A COMPARATIVE APPLIED ECONOMIC ANALYSIS OF SOVIET FOREIGN TRADE:
AN INTRA-INDUSTRY TRADE APPROACH

DISSERTATION

Presented in Partial Fulfillment of the Requirement for
the Degree Doctor of Philosophy in the Graduate
School of the Ohio State University

By

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* * * * *

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To

My Mother
ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

The traditional factor proportion theory of international trade, known as the Heckscher-Ohlin-Samuelson (H-O-S) Theorem,\(^1\) was applied to Soviet foreign trade by Steven Rosefeld (1973). His conclusion was that Soviet foreign trade planning has been capable and will continue to be capable of achieving surprisingly Heckscher-Ohlin consistent results.

On the other hand, Intra-Industry Trade (IIT), identified by the presence simultaneously of imports and exports of the products of a given industry, cannot be explained by the H-O-S model. Attempts to explain the phenomenon of IIT have been on the frontier of investigations of international economists over the last ten years, but with only a few exceptions the paradigms or models developed have not been applied to the Soviet case.

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1. This theorem states that a country's comparative advantage is determined by the proportion of the country's factor endowments. Therefore, a capital-abundant country will export capital-intensive commodities, while a labor-abundant country will export labor-intensive commodities.
One exception is the pioneering work of Joseph Pelzman (1978), where he confirms the existence of IIT in Soviet trade with COMECON. He does not, however, try to explain characteristic features of Soviet trade with the West (East-West or East-South) in comparison with COMECON (East-East), and he establishes trends in Soviet-COMECON IIT only for the period from 1957 to 1973. Cross-country explanations are therefore limited, and cross-section analysis is virtually ignored.

Another exception is the paper of Draebek and Greenaway (1984), which deals with IIT within the European Economic Community (EEC) and COMECON in terms of customs-union theory. In this work, West-West trade is compared with East-East trade within an IIT framework, although the Soviet case is omitted from their analysis of IIT of COMECON countries.

The main emphasis of the present dissertation is a comprehensive analysis of Soviet IIT, in which a comparison between East-West (Soviet inter-block) trade and East-East (Soviet intra-block) trade is made by means of cross-country studies. A cross-industry approach is also used for determining the sources of Soviet IIT. These econometric studies confirm the results of a descriptive

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2. According to the original prediction of customs-union theory, a customs union will encourage inter-industry specialization, whereas the reality of EEC was shown not to be the case. For details, see Chapter II.

Finally, it should be noted that while the general literature on IIT has developed with reference to four distinct areas of interest—theory, measurement, empirical evidence and policy—the dissertation will be mainly concerned with measurement and empirical evidence of Soviet IIT. Theoretical contributions are confined to a proposed IIT model of planned economies like the Soviet Union, while policy aspects such as the gains from trade, adjustment problems and commercial policy are not discussed.

The dissertation is, therefore, expected to make a contribution to the relatively new area of comparative applied economics, using a common theoretical framework and empirical methodology to analyze how economic institutions actually operate in different environments. In order to achieve these objectives, the dissertation is organized as follows:

In Chapter II, existing general theories of IIT are briefly reviewed, and, based on conclusions from these theories, hypotheses applicable to the Soviet case are proposed. In an effort to overcome the shortcomings of the general theories for explaining some special attributes of Soviet IIT, conceptualization of a unique

3. For a further reference, see Greenaway and Milner (1986).
'model' of planned economies is attempted, from which are drawn several hypotheses applicable to the Soviet Union.

Chapter III summarizes several methods for measuring IIT, in an attempt to identify the dependent variables of regression analysis of Soviet IIT. Issues arising from the measurement of IIT are discussed.

In Chapter IV, independent variables explaining Soviet IIT identified from the hypotheses in chapter II, along with dependent variables from Chapter III, are used to develop specific testing models of Soviet IIT. Regression results of a cross-country and cross-industry model are reported separately including explanations of data and testing methods.

In Chapter V, three representative years are chosen to calculate intertemporal patterns of Soviet IIT. These documentary results of changes over time in Soviet IIT tend to confirm the empirical findings of Chapter IV on the factors with which Soviet IIT appears to be correlated in a given year.

The dissertation concludes, in Chapter VI with a summary of findings and suggestions for future research.
CHAPTER II

THEORIES AND HYPOTHESES OF IIT

Since Grubel and Lloyd’s pioneering work (1975), considerable progress has been made in modelling IIT. In the present chapter, a number of theories of IIT in market economies from the literature are summarized and classified, following the approach of both Greenaway and Milner (1986) and Ray (1987). From these models of IIT in market economies, several hypotheses of Soviet IIT are proposed, related to trade by country and industry respectively.

In the second half of the chapter, the possibility of establishing a uniquely Soviet model of IIT is examined, and several hypotheses on IIT are offered for planned economies like that of the Soviet Union.

1. Models of IIT in Market Economies

In the modelling of IIT of market economies in the literature, progress has been made in two areas, one theoretical, the other empirical. Each area has developed, however, without mutual interaction.
1.1 Theoretical Models of IIT in Market Economies

Theories or theoretical models of IIT in market economies can be classified according to market types, according to whether they are competitive or oligopolistic. More orthodox theories of IIT are based on the competitive market assumption, an approach to be discussed in more detail below.

**Neo-Heckscher-Ohlin Models of IIT**

According to Falvey (1981), the most obvious modification which the neo-Heckscher-Ohlin model made about the traditional model is to allow each industry to include several differentiated products, with IIT then occurring when a country simultaneously exports some products and imports others within a given industry. The neo-Heckscher-Ohlin model differs from the traditional Heckscher-Ohlin-Samuelson paradigm in two crucial respects:

(i) It is assumed that one of the two factor inputs used in each industry (capital) is specific to that industry, implying that an industry is best defined by the range of products that a certain type of capital equipment can produce. Thus, although capital can move
freely between firms within a given sector, it is immobile between sectors. 4

(ii) At least one sector produces a differentiated rather than a homogeneous commodity. More specifically the commodity is vertically differentiated, i.e., by quality.

In this setting not only can IIT emerge, but the direction of trade is determinate.

