thesis.

General Industrial Machinery and Equipment

This industry accounts for the largest number of foreign collaborations in the Machinery and Transport Equipment sector. Foreign collaborations have been increasing rapidly. In 1970-71 there were 34 collaborations in this industry. This increased to 152 in 1985-86. This industry also accounts for the largest volume of imports in the Machinery and Transport Equipment sector.

Total imports, over the years have accounted for decreasing percentages of total GNP. For example, the percentage has decreased from close to 1% of total GNP in 1957-58 (Rs 11,585 lakhs) to a little under 0.3% of total GNP (Rs 46,957 lakh) in 1982-83. In 1986-87 the share was back up to 0.48% of total GNP.

Exports in the General Industrial Machinery and Equipment rank fourth among all industries in this sector. Exports picked up in this sector since the late sixties. They accounted for Rs 79 lakh in 1968-69 and for Rs 7,947 lakh in 1986-87[39].

Given the high level of foreign collaborations, imports and exports - in general activity, it is of interest to study the dynamics of this industry in more detail to try to

[39] Figures 32 through 35 in the Appendix

understand the possible trends here. This we hope will also shed light on the broader Machinery and Transport Equipment sector.

The results of our correlation and regression analysis are listed below in tables 38 through 40:

Table 38

Correlation Analysis for theGeneral Industrial Machinery & Equipment Industry

Pearson Correlation Coefficient for Data I

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exp & F.C.	.Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.7799	0.19033	-0.6618	0.86909	-0.75766	-0.89193
0.0010	0.5334	0.0137	0.0001	0.0001	0.0001
14	13	13	27	27	30

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.79022	-0.44590	-0.40592	0.86467	-0.70338	-0.85751
0.0065	0.1965	0.2445	0.0001	0.0005	0.0001
10	10	10	20	20	23

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exp. & F.C.	Imp & F.C.	Exports & Prod.	Exports & Imp.	Imp. & Prod
0.46154	0.84188	-0.71304	0.48321	-0.80786	-0.74312
0.2496	0.0175	0.0721	0.2720	0.0279	0.0556
8	7	7	7	7	7

Table 39

Correlation Analysis for theGeneral Industrial Machinery & Equipment Industry

Pearson Correlation Coefficient for Data II

Prob > |R| Under Ho: Rho=0/No. of Observations

For Years 1957-58 to 1986-87 (Period A)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.5499	0.60122	-0.4143
0.0181	0.0107	0.0982
18	17	17

For Years 1957-58 to 1979-80 (Period B)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.82207	-0.91554	-0.56083
0.0447	0.0104	0.2470
6	6	6

For Years 1979-80 to 1987-88 (Period C)

Prod. & F.C.	Exports & F.C.	Imports & F.C.
0.85054	0.78547	-0.92686
0.0074	0.0363	0.0027
8	7	7

Table 40

Dependent Variable: PROD8D

F Value	5.208
Prob>F	0.0192
R-square	0.4098
Adj R-sq	0.3311

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.046351	0.11656250	0.398	0.6965
INVGNP	1	0.698435	0.42259321	1.653	0.1192
FC8DST	1	0.742607	0.25978178	2.859	0.0120

Dependent Variable: PROD8D

F Value	13.655
Prob>F	0.0010
R-square	0.7129
Adj R-sq	0.6607

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.330608	0.13034998	2.536	0.0277
INVGNP	1	-0.860616	0.42986962	-2.002	0.0706
FC8DMS	1	0.255844	0.05630269	4.544	0.0008

Dependent Variable: EXP8D

F Value	5.618
Prob>F	0.0162
R-square	0.4453
Adj R-sq	0.3660

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.004410	0.01668982	-0.264	0.7954
INVGNP	1	0.093264	0.06413345	1.454	0.1679
FC8DST	1	0.108889	0.03664064	2.972	0.0101

Dependent Variable: EXP8D

F Value	6.072
Prob>F	0.0188
R-square	0.5484
Adj R-sq	0.4581

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.094798	0.02109100	4.495	0.0012
INVGNP	1	-0.267185	0.07933921	-3.368	0.0071
FC8DMS	1	0.013999	0.01001858	1.397	0.1925

Dependent Variable: IMP8D

F Value	3.316
Prob>F	0.0662
R-square	0.3214
Adj R-sq	0.2245

Parameter Estimates using Data I

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.767017	0.15556186	4.931	0.0002
INVGNP	1	-1.050853	0.59777254	-1.758	0.1006
FC8DST	1	-0.623008	0.34151864	-1.824	0.0895

Dependent Variable: IMP8

F Value	10.855
Prob>F	0.0031
R-square	0.6846
Adj R-sq	0.6216

Parameter Estimates using Data II

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.976381	1.50633521	0.648	0.5315
INVGNP	1	13.836267	2.99565944	4.619	0.0010
FC8MS	1	-1.042351	0.54892928	-1.899	0.0868

The correlations between P and FC are highly positive for all periods for both sets of data. The regression results also show a positive relation between P and FC with both sets of data. These results along with the correlation results between X and P that are positive, imply that foreign collaborations are indeed the driving force behind production in this industry and give validity to the null.

The correlations between FC and X are of interest in that they follow the same relationships across both sets of data. The relationship in all cases is also very strong. The correlations across periods A and C are positive while the relationship in period B is negative. The regression results show positive coefficients on FC. From these results as well as the correlation results between X/P there is strong indication that the data agrees with our hypothesis.

Finally, the correlation results between M and FC show a highly negative relationship between the two across all periods with both sets of data. The coefficients in period C, contrary to our expectations is highly negative. Our regression results show a negative relation between FC and M. This is contrary to the expectation of our hypothesis, since under our hypothesis, we expected a positive relation for period C. This leads to the rejection of our hypothesis and to the conclusion that increases in foreign collaborations do not lead to increases in imports in this industry. Imports are driven by some other variable.

The correlations between X/P, M/P and X/M show important trends in this industry. The correlation between X and P is extremely strong and positive across all periods, suggesting that increases in exports imply increases in production (complementary). The correlation between imports and production has a strong negative trend indicating that increases in production lead to decreases in imports (substitutes). The relationship between X and M is also highly negative. These correlation results lend further credibility to the conclusions on the relationships between FC, X, P and M reached earlier from our correlation and regression results in this industry.

From the SITC sector analysis on the Machinery and Transport Equipment sector, we observed the acceptance of our hypothesis for exports and the rejection of our hypothesis for imports.

In this section we looked at three of the eight industries that make up this sector. The results from the analysis of these industries do not give us a clear picture for the case

of production. Our hypothesis for production was accepted for the General Industrial Machinery and Equipment industry while it was rejected by the two other industries.

The results from the observations on the relationship between exports and foreign collaborations showed our hypothesis to be accepted by two of the three industries. Our hypothesis was overwhelmingly rejected by the Telecommunication and Sound Recording industry. However given the relative share of exports in this industry to the entire sector (ranks seventh out of eight industries in the sector)[40], this result would not appear to affect the general sectoral trend and we are inclined to accept our hypothesis for exports.

In the case of imports we observe our hypothesis to be rejected by the Telecommunication and Sound Recording industry and the General Industrial Machinery. It was accepted by the Electrical Machinery and Apparatus Industry. Both the General Industrial Machinery, and the Electrical Machinery and Apparatus Industry draw sizeable amounts of imports in this sector[41]. The acceptance of our hypothesis here implies that imports and foreign collaborations drawn by the other industries that comprise this sector along with the Telecommunication and Sound Recording industry and the General Industrial Machinery industries give this sector an overall positive trend.

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[40] See Figure 10 in the Appendix

[41] See Figure 11 in the Appendix

Conclusion

Summing up our results, it is difficult to find a pattern between exports and foreign collaborations. Clear results exist only in two of the aggregate sectors. These were the Machinery and Transport Equipment and the Commodities and Transactions not Classified according to Kind sectors. The results from the Machinery and Transport Equipment sector supported our hypothesis and therefore the conclusion that total factor productivity (TFP), proxyed by foreign collaborations, was the driving force behind exports. The results from the Commodities and Transactions not Classified according to Kind sector were inconsistent with our hypothesis.

The analysis for imports again showed mixed results. There were four sectors where clear results were possible. Our hypothesis was accepted by the Food and Live Animals Chiefly for Food and the Misc. Manufactured Articles sectors, again suggesting that TFP was the driving force behind imports. This is consistent with the finding of Nishimizu and Goldar[42]. They observed that import liberalization led to increased TFP through increases in cost reduction incentives. Our results show the relationship in reverse order, i.e., increases in TFP lead to increase in imports. Our hypothesis was rejected by the Machinery and Transport Equipment and the Commodities and Transactions not Classified according to Kind sectors.

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[42] See citation of work in the references section

There were clear results for both exports and imports in only two sectors- the Machinery and Transport Equipment and the Commodities and Transactions not Classified according to Kind sectors.

Our industry specific results are summarized below in Table 41:

Table 41
Results from Industry Analysis
(Acceptance/Rejectionof the Null).

Industries	P/FC.	X/FC.	M/FC.
Tea, Coffee, Cocoa & Spices	R	A	?
Leather, Leather Manufacturers & Dressed Furskins	?	?	?
Iron & Steel	?	?	A
Non-Ferrous Metals	?	?	?
Non-Metallic Mineral Manufactures	A	?	A
Electrical Machinery & Apparatus	?	?	?
Telecommunication & Sound Recording	R	R	?
General Industrial Machinery & Equipment	A	A	R

A= Accept the null; R= Reject the null; ?= Inconclusive.

It would be of interest to include competitive cost reduction incentives in our model and observe the results. This could be one direction of future work.

While the overall results of the empirical work are somewhat disappointing given that most of our analysis has led to inconclusive results, with the availability of additional data the results of this study would lead to stronger and more conclusive results under the adapted framework.

The lack of data explains why much work has been done in the areas of technology transfer and R&D, while there has been little or no empirical work done in the area of foreign investments and collaborations in India.

The underlying reason for this lack of data has been the inaccessibility to data sources, controlled by the government. It is only since 1981 that crude, very aggregated data on foreign investment has been accessible, although not easily available. In the case

of foreign collaborations the available data goes back to 1970-71. Perhaps with more efficiency and accessibility to these sources of data our results would be much stronger.

The lack of sufficient data on foreign collaborations has in many cases hindered the obtaining of clear results in this paper. It has also led to the prevalence of multicollinearity in most places. This has been a big problem with the data.

It would also be of interest to run the Chow test on our data and check for consistency in our regression results for Data I and Data II across periods A, B and C. This test would allow us to check for differences in coefficients in our regressions across our three periods. A constraining factor here however would be the degrees of freedom in period C (post 1980)- the Chow test requires n-2 degrees of freedom, where n is the number of observations.

Another direction of interest for future work would be to include the analysis of industrial structures in the economy in order to analyze the implications of foreign collaborations and investment in different industries. Lall in his book *Learning to Industrialize* did this although he did not include the impact of foreign investment and collaborations.

The expected contribution of this study was to establish the relationship between production, exports and imports and foreign collaborations. Instead this study has led to several unanswered questions, as suggested by the ambiguity in our results. However, given the avowed pace of liberalization in India, a study of this sort should help place significance on the emphasis on foreign collaborations and investments and their myriad manifestations.

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APPENDIX

FIGURE 1

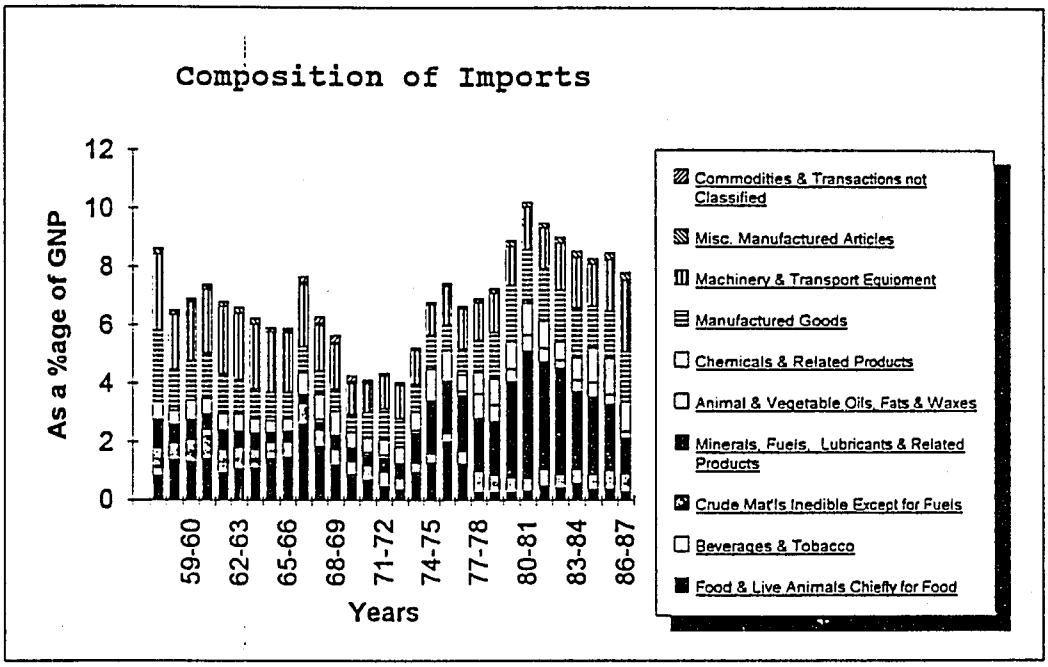
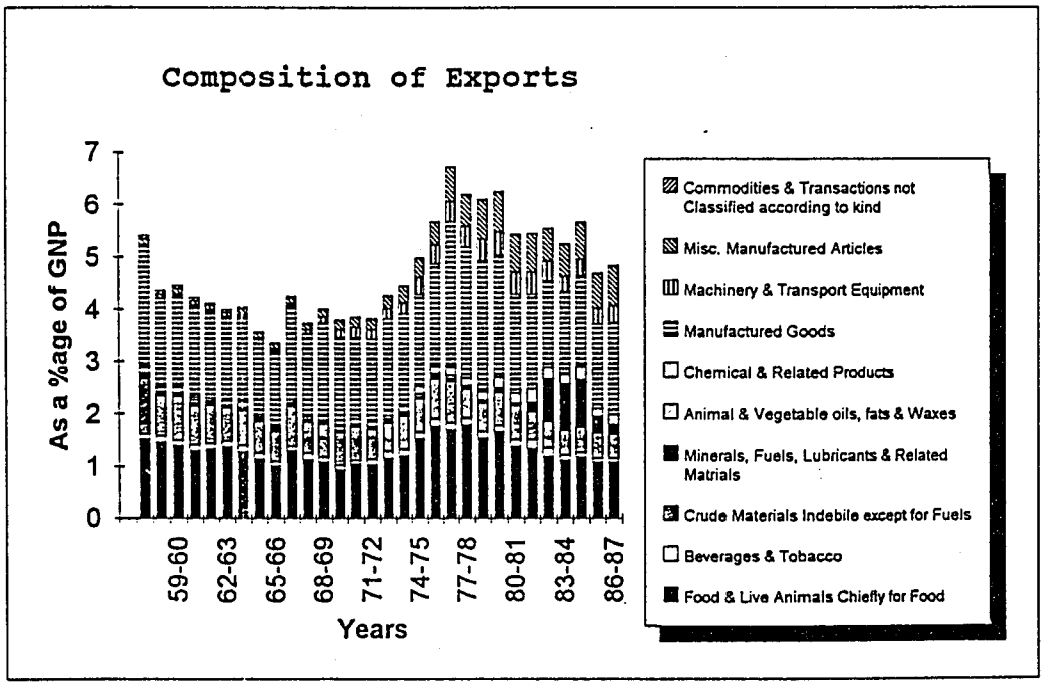


FIGURE 2



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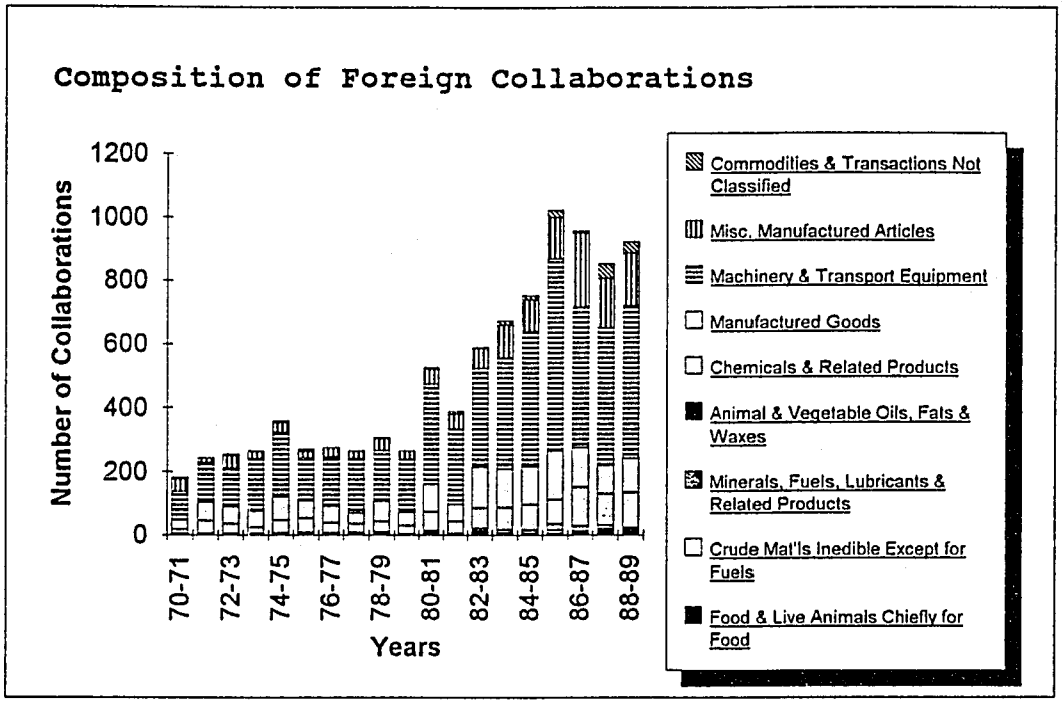

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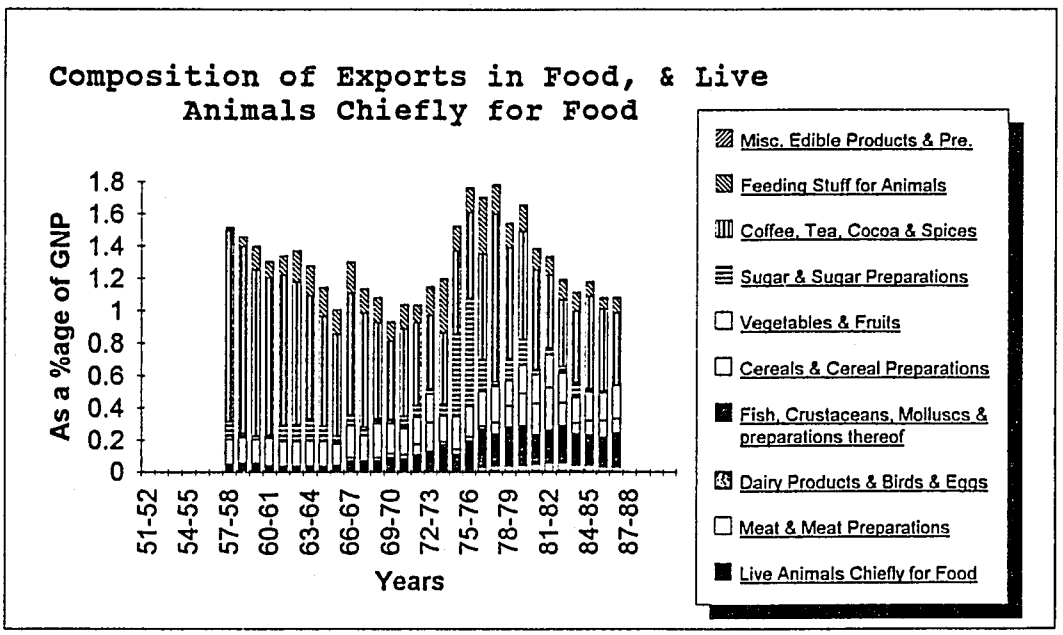

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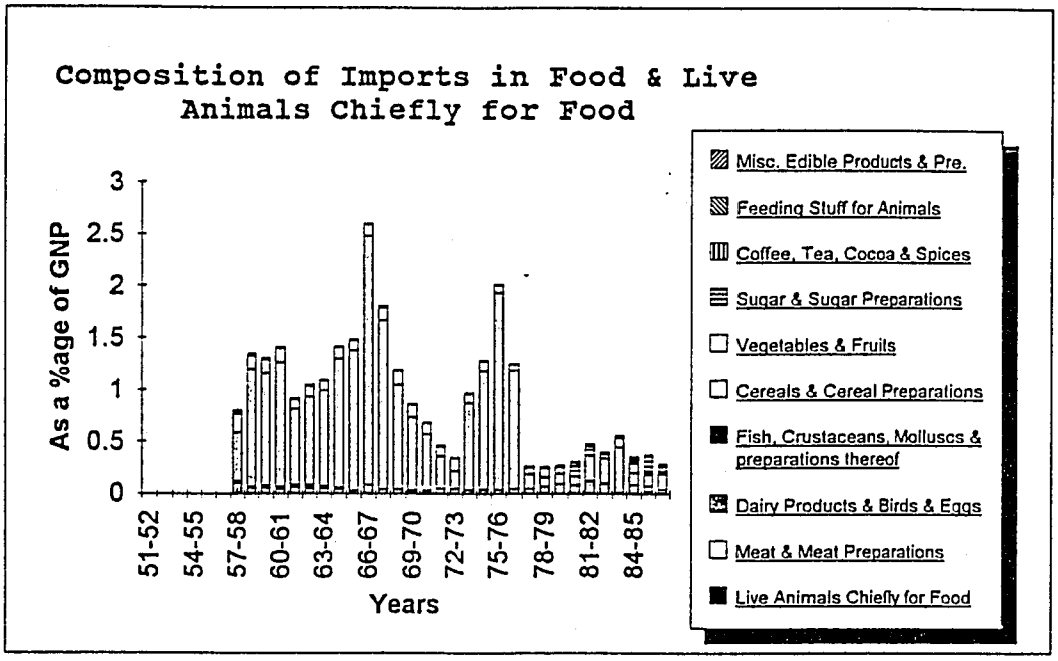

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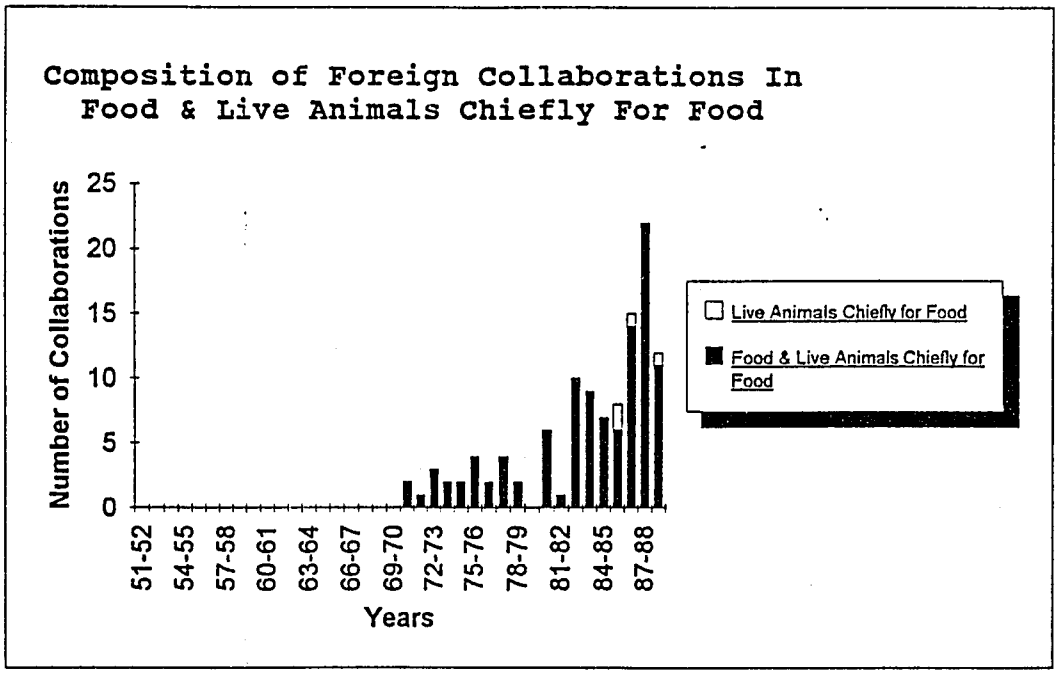

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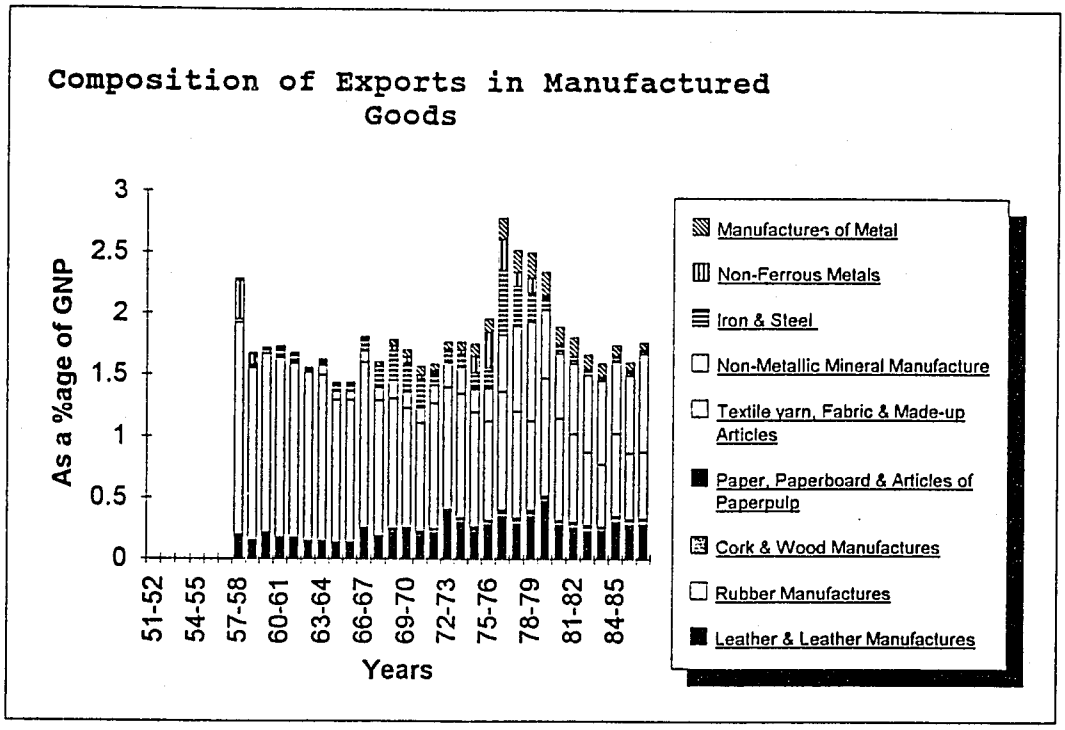

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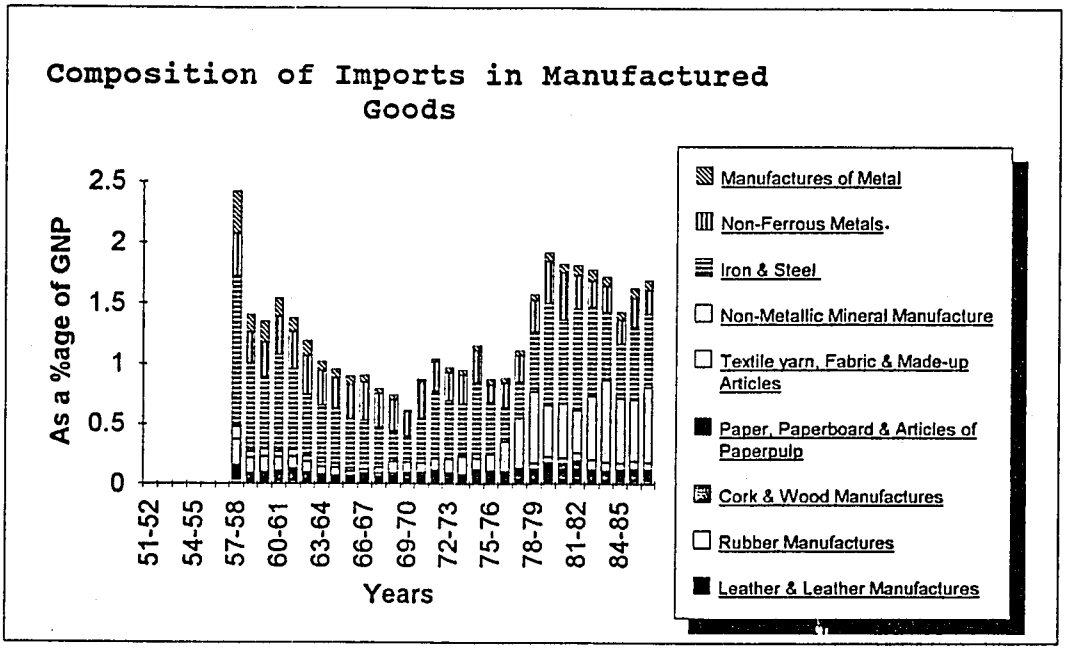

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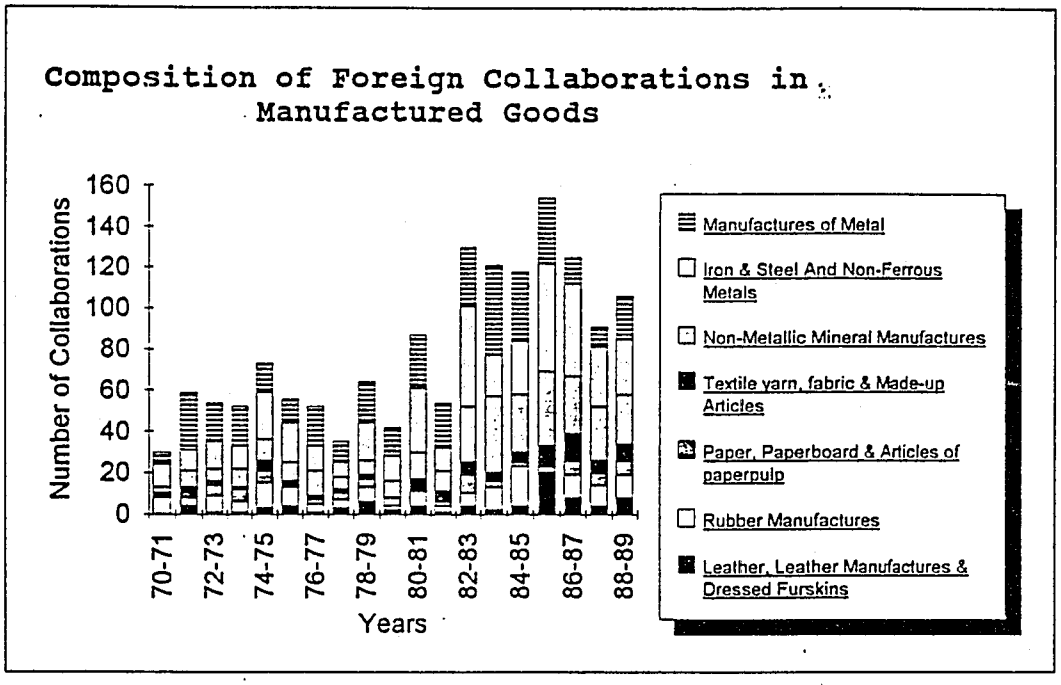