Following Falvey, product quality may be denoted by $\alpha$:

$$\pi(\alpha) = W + \alpha R$$

$$\pi^*(\alpha) = W^* + \alpha R^*$$

where

$W$=given wage rate,

$R$=rental on quality-specific capital,

$*=denotes foreign country

$\pi$=production cost

Each industry is assumed to be perfectly competitive and, as a consequence of initial factor endowments, it is assumed that $W^* < W$ and $R^* > R$. By implication there must be some marginal quality where

---

4. As Falvey noted, therefore, this model is in many respects a modified version of the Specific Factor Models of Jones (1971) and others.
\[ \pi(\alpha) - \pi^*(\alpha) = 0 \] (3)

or

\[ W + \alpha R - (W^* + \alpha R^*) = 0 \] (4)

thus

\[ \alpha = \frac{W - W^*}{R^* - R} \] (5)

It follows that

\[ [\pi(\alpha) - \pi^*(\alpha)] < 0 \text{ as } \alpha < \alpha \] (6)

and

\[ [\pi(\alpha) - \pi^*(\alpha)] > 0 \text{ as } \alpha > \alpha \] (7)

Equations 6 and 7 can be interpreted as follows:

The higher-wage home country has a comparative cost advantage in those qualities which require more capital-intensive techniques than the marginal quality and is at a comparative cost disadvantage in the other qualities. In other words, the home country has a comparative advantage in those qualities which are superior to the marginal quality or, conversely, will enjoy a comparative disadvantage in those qualities which are inferior to the marginal quality. As long as there exists a demand for both high quality and low quality products, intra-industry exchange will take place, along the lines similar to the pattern of inter-industry trade determined in the standard model.

As a consequence of the assumption that a higher capital-labor ratio results in a higher quality, the capital-abundant country
exports relatively high quality products, while the labor-abundant country exports relatively low quality products. In this model, however, IIT occurs without requiring the presence of increasing returns to scale or imperfectly competitive markets, and its pattern is determined by relative factor proportion.

Obvious examples of IIT that this kind of model may explain well are trade in ready-made clothing and some trade in motor cars. Counter examples would consist of made-to-order clothing or footwear, and custom-built motor cars.

**Neo-Chamberlinian Models of Monopolistic Competition**

An alternative approach to explaining IIT is the neo-Chamberlinian model of monopolistic competition that is developed to provide an explanation of trade which is independent of relative factor endowments.

Here, consumers are assumed to endeavor to consume as many different varieties as possible, and commodities are also assumed to be horizontally differentiated, while in the neo-Heckscher-Ohlin model commodities are vertically differentiated.

The main features of the basic neo-Chamberlinian model can be summarized with reference to Krugman (1979), who develops a simple, general equilibrium model of non-comparative-advantage trade. His approach differs from that of other formal treatments of trade under increasing returns, which assume that economies of scale are external
to firms, so that markets remain perfectly competitive. Krugman, however, assumes that economies of scale are internal to firms, with the market structure that emerges being one of Chamberlinian monopolistic competition.

All goods have the same cost function in a one-factor economy:

\[ l_i = \alpha + \beta x_i \]  \hspace{1cm} (8)

where \( \alpha = \) fixed cost
\( \beta = \) marginal cost
\( x = \) output

Thus, average cost will fall as output increases.

On the demand side of the economy it is assumed that all individuals have the same utility function and, furthermore, that all varieties enter into this utility function symmetrically,

\[ u = \sum c_i v(c_i) \]  \hspace{1cm} (9)

Each individual producer will attempt to maximize profits

\[ \Pi_i = p_i x_i - (\alpha + \beta x_i)w \]  \hspace{1cm} (10)

where \( w = \) the competitively determined wage rate.

Since all varieties enter consumers' utility functions symmetrically, no two firms will produce the same variety, and every firm will produce a different variety. Thus the output of each variety produced has to sum to the total of individual consumptions:
\[ x_i = Lc_i \text{ for all } i \]  
(11)

where

\[ L = \sum_i l_i \]  
(12)

Because of the symmetry of the model, all varieties produced will sell at the same price and will be produced in the same quantities.

Finally, the number of varieties produced \( n \) is determined by the size of the labor force and the amount of labor required to produce a representative variety,

\[ n = L = \frac{L}{\alpha + \beta x} \]  
(13)

To illustrate the potential for international exchange it is simply assumed that there exists a second economy that is identical in every respect to the home economy. Because firms have no incentive to produce the same varieties as others, further product differentiation will occur once trade opens.

Each consumer will be maximizing his utility,

\[ u = \sum_{i=1}^{n} v(c_i) + \sum_{i=n+1}^{n+n^*} v(c_i) \]  
(14)

through the consumption of foreign varieties \((n+1, \ldots, n+n^*)\), as well as home varieties \((1, \ldots, n)\).

There will be welfare gains for both countries due to the fact that the number of post-trade varieties available in both countries \( (n+n^*) \) is greater than the number available to either in autarky.
Also, there will be gains that result from increases in the scale of production, leading to lower unit costs and prices.

Finally, the direction of trade is indeterminate.

To summarize, Krugman’s model shows that trade need not be a result of international differences in technology or factor endowments. Trade may simply be a way of extending the market and allowing exploitation of scale economies, with the effects of trade being similar to those of labor force growth and regional agglomeration.

**Neo-Hotelling Models of Monopolistic Competition**

Although there are some similarities with neo-Chamberlinian models, the neo-Hotelling model differs in one crucial respect, namely the modelling of the utility function. In the neo-Chamberlinian approach all horizontally differentiated varieties of a commodity enter the utility function symmetrically. By contrast the neo-Hotelling approach assumes asymmetry.

The neo-Hotelling approach builds upon the Lancastrian analysis of consumer behavior as originally outlined in Lancaster(1966), and is fully articulated as a model of IIT in Lancaster(1980).

In the basic Lancaster model, IIT opens as a consequence of preference diversity, and decreasing costs. The nature of gains from trade resulting from greater product diversity is qualitatively
different from that associated with the neo-Chamberlinian model, in that the average distance between varieties on the spectrum is smaller with trade than under autarky.

Also, in this model, firms are faced with more than one decision variable, as well as price; they have to decide on specification prior to entry.

Therefore, IIT not only may occur among (or, between two) similar economies, it is most likely to occur between such economies, and the volume may be much higher than trade based on comparative advantage. However, a sufficiently great difference in comparative advantage may eliminate IIT in manufactures.

All of these three models are free-entry models, which implies that the costs of differentiating one's product are negligible, and/or (internal) economies of scale are limited such that the minimum efficient scale of production is small relative to the total market. The models also assume that markets are integrated, not segmented.

The models are embedded in a general equilibrium setting where the simultaneous existence of inter- and intra-industry exchange can be explained.

Finally, it should be noted that in the Falvey model, differences in initial factor endowments are a prerequisite for IIT, while in the neo-Chamberlinian & neo-Hotelling models, similarity of factor endowments is more likely to be associated with IIT.
1.2 Empirical Models of IIT in Market Economies

From a summary of existing literature about the theory of IIT in market economies, Ray (1987) proposes two representative models that are possible to test empirically.

The first is the Krugman-type model that explains IIT from the cross-hauling of slightly differentiated consumer goods. The driving force behind such a model is the presumed consumer preference for variety, coupled with fixed start-up costs of production. The economies of scale are presumed to be significant enough to sustain specialized production even after sales go beyond the domestic economy to include export sales abroad. Monopolistic competition is assumed to prevail in the final goods market.

The Ethier model (1982), on the other hand, is under competitive conditions, and concerns the production of final goods which uses both domestic and imported intermediate goods. Under these conditions, IIT occurs primarily in those intermediate goods that are subject to start-up costs and thus have a substantial range of declining average costs. There are thus economies of scale in manufacturing associated with expansion in the number of components available to use as intermediate inputs in the production of finished manufactures. In this case, components are assumed to be produced competitively, and the scale effects of specialization in the production of intermediate components that are internal to the finished manufactured goods sector are presumed to be external
economies to individual competitive producers of intermediate components.

Marvel and Ray (1986) argue that IIT should consist primarily of trade in intermediate goods produced, using non-standardized techniques of production by small enterprises on a made-to-order basis. The key distinction between them and Ethier's model is their argument that scale economies not only should be absent from the production of made-to-order intermediate goods that enter IIT, but that such trade should systematically entail goods produced in small scale operations.

It can be said that all of the above models deal with product differentiation and increasing returns to scale as common variables influencing the level of IIT, but the problem is that none of those studies succeeded in formally integrating aspects of any of the theoretical studies cited above into empirical model. In a recent paper, therefore, Peter Gray(1988) concluded that the large number of factors that can generate IIT argues for a paradigm rather than a precise, formal model.

1.3 General Hypotheses Applicable to Soviet IIT

The theoretical survey about IIT in market economies in Section 1.1 above, makes it possible to propose several hypotheses that can be used to explain Soviet IIT. Derived from general theories
of IIT, the hypothesis may be classified into two categories: country hypotheses and industry hypotheses.

**Country Hypotheses**

Country hypotheses applied to the Soviet case incorporate what are felt to be four basic determinants of Soviet IIT with other countries, namely: level of development; market size; COMECON vs non-COMECON trade; and border vs non-border trade. The four hypotheses reflecting each of these determinants may be stated and briefly explained as follows:

**Hypothesis 1:**

The level of Soviet IIT with another country will be higher, the smaller the difference in their respective levels of development.

Traditional factor proportion theory can be said to attribute different patterns of trade to inter-country differences in supply conditions. Alternately, as put forth by Linder (1961), demand conditions are a major determinant of trade patterns. Linder’s model is based on the notion that intercountry dissimilarities in taste constitute a major barrier to trade because of the high cost involved in modifying products and adjusting their attributes to suit the tastes of consumers abroad. On the assumption that countries with
similar per capita income have similar tastes as well as similar capital/labor endowments, he concludes that countries with similar incomes will trade with each other more intensively than countries with diverging incomes.

If a similar level of development may be represented by a similar level of per capita income, it leads to a high possibility for an intense IIT in only slightly differentiated goods. Even though the Soviet trading partner has a high level of development, if the difference in their levels of development is large, then the potential IIT is much smaller because the respective demand pattern of the two countries and thus the goods produced are poorly matched.\textsuperscript{5}

In testing Hypothesis 1, the absolute difference of 1985 per capita incomes in US dollars between the Soviet Union and country \( k \) (\( \text{PCID}_k \)) is used as an indicator for development stage differentials.

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\textsuperscript{5} In the existing literature about the IIT of market economies, the hypothesis that the level of IIT with another country will be higher, the higher the development level of the trading partner is usually tested. This hypothesis is proposed for three reasons. (1) Highly developed countries command a high capability to innovate and, hence, an important precondition to develop and produce highly differentiated goods. (2) These countries have highly differentiated demands which allow for the exploitation of economies of scale in the production of a wide variety of individual commodities. (3) Highly developed countries enjoy highly developed information and communication linkages. All three factors enlarge the scope for the realization and expansion of trade in highly differentiated products. For empirical analysis, the level of development is measured by per capita income. In the Soviet case, however, the foregoing hypothesis contradicts Hypothesis 1, above, since the Soviet Union is located in the middle of range of levels of development. The former hypothesis about the absolute level of development is, therefore, deleted from the empirical test.
Hypothesis 2:

The level of Soviet IIT with another country will be higher, the larger the market size of the trading partner.

In large markets, many differentiated goods can be produced under conditions of economies of scale. Also, a large demand for foreign differentiated goods makes the potential for IIT high, a condition that is consistent with the Dreze standardization hypothesis (1961). According to the latter, small industrial countries enjoy a comparative advantage in those sectors where demand is standardized while small countries are at a disadvantage in highly differentiated goods because the domestic market is not sufficiently large to enable economies of scale to be fully exploited.

In testing hypothesis 2, the 1985 GNP of country k (\(\text{GNP}_k\)) in US dollars is used to indicate market size.

Hypothesis 3:

The level of Soviet IIT will be higher in trade with COMECON countries than with non-COMECON countries.\(^6\)

The impact of geographical proximity and trade liberalization may be more influential on trade patterns than economic integration itself.

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6. Non-COMECON countries include those of market economies as well as planned economies.
(within COMECON or the European Community). Alternatively, it may not be the harmonization of the policy aspects of integration, but rather the increased potential for enjoying economies of scale in enlarged markets that encourages IIT following economic integration. Similarly, COMECON countries have, in practice, geographical, political and economic proximity so that demand conditions are also very similar. Overlapping demand patterns between any two countries result in a higher volume of reciprocal trade as a proportion of national income and consequently a higher level of IIT, an observation reminiscent of Linder's hypothesis (1961).

However, this hypothesis implies results that are the opposite of the Pelzman's paper (1978), according to which Soviet IIT with COMECON countries is less significant than with non-COMECON countries.

Hypothesis 3 is indicated by means of the following notation:

\[ H_0 : B_k^{COMECON} = B_k^{NONCOMECON} \]

\[ H_1 : B_k^{COMECON} \neq B_k^{NONCOMECON} \]

where \( B_k^{COMECON} \) is an index of the average level of Soviet IIT with
COMECON country $k$, while $B_k^{\text{NONCOMECON}}$ is an index of the average level of Soviet IIT with non-COMECON country $k$.\(^7\)

An economic integration dummy ($\text{INTEG}_k$) is used in the empirical testing.

**Hypothesis 4:**

The level of Soviet IIT will be higher in border trade than otherwise.

The case is simply that, in border trade, the barriers to trade and transport costs are low so that IIT may be encouraged.

Hypothesis 4 is tested by means of a border-trade dummy ($\text{BORD}_k$). Given the nature of dependent variables used here and elsewhere, however, the border-trade dummy variable may be collinear with such variables as the COMECON dummy.