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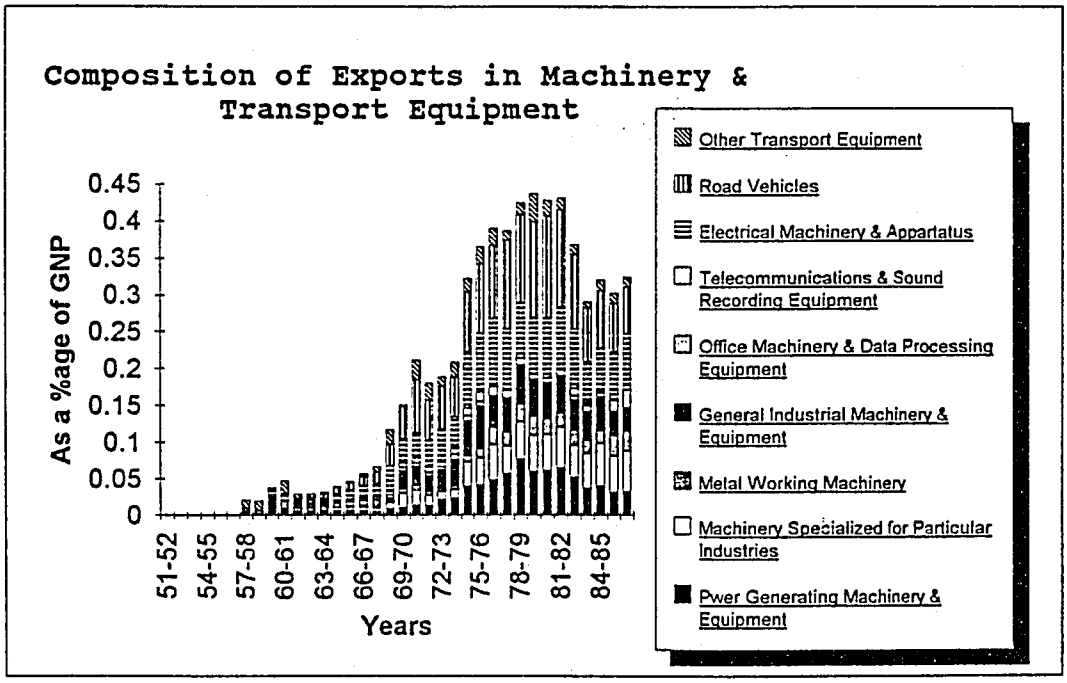

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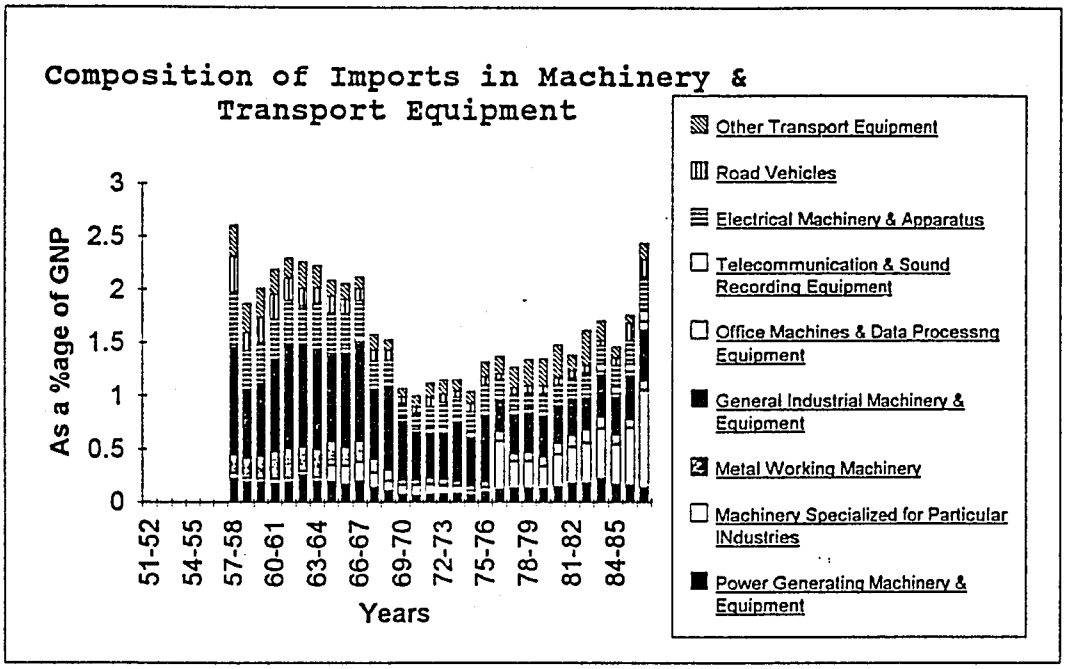

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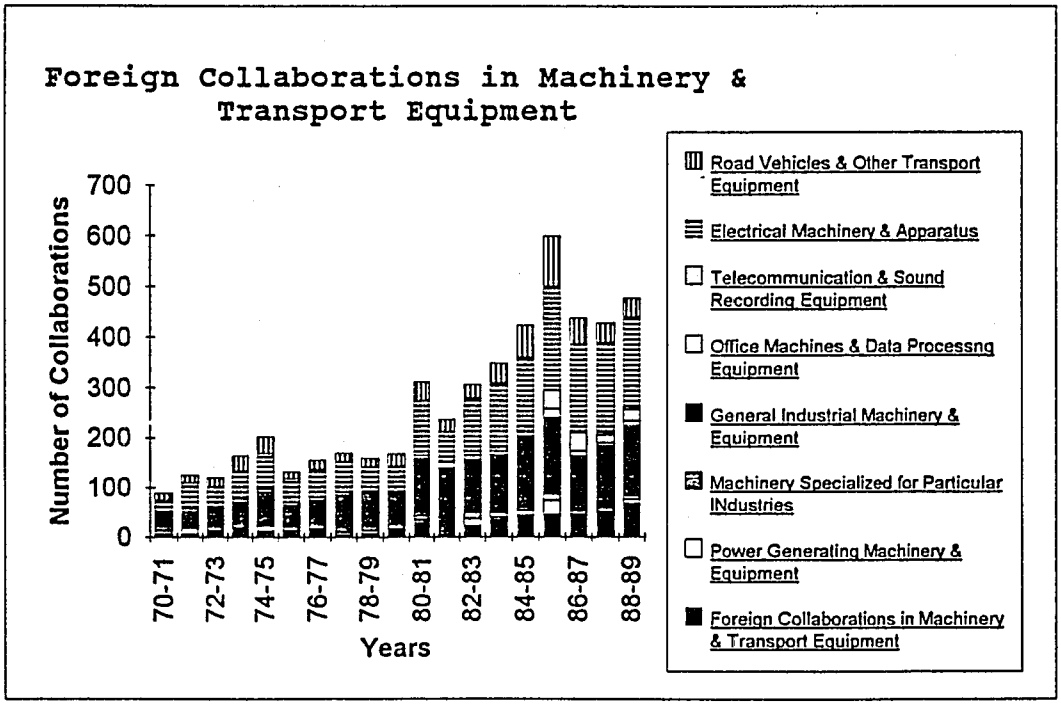

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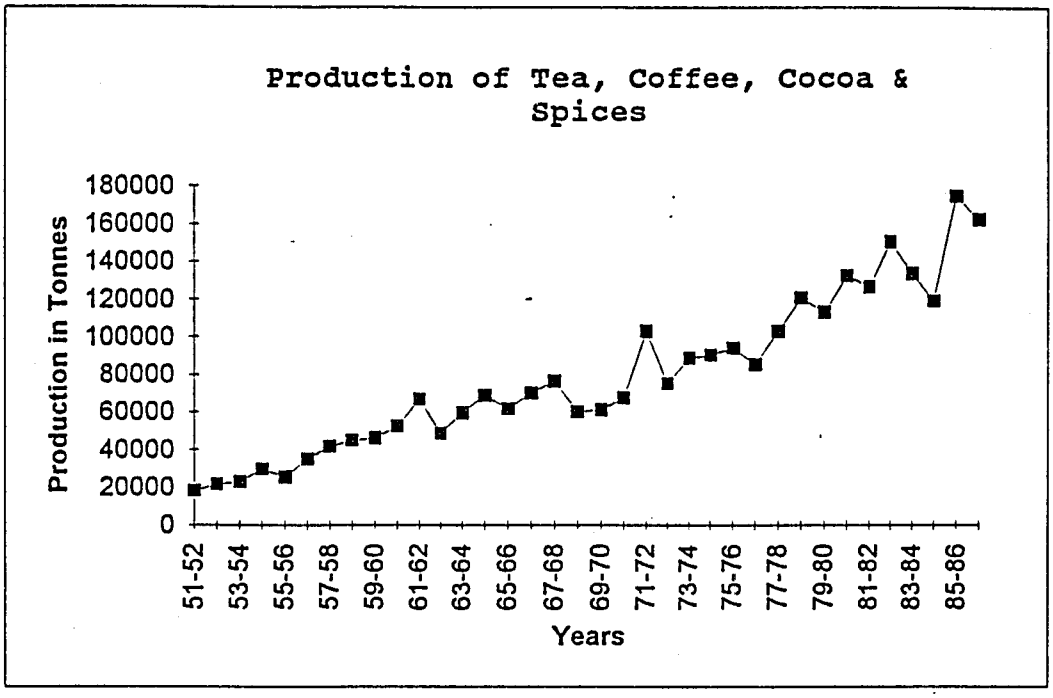

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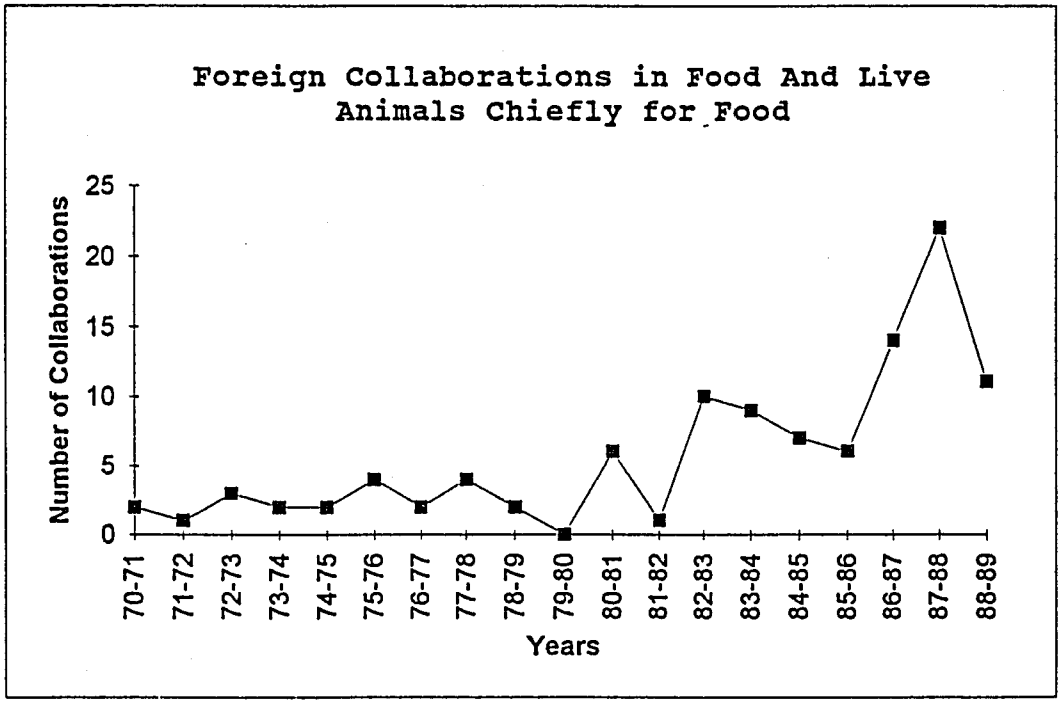

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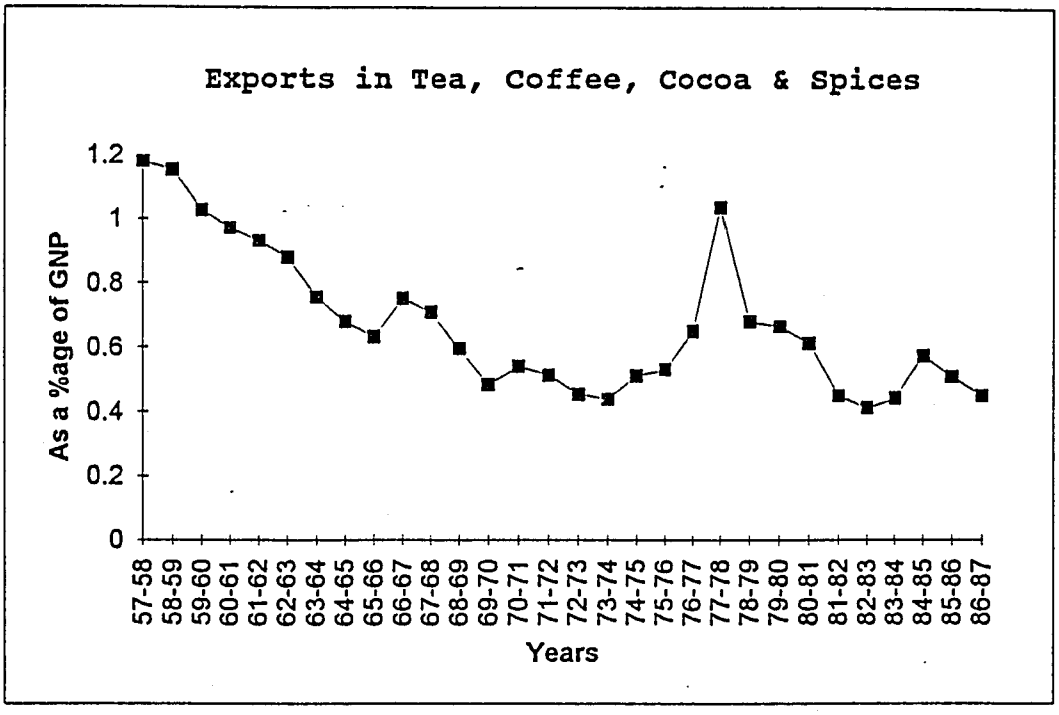