---

7. More details about the indices of IIT are discussed in Chapter III.
Industry Hypotheses

Theory and evidence suggest several characteristics of market economies that are conductive to IIT in market economies, namely: market characteristics (e.g. number of firms), product characteristics (e.g. scope for product differentiation) and production characteristics (e.g. scope for economies of scale).

With the exception of those specifically related to the market mechanism (i.e. market characteristics, above) the following three hypotheses about cross-sectional determinants of IIT in the market economies may be applied to the Soviet case:

Hypothesis 5:

The level of Soviet IIT in a given industry j will be higher, the higher the potential for product differentiation in that industry.

To test this hypothesis, a proxy variable is introduced, namely, the number of product groups or tariff positions in each three-digit group or 'industry' (PD_j). In this case, the posited direction of influence is positive.

Hypothesis 6:

The level of Soviet IIT in a given industry j will be higher, the greater the scope for economies of scale in that industry.
One could argue that a low minimum efficient scale (m.e.s.) in industry A would imply that most varieties could be produced at home and abroad, and that little IIT would occur, while a higher m.e.s. in industry B would increase the scope for IIT.

Alternatively, one could view a low m.e.s. relative to the total market as increasing the number of firms which industry A can accommodate, and therefore as increasing the scope for intra-industry specialization and product differentiation. According to this reasoning, high m.e.s., as is the case for industry B, could restrict the number of firms, encourage product standardization, and result in a low level of IIT.

Therefore, it is not the case that all authors hypothesize a positive sign on the proxying variable for the scope of scale economies. Some studies generate mixed signs and others get low significance for these variables. Scale economies are usually measured by midpoint plant shipments (see Weiss, 1974).

The capital-labor ratio (KLR) from the 1966 Soviet input-output tables that are the only available data for the Soviet case will be used as a proxy variable.

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8. As already mentioned above, Marvel and Ray (1986) posited a negative sign on the variable of economies of scale.
Hypothesis 7:

The level of Soviet IIT in a given industry j will be higher, the more comprehensive the definition of that industry.

Notably, as Finger (1975) argues, some IIT is a statistical artifact. The degree of industry aggregation in the Soviet Foreign Trade Classification (SFIC) group j (AGGR_j), measured as the number of five digit SFIC positions in a given three digit SFIC group, is used to test this hypothesis. 9

2. A Model of IIT in Planned Economies

2.1 A Theory of IIT in Planned Economies

In the Soviet case, there is further difficulty in formulating a theoretical model because all existing models explain IIT of a given market economy or among market economies. Much of the literature deals with IIT only in the West-West trade context, while the dissertation deals with East-East, East-West, or East-South trade from the point of view of a planned economy. A frame of reference is therefore required for analyzing the IIT of a planned economy.

9. Market structure variables are not discussed in the present study, because it is not easy to figure out any persuasive implications of the market structure on the foreign trade behavior in a planned economy like the Soviet Union.
As Balassa et al. (1988) summarized, there are three sets of variables affecting bilateral trade in individual products (industries) of market economies:

(i) Variables affecting comparative advantage, such as factor intensities and factor endowments;

(ii) Variables influencing IIT, such as country characteristics and industry characteristics; and

(iii) Variables representing gravitational factors, such as distance, economic integration and common language and culture.

In short, it can be assumed that the market itself (or operation of market forces) leads to an increase either in intra-industry trade by country or industry characteristics, or in inter-industry trade (implying a decrease in intra-industry trade) by comparative advantage, or in both by gravitational factors.

It is not possible therefore to predict a priori the direction of influence of the market for IIT. On the contrary, central planning itself seems to discourage IIT, as Greenaway & Milner (1986) have pointed out.

(i) Centrally Planned Economies (CPEs) have less possibility for free expression of tastes and preferences as well as less competitive supply and market entry. These features of CPE's are less conducive in turn to the creation of demand and supply of differentiated goods, hence more conducive to a lower level of IIT.

(ii) The control systems and incentives in a centrally planned economy are not likely to induce domestic market structure akin to
monopolistically competitive ones as in market economies, or to encourage competitive forms of behavior in oligopolistic international market.

(iii) State trading corporations in CPEs use criteria and face incentives which may actually deter IIT.

(iv) Limitations on free movement of capital into and within CPEs deter the scope for vertical specialization within industries, while the planning process tends to direct capital so as to produce complementary production structures among CPEs, which reap scale benefits via inter-industry specialization.

In addition, Most importantly, in planned economies, foreign trade is also planned, and foreign trade planning relies increasingly on efficiency criteria based on comparative advantage (L.J. Brainard, 1976 and G. Grote & H. Kuhn, 1988).

Finally, in planning procedure it is practically impossible to calculate efficiency indices for each of a huge number of differentiated goods.

As a result, in developing a frame of reference or conceptual framework for a planned economy's IIT, the following assumptions are made:

(i) The plan itself or "plan success" deters IIT, particularly in trade with other planned economies.

(ii) Particularly in trade with market economies, "plan failure" encourages IIT in some cases, discourages it in others, and encourages both intra- and inter-industry trade in still other cases. Plan
failure is defined as the concept that describes all discrepancies between planned targets and resulting performances (shortages or surpluses) not only in the foreign trade plans but also in the national economic plan covering the entire economic sectors. Plan failure tends to involve the unplanned introduction of market forces.

(iii) The foreign trade plan contains export and import plans by item and by country. Among them, the trade plans with market economies would be called, "planned use of market", to be distinguished from the unplanned use of market forces or plan failure. Planned use of market is assumed to be a source discouraging IIT.

In the literature about Soviet foreign trade (e.g. T.A. Wolf, 1982), it is usually assumed that Soviet trade with other COMECON countries is largely planned whereas Soviet trade with Western countries is conducted on the basis of market conditions or complements the plan failure as in the case of grain or consumer goods import.

This conceptualization of a Soviet IIT theory is set forth in Figure 1, where the Centrally Planned Economy (CPE) is classified into two models: the Classical CPE Model and the Modified CPE Model.

The followings are distinctive features of the Classical CPE Model (from T.A. Wolf, 1985):

(i) State ownership of the means of production;

(ii) Financial plans that mirror the physical flows embodied in the quantitative plans;
Figure 1

Schematic Diagram for a Theory of Soviet IIT
(iii) Information flows and bargaining over plans and actual access to resources, which occur mainly in a bureaucratic (vertical) rather than a market (horizontal) setting;

(iv) Rigid prices set by the central authorities so as to facilitate quantitative planning and evaluation;

(v) Plan fulfillment rather than profits as the main evaluative criterion for enterprises;

(vi) A relatively free labor market, but wages that are (in principle) regulated closely from the center;

(vii) A monolithic state banking system ("monobank") with no fractional reserve banking;

(viii) A dichotomized money supply in which household and enterprise money stocks are strictly separated; and

(ix) Detailed central plans for enterprise inputs and outputs and for foreign trade.