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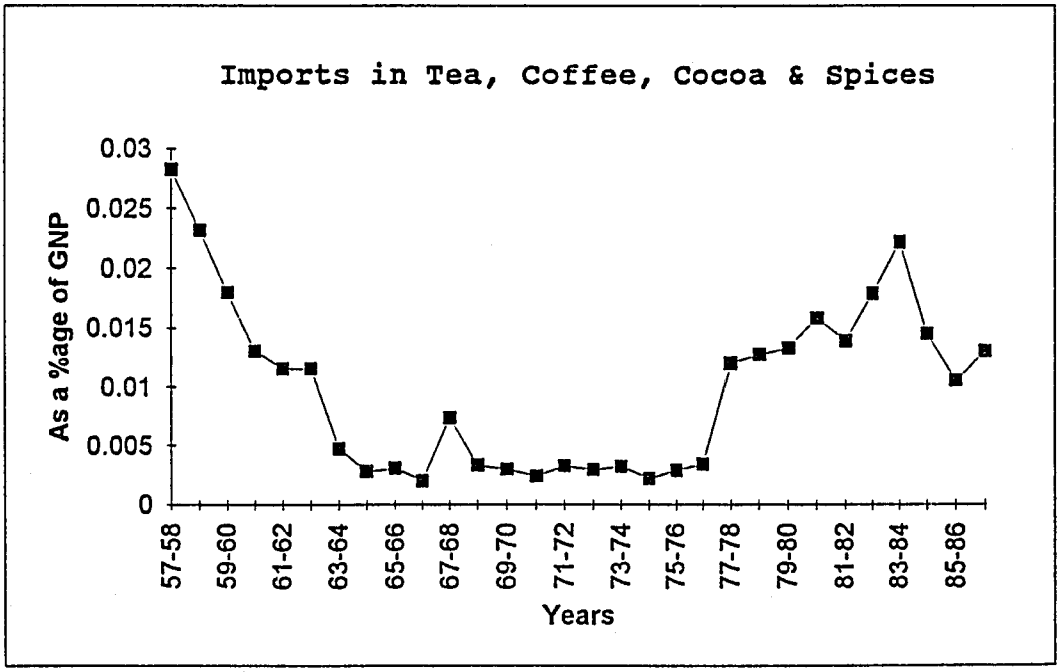

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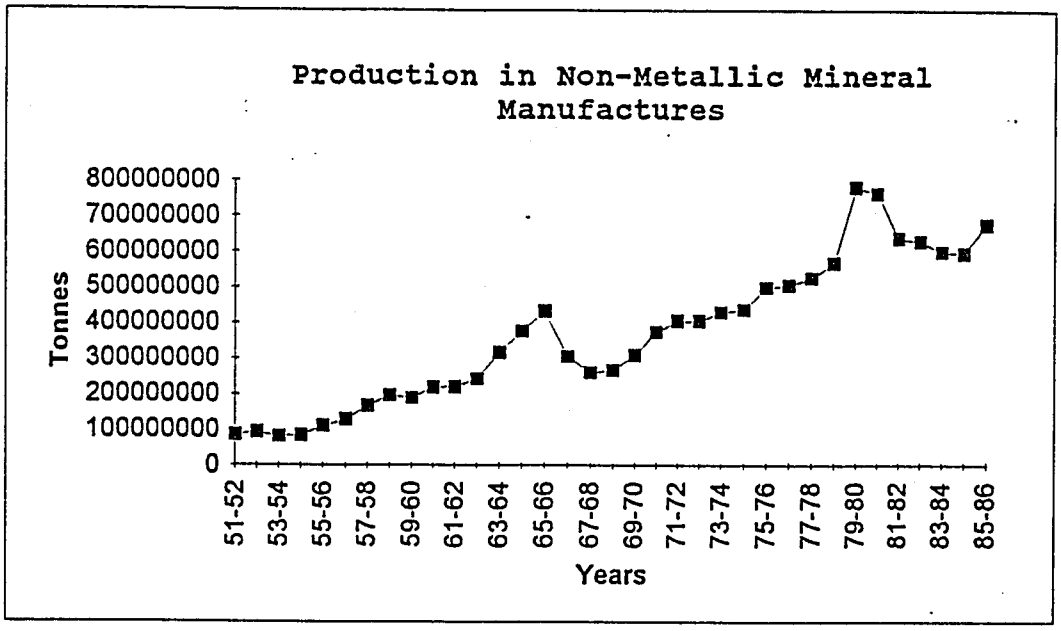

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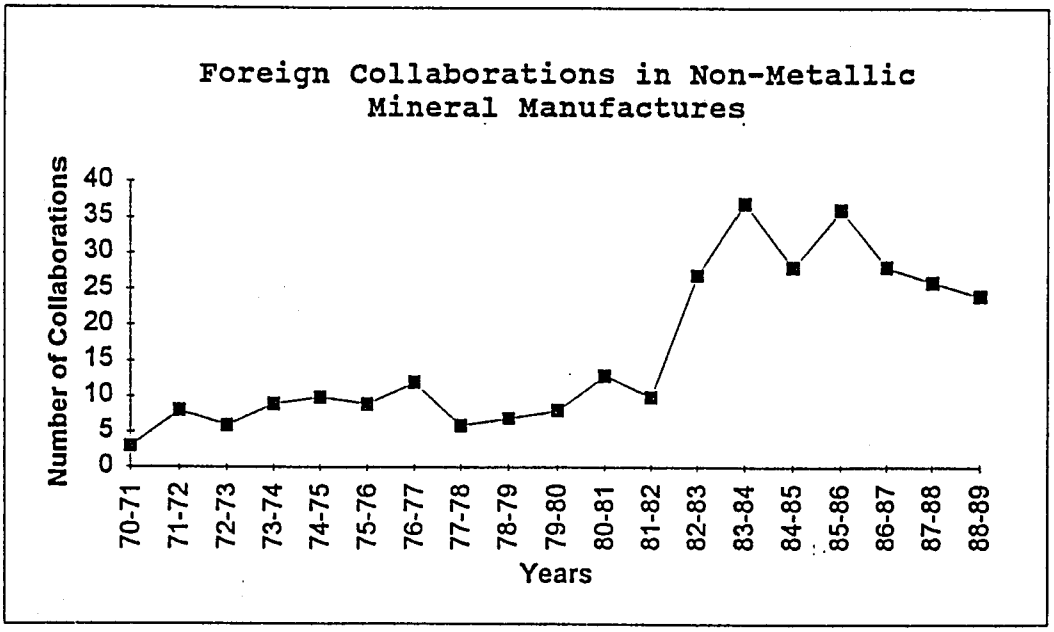

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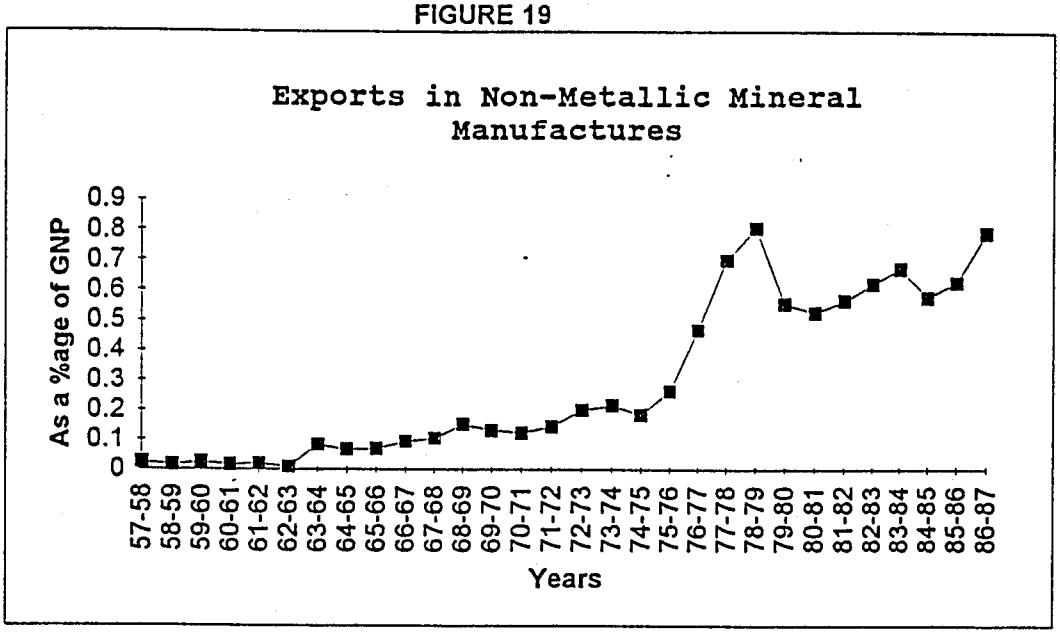

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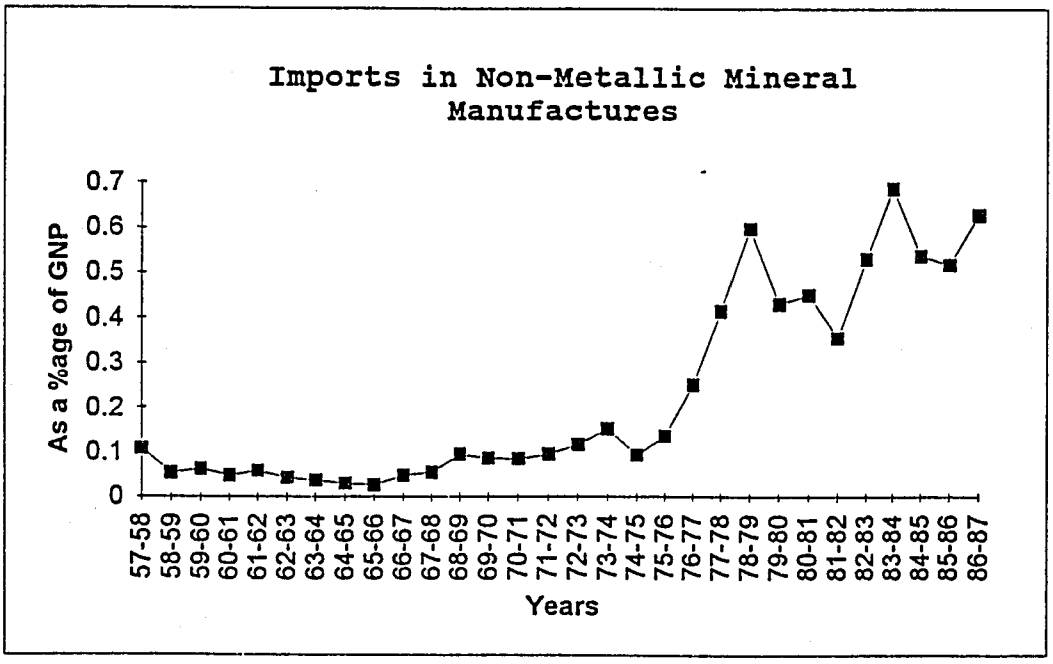

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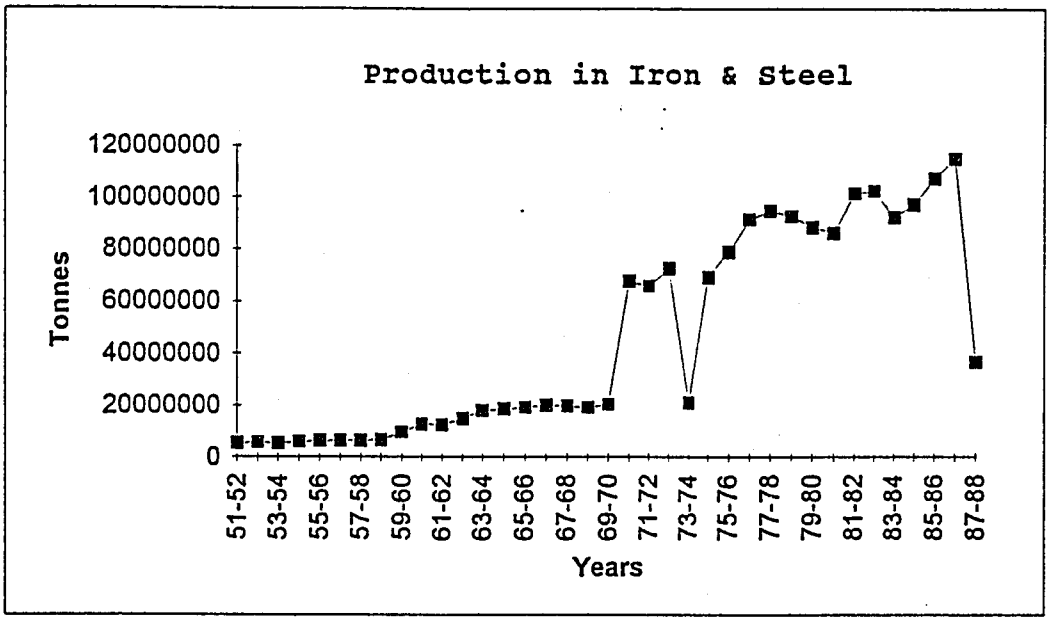

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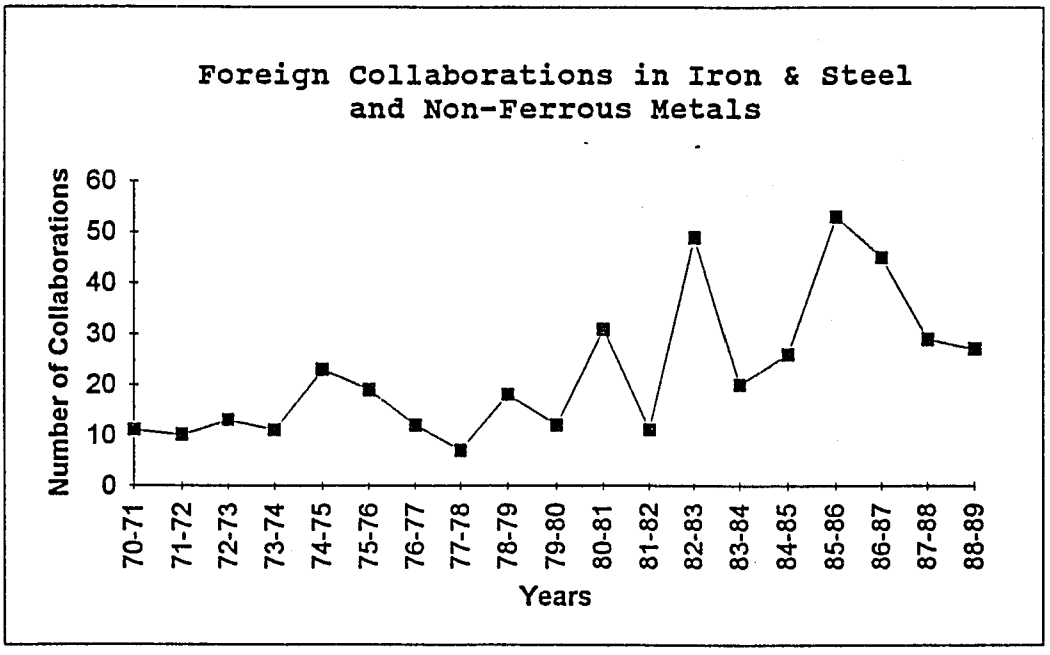