From these characteristics of the classical CPE Model, it can be argued that there is no ground for predicting the direction of influence of the plan itself or market, in trade with either planned economies or market economies. Therefore, the direction of influence is assumed to be indeterminate.

It can be said that each of the European COMECON countries including the Soviet Union has evolved to a greater or lesser degree over the past 25 years from a Classical CPE to the Modified CPE. A
Modified CPE may be characterized by the following eight changes in the classical system (Wolf, 1985).\(^{10}\)

(i) Detailed plans regarding enterprise inputs and outputs are no longer developed in close consultation with the central authorities. Whereas detailed central planning may still characterize many infrastructural activities, enterprises in the rest of industry are encouraged to develop their own plans.

(ii) Enterprise profitability is meant to supplant plan fulfillment.

(iii) Encouragement is given to significantly increased horizontal bargaining among enterprises and to the markets as an allocator of resources.

(iv) The system of wage regulation is modified so as to give the enterprises much greater leeway in determining the distribution and growth of wages among their employees.

(v) The scope for governmental price controls is reduced, an obvious corollary to the intention to expand the allocative role of the market.

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10. The concept of Modified CPE, however, should be used with caution because the Modified CPE in the present study includes "Reformed CPE" in addition to the Modified Planned Economy (MPE) in the sense used by Wolf, and there exist the continuing de facto similarities between MPE and CPE in reality that enterprise decisions are influenced to a considerable degree by various institutions, policies, practices and relationships developed over a number of years in the CPE from which the MPE has evolved (Wolf, 1988).
(vi) Bank credits and enterprise self-financing are meant to become much more important in the financing of investment.

(vii) The intention to reduce and, indeed, virtually to eliminate price distortions gradually leads to the encouragement of more direct, export-oriented linkages between domestic production enterprises and foreign markets, and the development of organic linkages between domestic and foreign currency prices for a wide range of products. Therefore, it can be said that the autonomy of enterprises in foreign trade participation is greater in the MPE than in the classical CPE. This autonomy of enterprises in foreign trade participation involves introduction of genuine market forces as in the case of plan failure. In the present study, however, this aspect is ignored because until as recently as 1985, Soviet foreign trade had not been decentralized enough, so that the monopoly system controlled by the state still discouraged the competitive behavior of enterprises in domestic and international markets.

(viii) "Since the early 1960s, the question of utilizing comparative advantage deriving from the international division of labor in a socialist economy, together with a critical assessment of the theorem of comparative advantage (or costs) in bourgeois foreign trade and practice, has played an essential role in creating a theory of foreign trade under socialism." Even though "the views of [Soviet and East European] economists who have addressed this problem range from total rejection to unqualified acceptance of it as an important factor in determining the direction of development of foreign trade..."
[in the CPEs]" (G. Grote & H. Kuhn, 1988), the planned utilization of comparative advantage in socialist countries is increasingly becoming a key measure in the increasing efficiency of foreign trade. Rosefielde (1973) assumes that the concept of rational factor utilization is applicable for any economic system, and thereby constitutes a major justification for undertaking a factor proportion analysis of the Soviet Union. It may therefore be assumed that Soviet planning, especially Soviet foreign trade planning per se is guided by efficiency criteria based on comparative advantage or factor proportion idea, justifying the application of existing IIT theories based on a market economy to the Soviet case. Therefore, this assumption, further, may justify the assumption that planning per se deters IIT, particularly in MPE.

2.2 Hypotheses Unique to Planned Economies

Based on the foregoing theoretical considerations, several hypotheses are proposed: first, within the general framework of Market Integration vs Plan Integration; and second, under the conditions of Trade with a Market Economy vs Trade with a Planned Economy; third, in terms of Efficiency Calculation; and finally, with respect to Plan Failure and Consumer Goods.
Market Integration vs Plan Integration

It is a well known fact that interest in the study of IIT can be dated from attempts to explore the trade effects of economic integration in Western Europe. Even though according to Vinerian customs-union theory, integration is predicted to encourage inter-industry specialization rather than intra-industry specialization, early studies (e.g. Balassa 1966 and Grubel 1967) report evidence which suggests a direct relationship between the formation of the EEC and the growth of IIT.

Drabek and Greenaway (1984) compare the EEC and COMECON with respect to the effect of economic integration on IIT. They expect that customs union formation will be accompanied by tariff liberalization and, in turn, that this will stimulate intra-customs-union trade expansion. They note that whether the trade expansion takes the form of inter- or intra-industry exchange depends very much on pre-union market structures, and the role of taste overlap is emphasized: "if the pre-integration economies have similar preference structures, and produce similar commodities, a greater stimulus will be given to intra-industry exchange than would be the case with multilateral tariff liberalization (pp. 447-8)." Therefore, the necessary condition for IIT is the competitive nature of the production structure in individual member countries rather than its complementarity. They note, however, that the emergence of IIT is independent of institutional differences existing among different
integration schemes\textsuperscript{11}; the competitive production structures of member countries are the necessary but not sufficient condition for IIT in centrally-planned economies as much as in market-type economies.

In addition, they test the null hypothesis that different integration groupings (EEC and COMECON) should lead to identical levels of IIT against the alternative hypothesis that integration groupings will have different levels of IIT. More generally and formally:

Hypothesis 8:

Economic integration based on central planning leads to a lower level of IIT than one based on the market.

The notation for this hypothesis would be:

\[ H_0: B_{\text{COMECON}} = B_{\text{EEC}} \]

\[ H_1: B_{\text{COMECON}} < B_{\text{EEC}} \]

\textsuperscript{11} While EEC is based on the market integration scheme, COMECON is an economic integration based on the plan. It should be noted that even though COMECON integration has been developed following the plan approach, the actual organization and operation was a result of compromising two extremes of the full market solution and the full centrally-planned solution. For further reference, see A. Smith (1983).
This hypothesis is not tested in the econometric study of Chapter IV. Instead, econometric results that Drabek and Greenaway (1984) found are introduced in Table 9 of Appendix. As expected, the level of IIT for Czechoslovakia is lower than the EEC average. On the other hand, the level for Hungary is somewhat higher than the EEC average. This could be partly due to the fact that Hungarian indices are calculated at the 2nd digit of the SITC and therefore likely to be subject to an upward bias.