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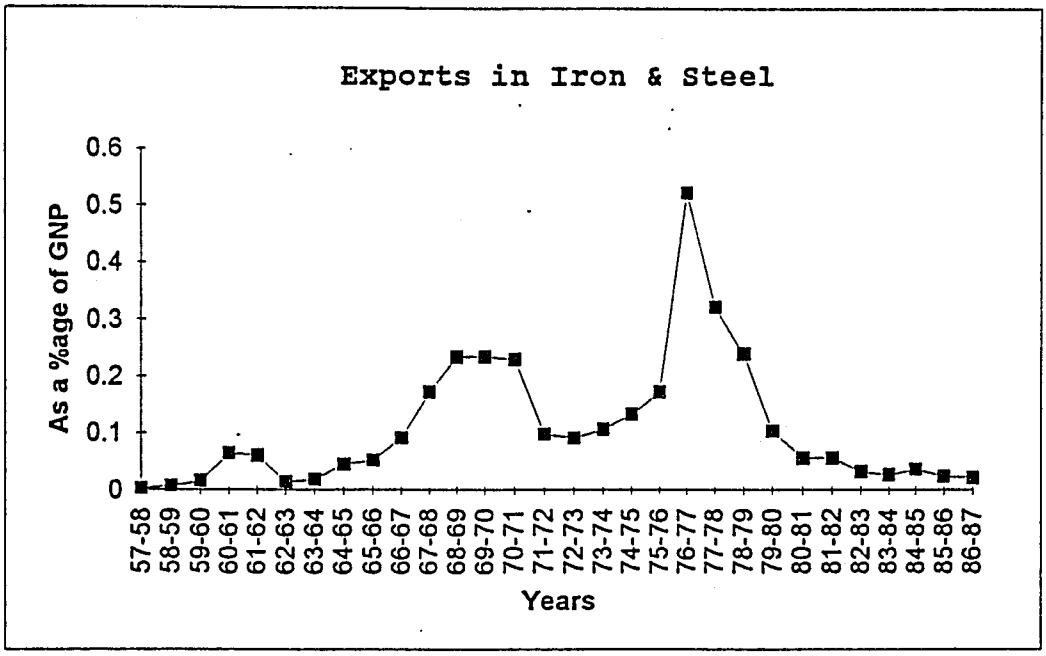

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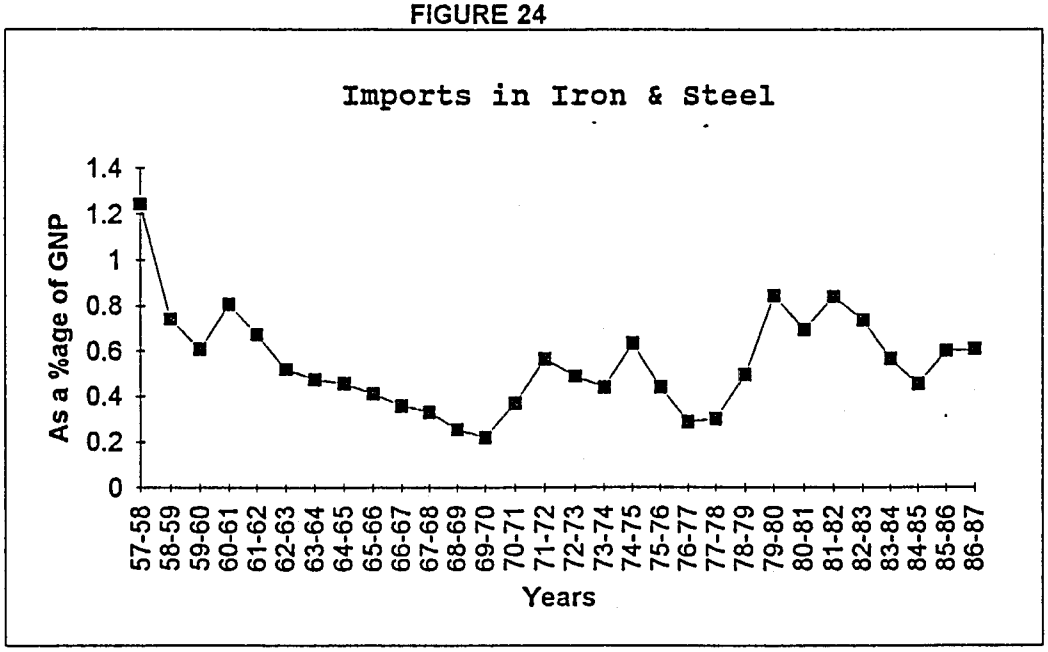

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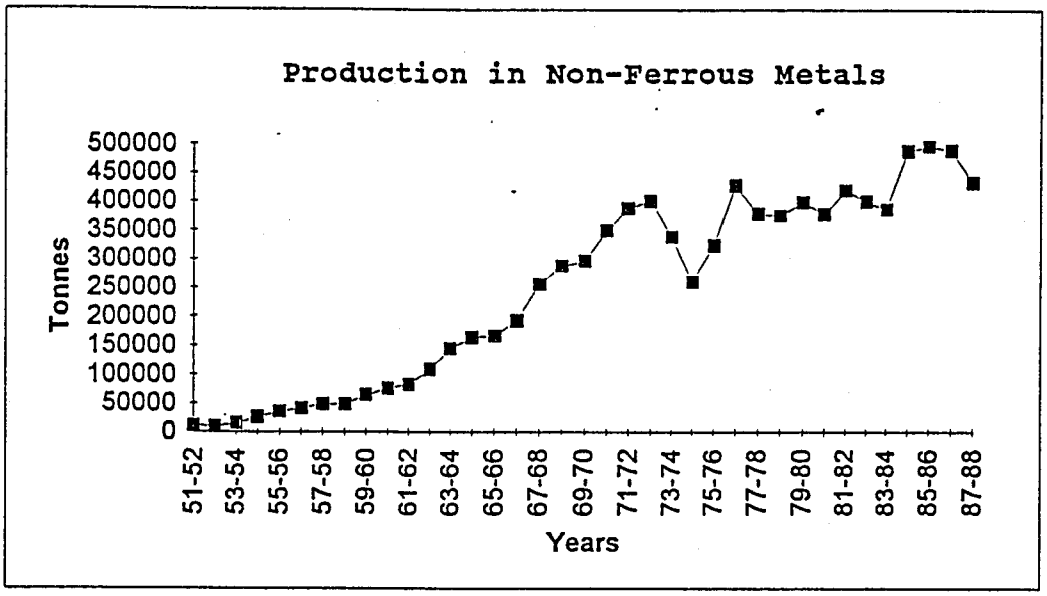

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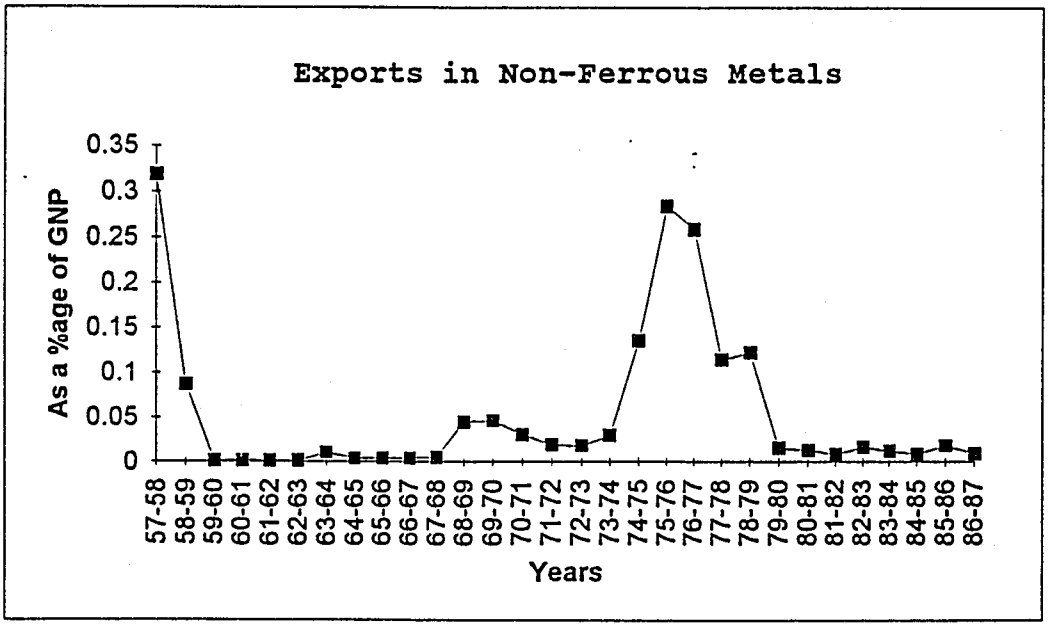

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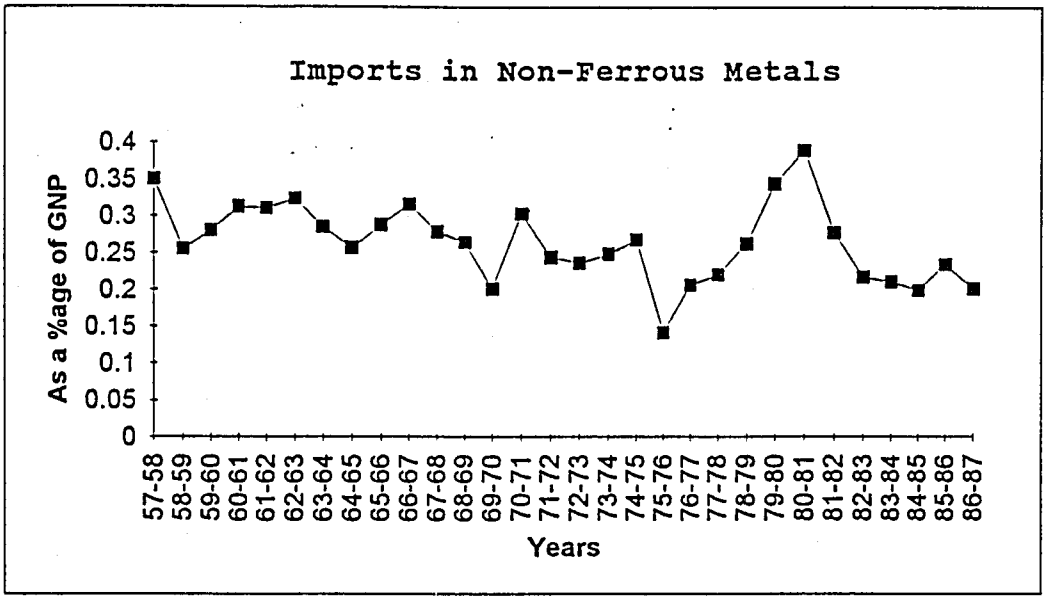

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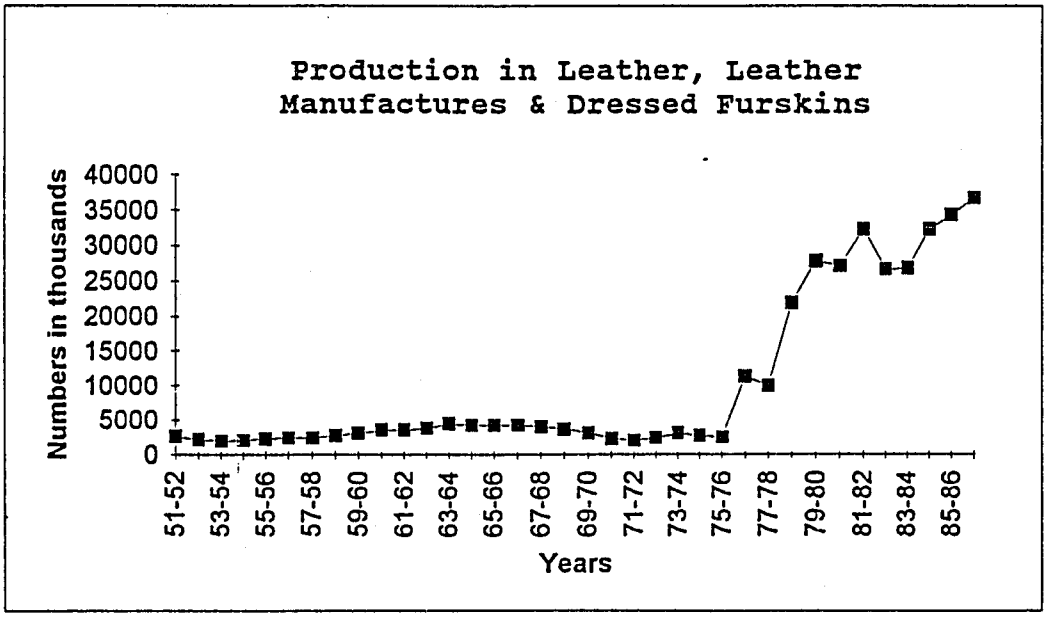

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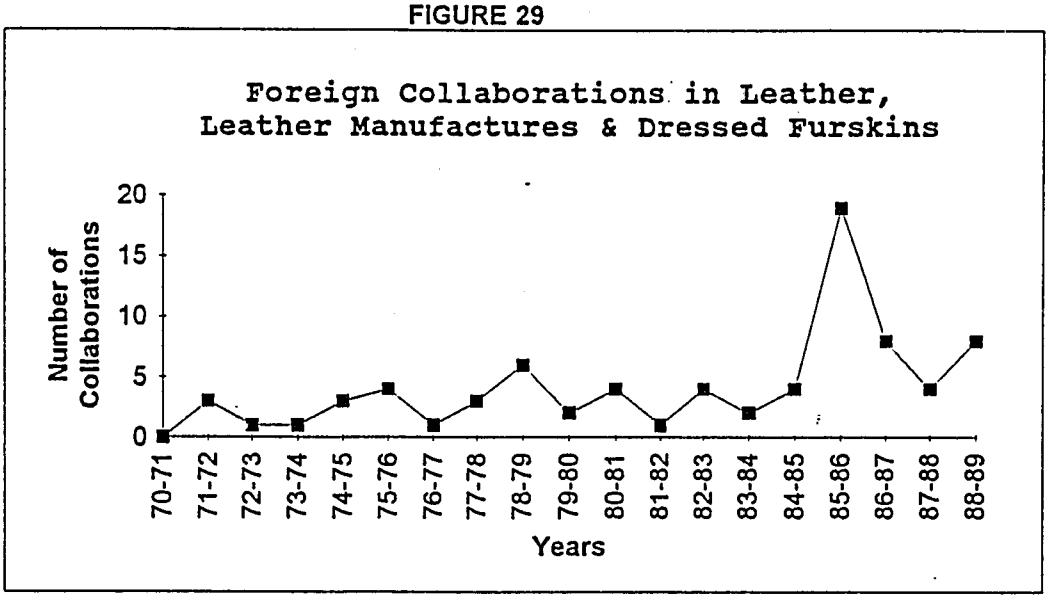

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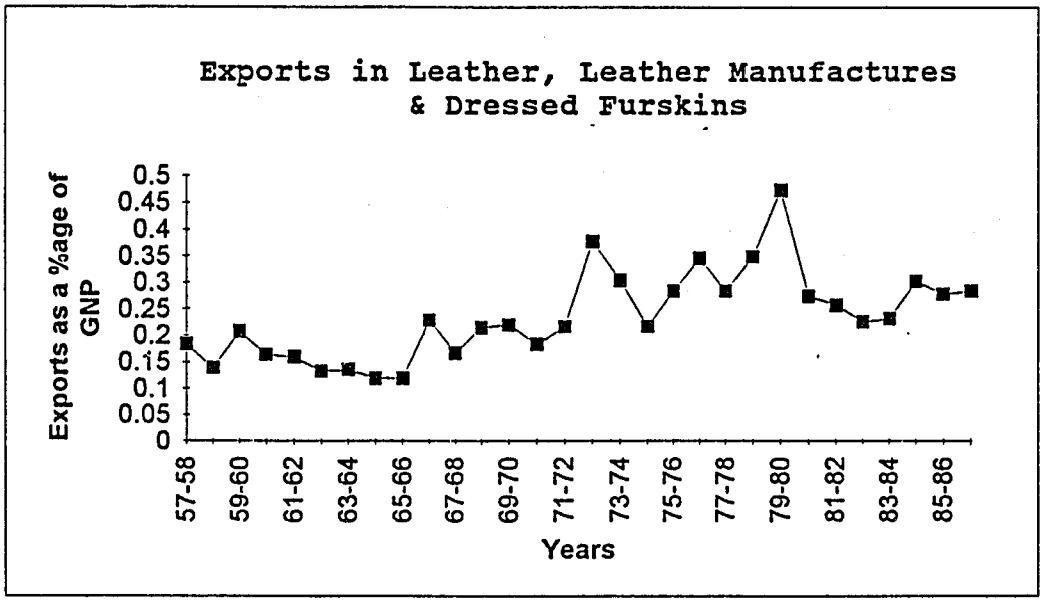

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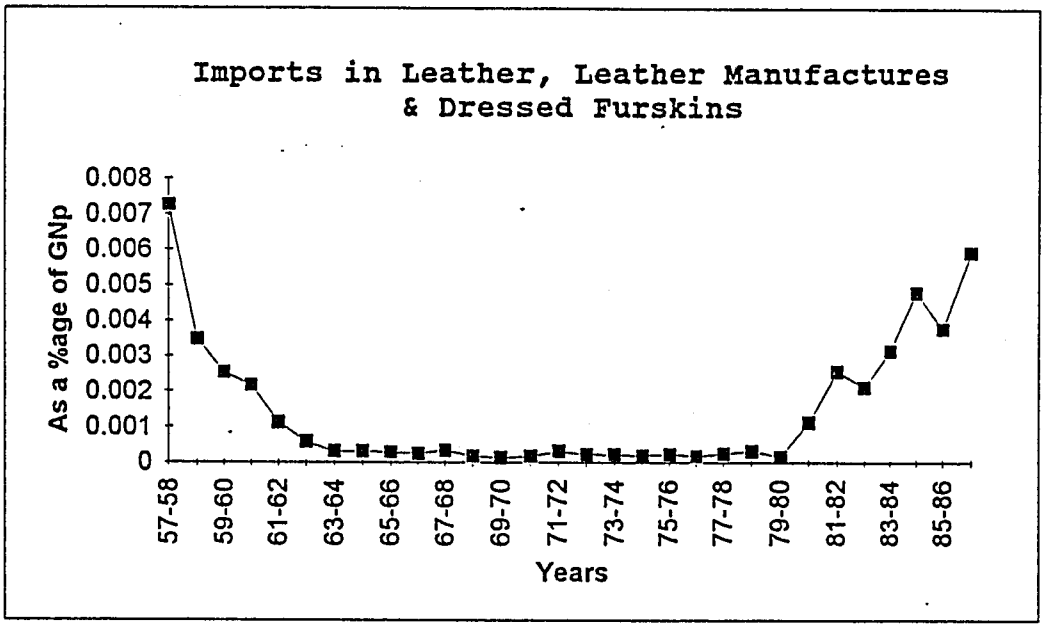

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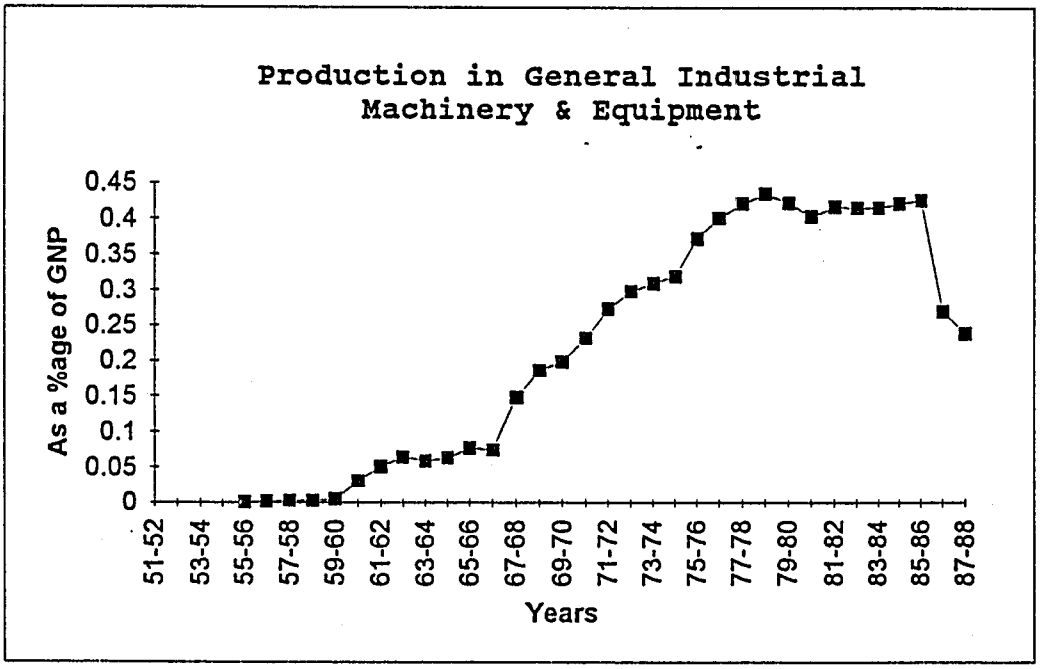

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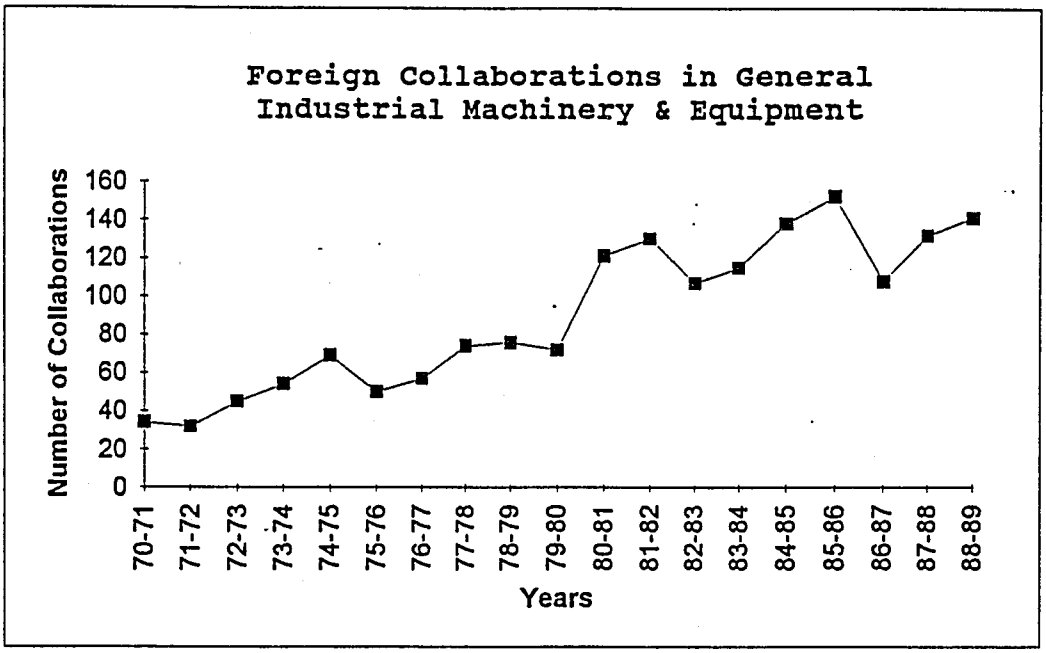

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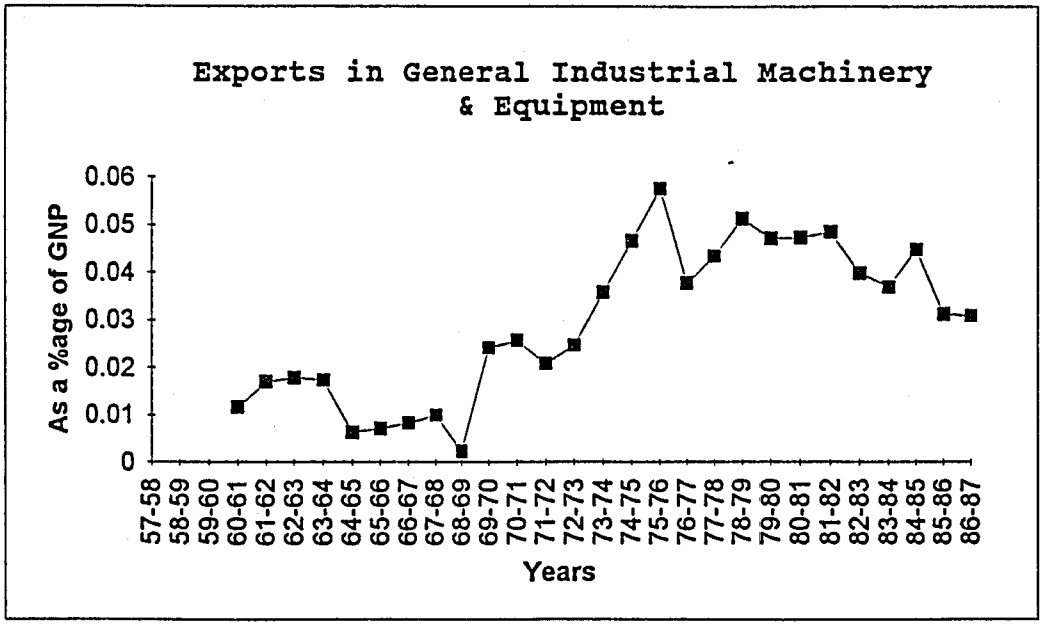

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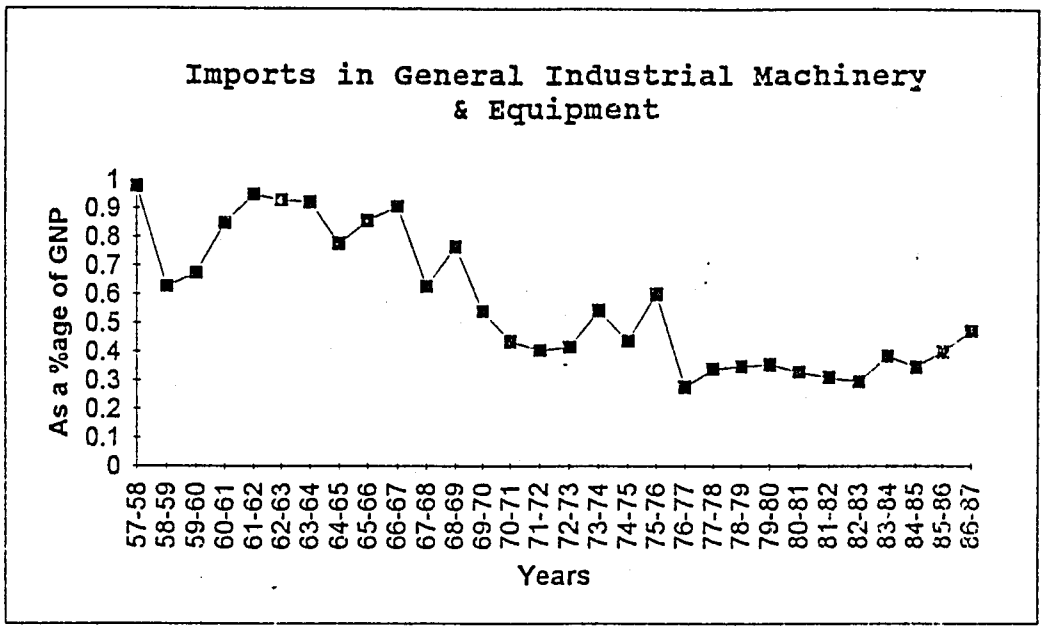

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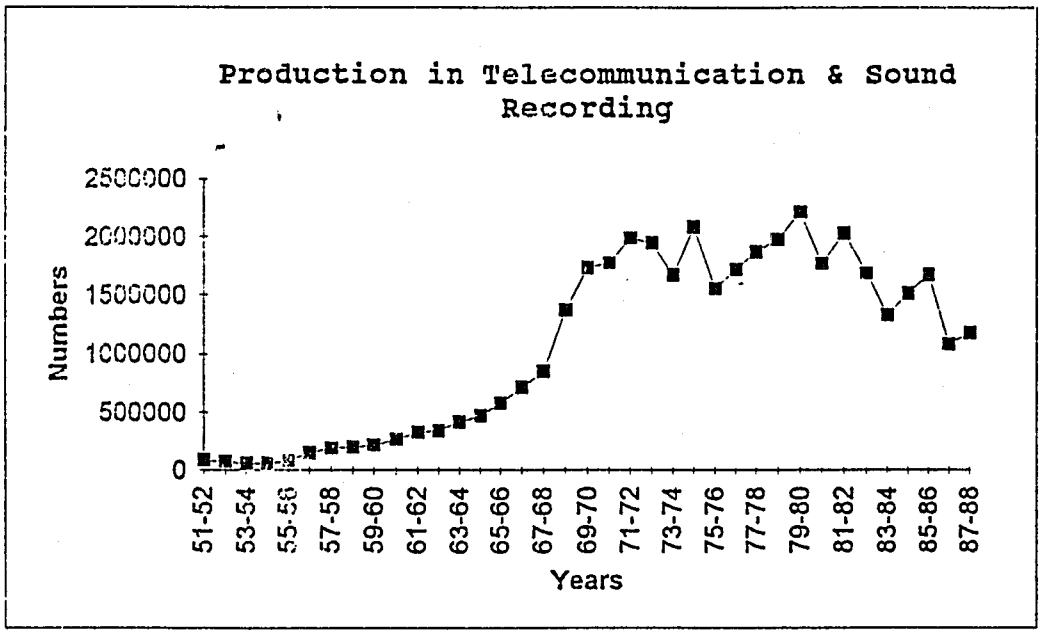

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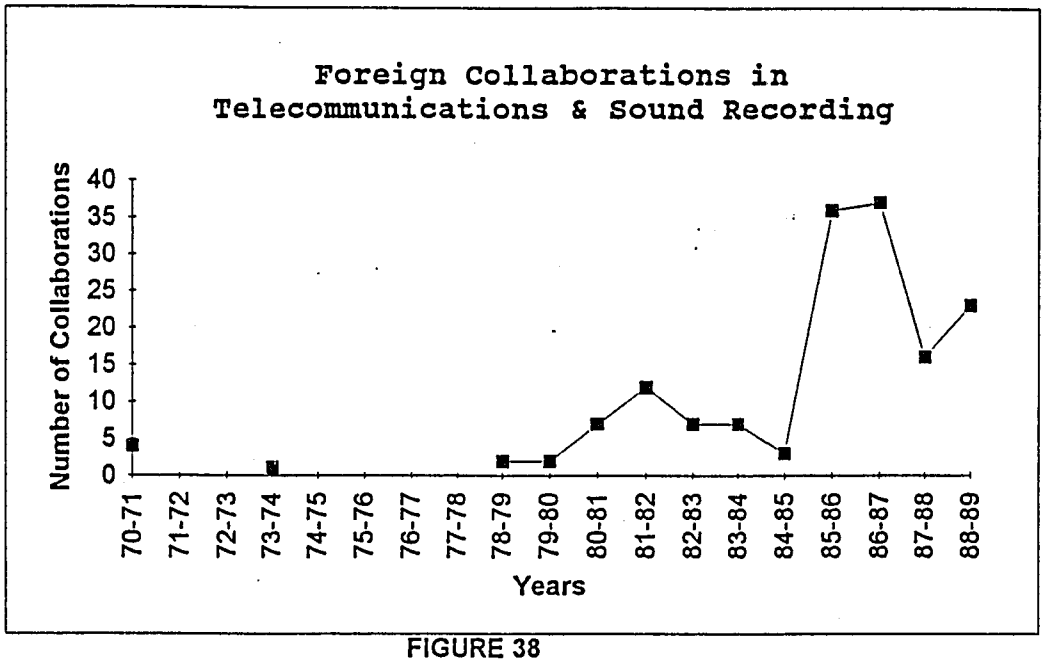