Drabek and Greenaway interpret their empirical finding by saying that:
"one would presume that higher incomes per capita in the EEC, and a freer expression of tastes and preferences has resulted in a greater demand for (and supply of) differentiated goods, and a greater potential for IIT" (p. 463). They, also, point out that "there are in fact a priori reasons to expect that the preferences in the CPEs revealed through plan targets desired or, at least under the control of the planners are different in comparison to economies in which market forces are allowed to reveal preferences of individuals" (p. 463).

Two additional factors are mentioned that are likely to depress the level of IIT in COMECON: non-tariff government interventions based on state trading and the nature of capital flows in CPEs. The latter had already been pointed out by Greenaway and Milner (1986) as among the reasons why planning itself discourages IIT.
Trade with a Market Economy vs Trade with a Planned Economy

Hypothesis 9:

The level of Soviet IIT will be higher in trade with market-type economies (MEs) than in trade with centrally planned economies (CPEs).

This is to be expected in part as a result of higher per capita incomes in developed market economies. As already mentioned, however, there are several reasons to believe that the planning process itself deters IIT in CPEs. In other words, the planning process pursues comparative advantage so that inter-industry trade may be encouraged. Comparing Soviet trade with the planned economies and Soviet trade with the market economies, however, it cannot be predicted a priori which one has the higher IIT. The reason is that even though the plan itself deters IIT, plan failure may also deter IIT.

Hypothesis 9 can be expressed as follows:

\[ H_0 : B_k^{\text{CPE}} = B_k^{\text{ME}} \]

\[ H_1 : B_k^{\text{CPE}} \neq B_k^{\text{ME}} \]

This hypothesis is tested using a market economy dummy (ME_\text{T}_k).
Efficiency Calculation

According to Brainard (1976), the theoretical basis of the recommended procedures in Soviet foreign trade planning is a calculation of the domestic costs of foreign exchange—that is, foreign exchange earned in the case of exports and foreign exchange expended in the case of imports. Therefore, the notion of 'Foreign Trade Efficiency Indices (FTEI)' provides a measure of (a) the cost to the national economy of producing a good for export relative to the foreign exchange received abroad, or (b) in the case of imports, the foreign exchange expended abroad in purchasing a good relative to what it would have cost to produce the good domestically. Even though there have been several indices measuring foreign trade efficiency, in fact all of them rely on calculating comparative costs or comparative advantage. Thus, it may be possible to set up an industrial hypothesis as follows:

Hypothesis 10:

The easier it is to calculate the efficiency of a given industry or product in foreign trade planning, the lower the level of IIT of that industry or product.

Recognizing the fact that the more standardized the goods the easier the efficiency calculation, however, the above hypothesis becomes equivalent to the familiar one that IIT is greater among
differentiated goods (see Hypothesis 5 among the industrial hypotheses).

**Plan Failure and Consumer Goods**

Still another hypothesis may be offered for analysis by industry.

**Hypothesis 11:**

The more susceptible a given industry is to plan failure, the lower the level of IIT in that industry.

Grain or consumer goods imports would be a good example in support of this hypothesis. Agricultural products such as grain are easily subject to plan failure because they are easily subject to influences of changes in the condition of natural environment that cannot be planned or predicted precisely (e.g. weather). In addition to difficulties in balancing demand for and supply of consumer goods at both the micro and macro level, a more important reason why consumer goods are easily subject to plan failure is that the consumer sector has tended to be neglected for the sake of achieving balances in planning, with the result that it has at times been called the "buffer" sector of the planned economies. It may be assumed that if plan failure (shortages or surpluses) occurs, shortages (surpluses) are usually eliminated by means of unplanned imports (exports) or
hard-currency trade with the market economies. It should be noted, however, that whether the trade of consumer goods will have a high or a low level of IIT depends on the test result of Hypothesis 9 about two different economic systems. Hypothesis 11 is tested in chapter IV, using the consumer goods ratio (CON \(_j\)) as a regressor,\(^{12}\) the ratio derived from the 1966 Soviet input-output tables.

Among all of these hypotheses unique to planned economies, the second country hypothesis (Hypothesis 9) is analyzed by the first group of regression equations (equations 27, 28 and 29) whereas the last two industrial hypotheses (Hypotheses 10 & 11) are analyzed by the second group of regression equations (equations 30 and 31) in Chapter IV along with the hypotheses common to both market economies and planned economies.

\(^{12}\) Sometimes the consumer goods ratio is used as a regressor for measuring product differentiation. See Marvel & Ray (1986).
CHAPTER III
MEASUREMENT OF IIT

The extent of actual IIT as opposed to recorded 'two-way trade' or 'trade overlap' induced by the arbitrariness of official classifications depends on the definition of an 'industry'. Since there are no unique criteria for defining an 'industry', however, the identification and measurement of IIT depends heavily upon the degree and kind of homogeneity of the commodities included in each 'industry'. 1

1. Possible Indicators of IIT

1.1 The Balassa Index

Balassa (1966) first proposed a measure \( A_j \) of the extent of trade matching, that is, the extent to which the absolute amount (by

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1. This chapter relies heavily on the excellent summary of measurement methods of IIT by Greenaway and Milner (1986).
value) of commodity exports \((X_j)\) is offset by imports \((M_j)\) at a given level of aggregation:

\[
A_j = \frac{|X_j - M_j|}{(X_j + M_j)} = \frac{\text{net trade}}{\text{gross trade}}
\]  (15)

where \(0 \leq A_j \leq 1\).

\(A_j\) is inversely related to IIT, that is, \(A_j\) equals unity when either \(X_j\) or \(M_j\) equals zero and it equals zero when \(X_j = M_j\). Therefore, borrowing Balassa's expression, it can be said that should inter-industry specialization predominate, one would expect the resulting 'representative ratios' \((A_j)\) to approach unity since a country would either export or import a commodity. By contrast, in the case of intra-industry specialization, the ratios would tend toward zero because exports and imports would tend toward equality within each category.

In this case net trade is measured relative to gross trade and not domestic production or sales. Therefore, a high level of IIT as indicated by this measure does not necessarily involve a high level of intra-industry specialization.
1.2 The Michaely Index

Michaely (1962) proposed an index \( T_j \) which measures the degree of multilateral balancing in a country \( j \)'s trade as follows.

\[
T_j = \frac{1}{2} \sum_{k=1}^{n} \left| \frac{X_k}{\sum X_k} - \frac{M_k}{\sum M_k} \right|
\]  

This index expresses the share of the country's trade which is conducted on a multilateral basis. The potential range of the index is from zero to unity. It will be zero when the proportion of each foreign country \( k \)'s share in country \( j \)'s exports is equal to the proportion of that country's share in \( j \)'s imports (a result that is defined as perfect bilateral balancing). On the other hand, the index will be unity when the country in question buys nothing in countries to which it exports--and vice versa (defined as perfect multilateral balancing).

The index \( T_j \) was modified and applied to industry studies by Greenaway and Milner (1986) in order to measure the overall similarity of the commodity composition of imports and exports as follows.

\[
\bar{H} = 1 - \frac{1}{2} \sum_{j=1}^{n} \left| \frac{X_j}{\sum X_j} - \frac{M_j}{\sum M_j} \right|
\]
The index, $H$, measures the extent to which exports in each industry $j$ or commodity grouping as a proportion of total exports offset imports of each industry as a proportion of total imports. Higher values imply greater similarity in the commodity composition of imports and exports, but a value of unity is not dependent on overall trade balance ($EX_j = EW_j$) or an exact matching in the individual groupings.

By using a scaling procedure, the index in fact measures the overall similarity between imports and exports that would be achieved if the overall trade was balanced.

1.3 The Standard Grubel and Lloyd Index of IIT

The majority of empirical studies use the index proposed by Grubel and Lloyd (1975), i.e. the GL index for the measurement of actual IIT. On a multilateral basis the GL index ($B_j$) measures the extent of the absolute amount of commodity exports in a particular industry ($j$) or commodity grouping which is offset by imports in the same grouping, and expresses this IIT as a proportion of the total trade in this commodity.

$$B_j = \frac{(X_j + M_j) - |X_j - M_j|}{(X_j + M_j)}$$  \hspace{1cm} (18)

In its contracted form:
\[ B_j = 1 - \left( \frac{|X_j - M_j|}{(X_j + M_j)} \right) = 1 - A_j, \quad 0 \leq B_j \leq 1 \] (19)

Whereas \( A_j \) is directly related to the level of inter-industry trade, \( B_j \) is directly related to the level of intra-industry trade. When \( X_j \) or \( M_j = 0 \) and there is no overlap of imports and exports, then \( B_j = 0 \). Alternatively if \( X_j = M_j \) and there is complete matching, then \( B_j \) is unity. Borrowing Grubel and Lloyd (1975)'s expression, "when the exports are exactly equal to imports of an industry, \( B_j \) is unity. When there are exports but no imports, or vice versa, the measure is zero, which is desirable. When exports are equal to one-half of imports, or vice versa, the measure is 66.6 per cent. That is, the value matching exports and imports is \( 2/3 \) of the total value of exports plus imports."

Since \( B_j \) measures the amount of 'matched' trade relative to gross trade in that particular commodity grouping, a high proportion of 'matched' trade may be recorded for a particular industry where gross trade is absolutely small or large or relatively small or large (in terms of overall trade in manufactures, for instance). And also the level of gross trade in each industry may or may not vary directly with the level of industry production or sales.

For the comparison of 'average' levels of IIT on an economy or manufacturing industry-wide basis between countries or over time, unweighted or weighted average can be used. If the level of
aggregation \( (j) \) has been predetermined satisfactorily then a simple arithmetic average

\[
\bar{b}_j = \frac{1}{n} \sum_{j=1}^{n} b_j
\]

(20)

may be a satisfactory representative measure of IIT if the distribution of \( b_j \) is uni-modal and reasonably peaked. Given greater ambiguity about the definition of \( j \), a weighted summary index

\[
\bar{b}_j \text{(weighted)} = \sum_j v_j b_j \quad \text{(where } v_j = \frac{x_j + m_j}{\sum_j x_j + \sum_j m_j})
\]

(21)

may be more appropriate. This index uses as weights the relative size of exports plus imports of each industry in the total value of exports plus imports of the set of all industries examined. This can be calculated as follows:

\[
\bar{b}_j \text{(weighted)} = 1 - \frac{\sum_j |x_j - m_j|}{\sum_j (x_j + m_j)}
\]

(22)

where \( \sum_{j=1}^{n} |x_j - m_j| \neq |\sum_{j=1}^{n} x_j - \sum_{j=1}^{n} m_j| \) if, as is likely, the sign on industry trade balance differs.

It should be noted that a measurement method of IIT on a bilateral basis might be used for certain purposes, i.e., imports and
exports in an industry for one country with another country (k) or group of countries: 14

\[
B_{jk} = 1 - \frac{|X_{jk} - M_{jk}|}{(X_{jk} + M_{jk})}
\]  

(23)

But, as Greenaway and Milner (1986) noted, when disaggregating on a geographical basis, there is a danger of biasing the measurement of IIT and of capturing the impact of idiosyncratic influences on bilateral trade flows, or of inappropriately testing hypotheses of multilateral trade flows. There is less danger of this happening where k is a country grouping based on economic characteristics (levels of industrialization, geographical proximity or integration). Of course there is the possibility of upward bias in multilateral measures of \(B_j\) [for instance, in the extreme \(B_j = 1\) but \(B_{jk} = 0\) (for \(k=1...n\)) and \(B_{jk} = 0\) (for \(k>n\))] which may be called 'geographical aggregation'. 15 If a country imports only in a commodity grouping from Developed Market Economies (DMEs) and exports only in the same grouping to non-DMEs, then it is very likely that there are different

14. In Chapter IV, this bilateral measurement of IIT is used for the country analysis. In this case, \(k = 30\) other countries.
15. This is not easy to distinguish from categorical aggregation. Categorical and geographical aggregation will be explained in more detail later in this chapter.
input ratios in the sub-groups which make up this commodity grouping. 16

2. Adjustment for Aggregate Trade Imbalance

When there is overall trade imbalance, then

\[ \sum_{j=1}^{n} |X_j - M_j| > 0 \]  \hspace{1cm} (24)

and \( B_j \) must be less than one. In association with this mathematical requirement, there is a controversy as to whether it unequivocally introduces bias into the measurement of IIT. Some authors answer in the affirmative (Grubel and Lloyd, 1975; Aquino, 1978), while others argue only that it may induce measurement bias, and that the nature of the bias can not be easily captured as the above authors claim (Greenaway and Milner, 1981, and 1986).