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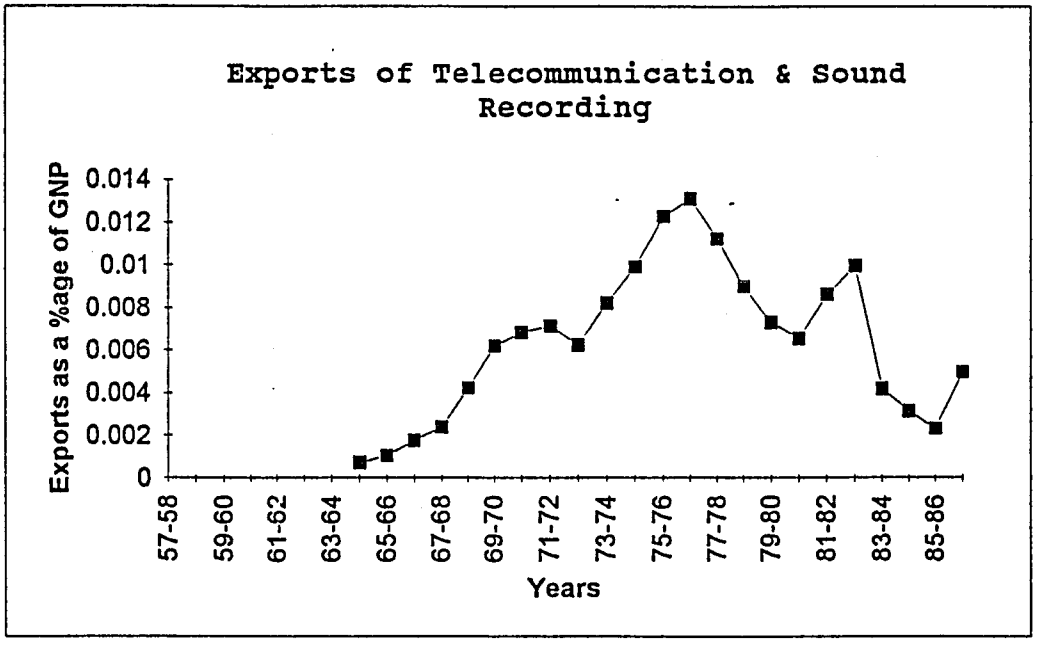

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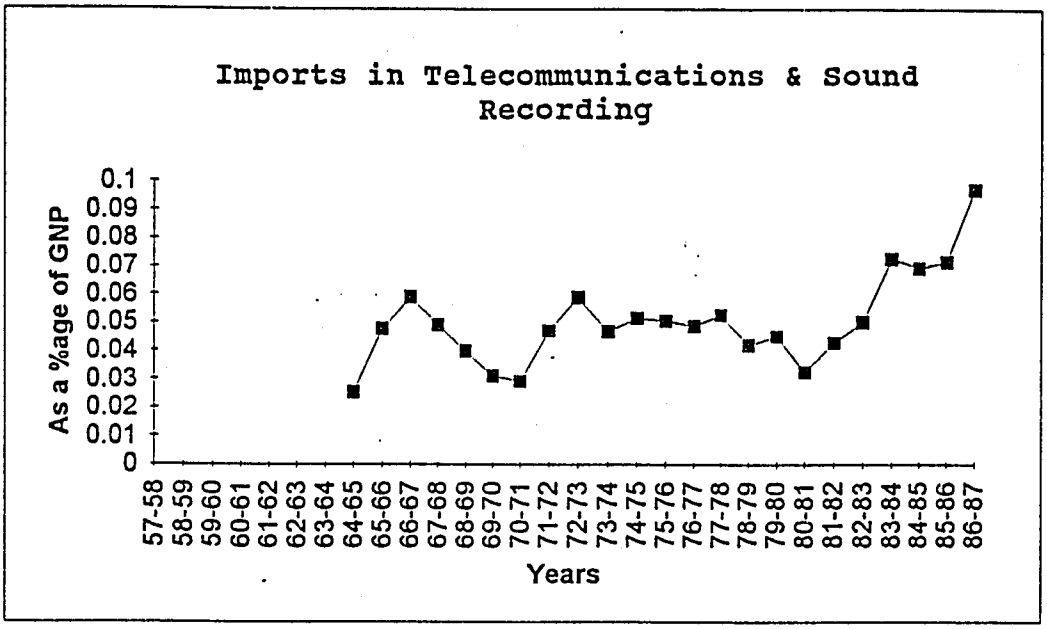

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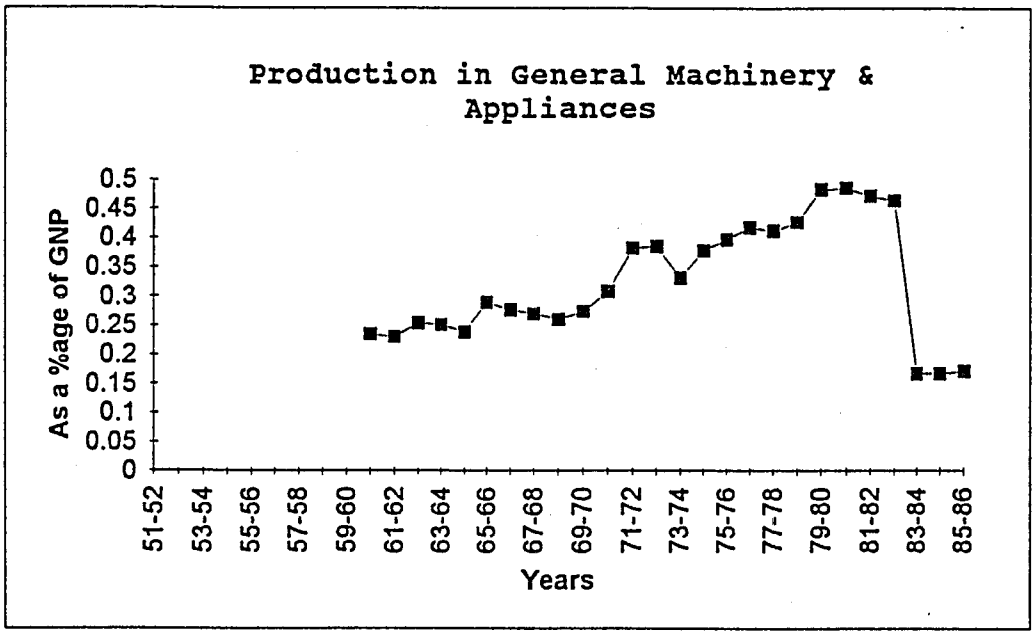

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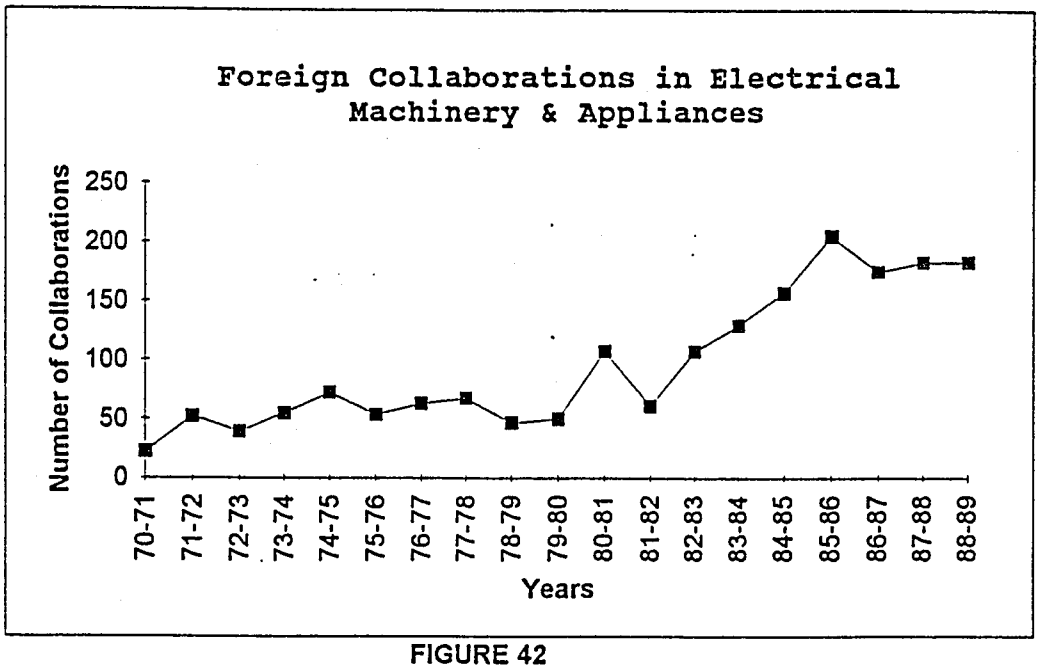

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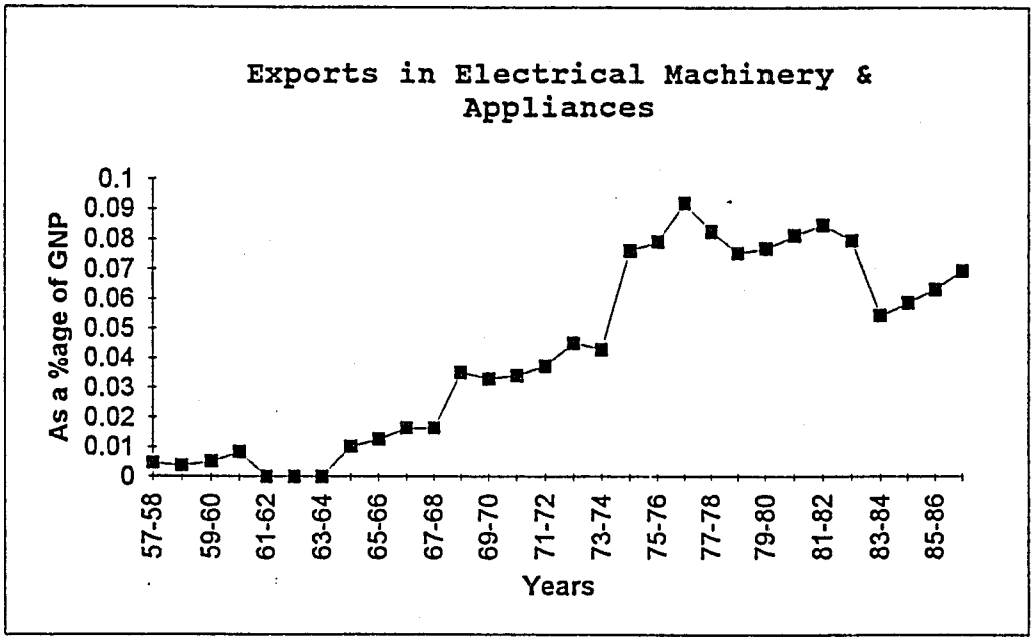

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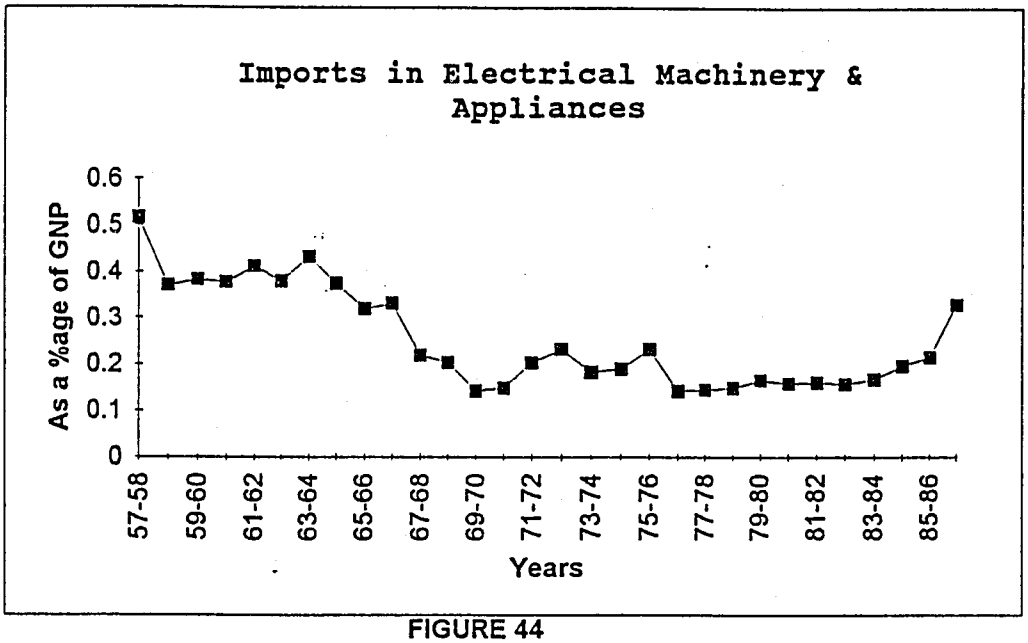

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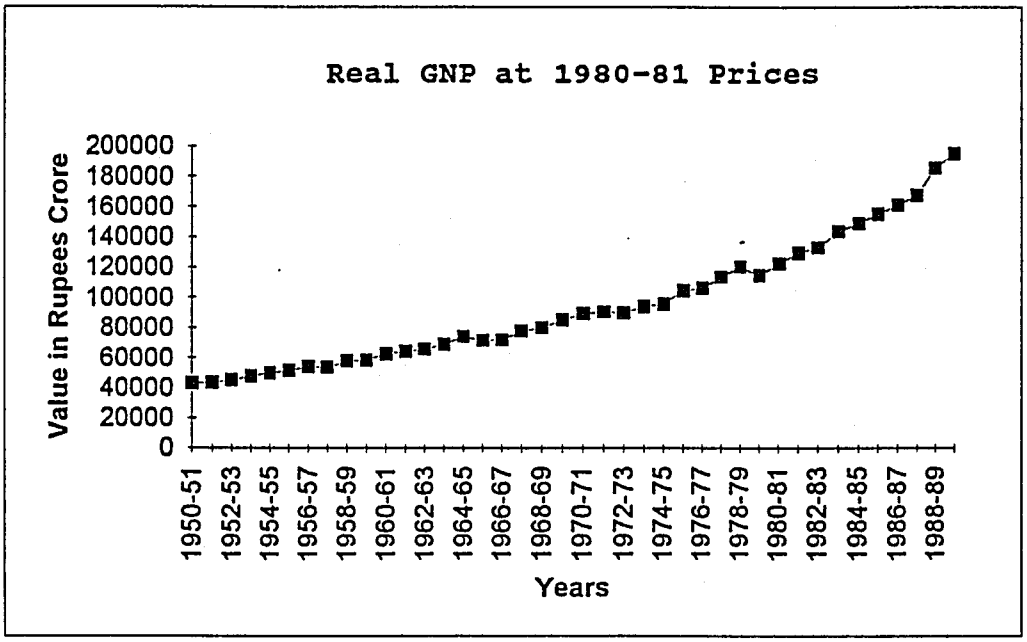

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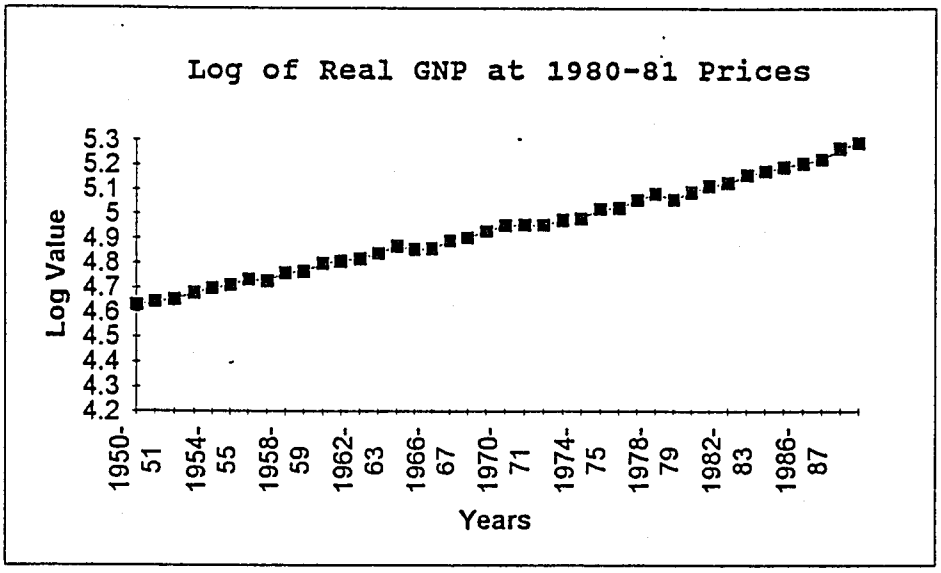

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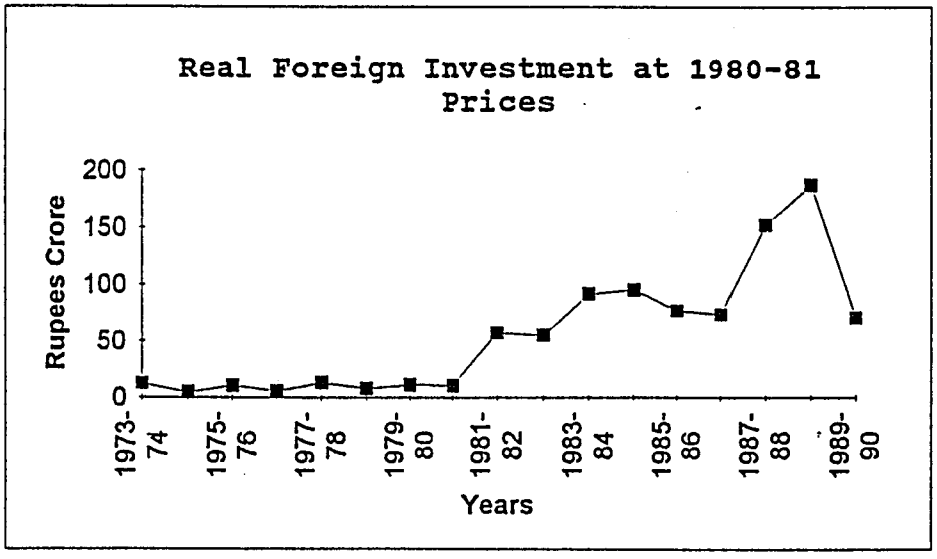

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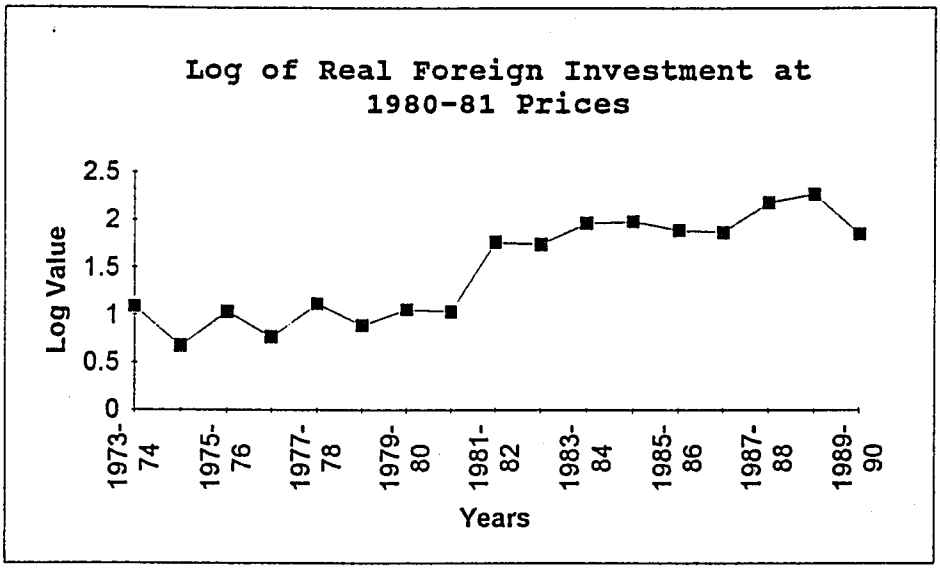

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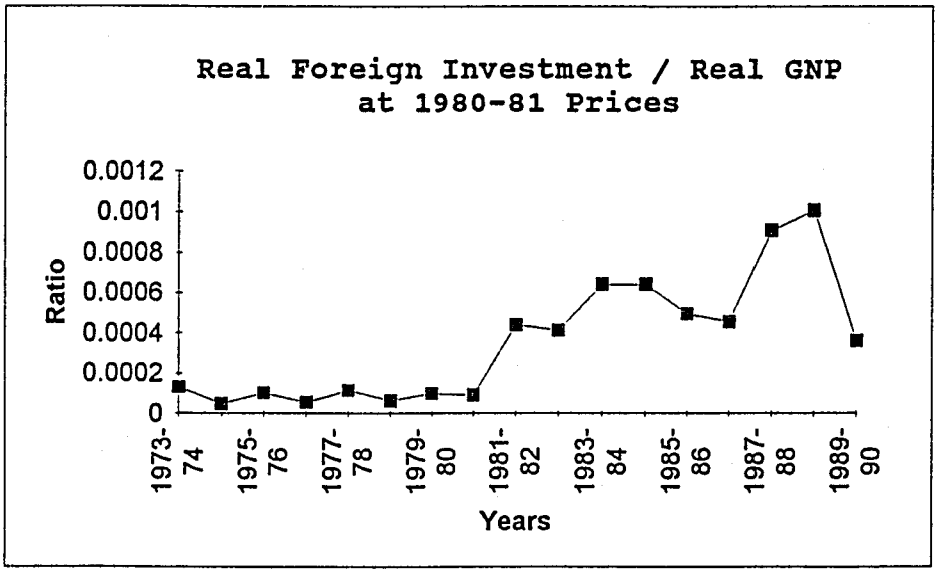

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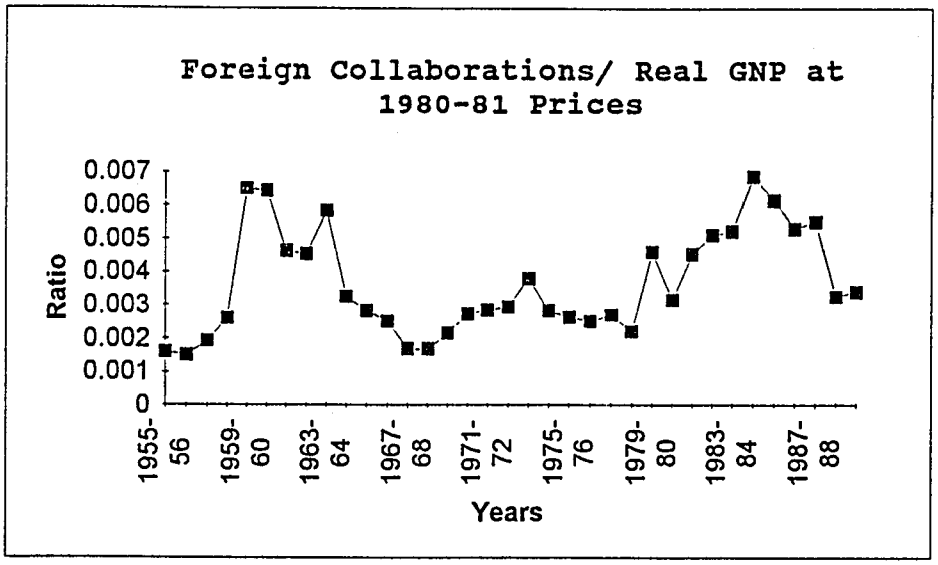

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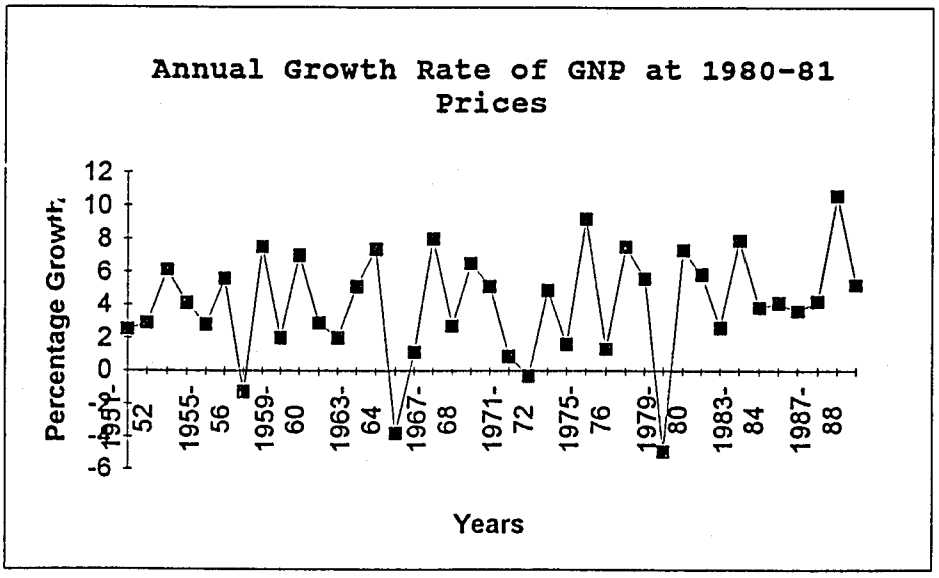

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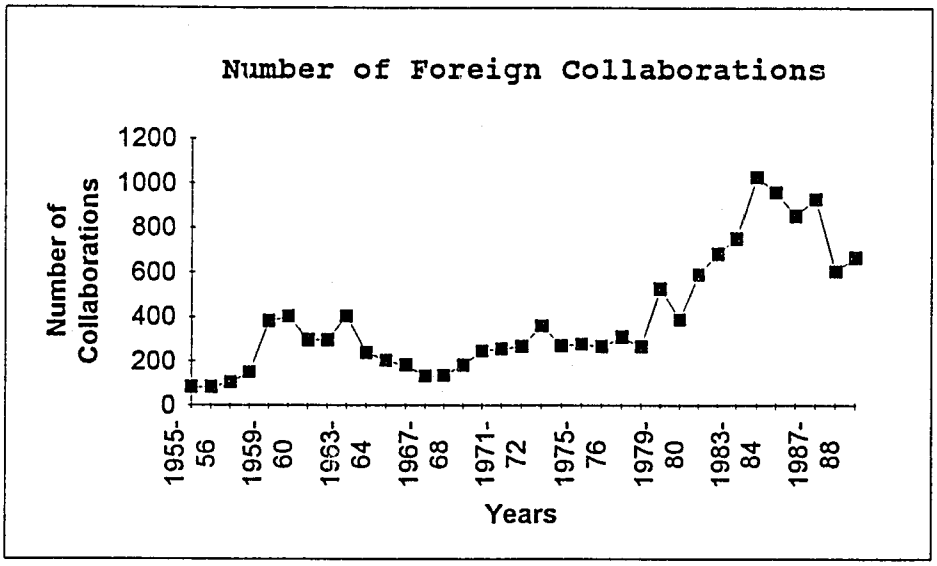

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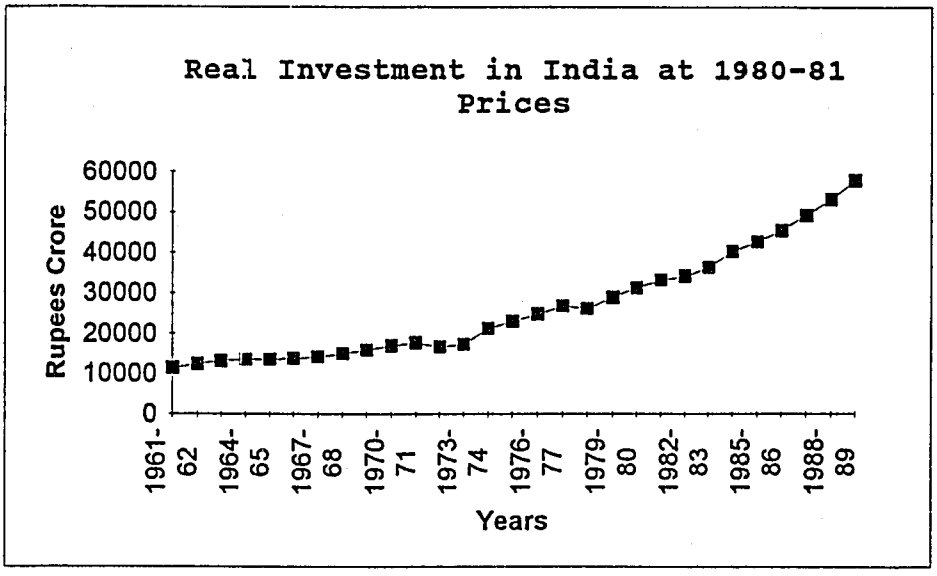

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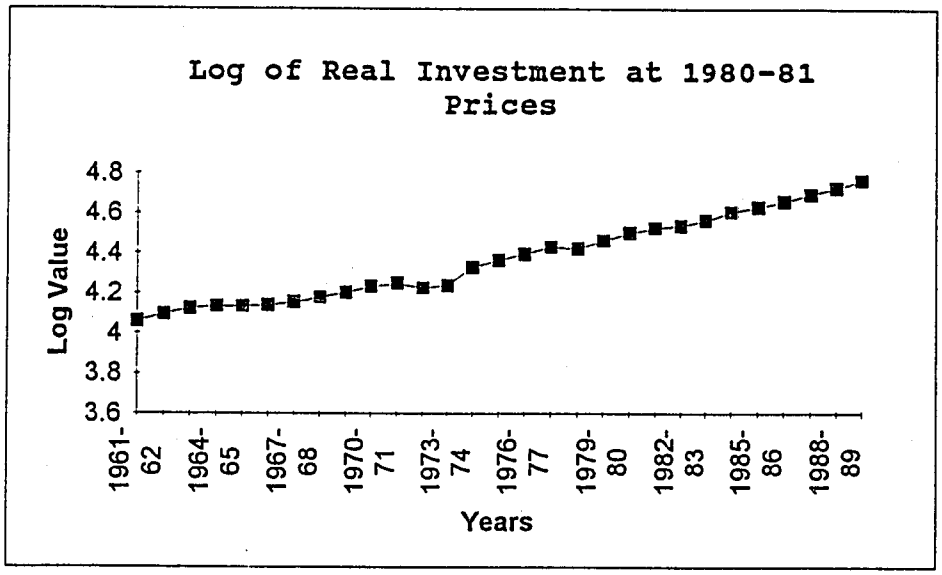

FIGURE 54