16. This actually happens in Soviet IIT where the Soviets import high-quality equipment from the West and export low-quality equipment to developing countries. See Chapter V.
The Grubel and Lloyd Adjustment

Grubel and Lloyd (1975) argue that given an overall trade imbalance, $\bar{B}_j$ is biased downward as a measure of mean IIT. Thus, they argue that one way of adjusting for the aggregate trade imbalance is expressing IIT as a proportion of total commodity export plus import less the trade imbalance as follows:

$$\bar{B}_{j\text{(adj)}} = \frac{\sum_j (X_j + M_j) - \sum_j |X_j - M_j|}{\sum_j (X_j + M_j) - |\sum_j X_j - \sum_j M_j|}$$  \hspace{1cm} (25)$$

$$\bar{B}_{j\text{(weighted)}} = \frac{\sum_j X_j - \sum_j M_j}{1 - k}$$  \hspace{1cm} (26)

where $k = \frac{\sum_j X_j - \sum_j M_j}{\sum_j (X_j + M_j)}$

$$0 \leq \bar{B}_{j\text{(adj)}} \leq 1$$

Thus the adjusted index increases as $k$, i.e. the overall trade imbalance as a proportion of total trade, increases. When the measures relate to trade with individual countries, this adjustment makes a substantial difference if the bilateral trade imbalances are large relative to the combined total export and import trade. For example, if the trade deficit (surplus) is equal to one-tenth or one-fifth of the value of export plus import the adjustment increases the
measure by one-ninth or one-quarter respectively. For trade with a given country or with all countries this adjustment increases the average measures by the same proportion at all levels of aggregation (Grubel and Lloyd, 1975), implying that such an adjusted index can be used to measure IIT on a multilateral or bilateral basis as in our case. Therefore, three indices, i.e., $\bar{B}$, $\bar{B}$ (weighted) and $\bar{B}$ (adjusted) are calculated and used in this study.

3. Adjustment for Categorical Aggregation

Categorical aggregation occurs when products are inappropriately grouped together in trade categories for the purpose at hand. However, in the case of measuring IIT the purpose is to group together products which constitute an 'industry'. The problem is that there are alternative possible criteria of homogeneity that can be used in practice to group commodities together in official classifications. Balassa (1979), for instance, views homogeneity as 'high' substitution elasticities in production. On the other hand, Aquino (1978) defines the kind of homogeneity that matters in manufacturing trade as the 'similarity' of the 'technological intensity' of production process. Also, official statistical trade classifications can not be based on appropriate economic theory for guidance of how they should group products or activities into 'industries'. As Greenaway and Milner (1986) noted, the nature, methods and diverse purpose of data collection impose constraints on
the compatibility of any official classification with the needs of economic analysis. 17

There is some evidence for both the SITC (Finger, 1975) and the U.K. SIC (Rayment, 1976) suggesting that variability in input requirements within the third digit of each of these classifications, could be greater than variability between groups. Greenaway and Milner (1986) argue that although the significance of inappropriate classification (categorical aggregation) may be expected to be positively related to aggregation of the data, simultaneous exchange does not disappear with regrouping at higher digit levels. 18

They also note that in contrast to the fear that IIT is the product of random measurement error produced by the arbitrariness and idiosyncrasies of official trade classifications, in the case of regrouping there could be the danger that IIT is the product of systematic, personal bias in the researcher's selection process. There may not be unanimous agreement among economists about what constitutes an industry, but there is certainly little support for

17. For instance, the Standard Industrial Classification (SIC) appears to distinguish between activities according to process characteristics, whilst the Standard International Trade Classification (SITC) emphasizes product characteristics. On the other hand, Soviet Foreign Trade Nomenclature (FTN) classifies commodities by industrial origin or end use.
18. Aquino (1978) re-classified two, three and four digit SITC data into 25 'industries' in order to produce 'industry' groupings which conform more closely with the theoretical construction of an industry. Also Balassa (1966) grouped three and four digit SITC data into 91 'industries'. 
adopter the finest level of disaggregation. As Greenaway and Milner (1983, 1985 and 1986) have argued, a degree of professional consensus does exist in regard to the third digit of the SITC as a reasonable initial approximation of an industry. 19

It can be said, therefore, that although observed or recorded IIIT remains a somewhat uncertain mixture of genuine IIIT and measurement error, the bulk of economists of IIIT remain confident that recorded IIIT is not only or predominantly the product of random measurement error.

Finally, it may be worthwhile to note that in the Soviet case so-called 'geographical aggregation' as well as categorical aggregation emerges as another important issue. As already explained above, this geographical aggregation, analogous to categorical aggregation, means that in a multi-country, multi-product, and multi-factor world in which market sizes and demand conditions are diverse, IIIT can be generated on a multilateral basis with or without two-way trade on a bilateral basis. This geographical aggregation may be greater in the case of trade between different types of economies(e.g. East-West trade).

Therefore, as seen below in Chapter V, in order to partially eliminate any bias from the geographical aggregation the same number

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19. In this study, the third digit of the FTN is used. There is no real difference between the third and fourth digit level of aggregation because the main disaggregation at higher than the third digit is made at the fifth digit level in the Soviet case.
of countries are selected for each country group in comparing the IIT levels of different country groups (e.g., COMECON countries, developed countries and developing countries).
CHAPTER IV

AN ECONOMETRIC STUDY

1. Testing Specific Models of Soviet IIT

From the discussions in chapters II and III, two separate testing models of Soviet IIT may be established according to whether they are cross country or cross industry.

1.1 A Cross-Country Model of Soviet IIT

Empirical testing of the country hypotheses 1, 2, 3, 4 and 9 in Chapter II may be carried out by means of the following regression equations:

\[
\bar{E}_k = f (PC\bar{D}_k, G\bar{N}P_k, IN\bar{E}G_k, M\bar{E}T_k, BO\bar{D}D_k) \tag{27}
\]

\[
\bar{E}_k\text{(weighted)} = f (PC\bar{D}_k, G\bar{N}P_k, IN\bar{E}G_k, M\bar{E}T_k, BO\bar{D}D_k) \tag{28}
\]

\[
\bar{E}_k\text{(adjusted)} = f (PC\bar{D}_k, G\bar{N}P_k, IN\bar{E}G_k, M\bar{E}T_k, BO\bar{D}D_k) \tag{29}
\]
where $\bar{B}_k$ is a simple average of the intensity of Soviet IIT with country $k$ calculated according to equation (19) above; $\bar{B}_k^{(\text{weighted})}$ is a weighted average of the intensity of Soviet IIT with country $k$ calculated according to equation (22) above; and $\bar{B}_k^{(\text{adjusted})}$ is an adjusted average of the intensity of Soviet IIT with country $k$ calculated according to equation (26) above.

The signs above the individual exogenous variables indicate the expected direction of influence.

Here, $k = 30$, because we deal with Belgium and the Netherlands in addition to "G7" as developed countries, with 9 COMECON countries, 9 developing countries, and 3 non-COMECON socialist countries (China, North Korea, and Yugoslavia).\textsuperscript{20}

1.2 A Cross-Industry Model of Soviet IIT

Empirical testing of the industry hypotheses in Chapter II (viz, hypotheses 5, 6, 7, 10, and 11) may be summarized by the

\textsuperscript{20} The reasons that these countries are selected are explained in Chapter V.
following regression equation for empirical testing. 

\[ B_j = f (P_{j}, C_{j}, K_{j}, AGR_{j}) \]  

(30)

where \( B_j \) is the intensity of Soviet IIT in 1985 and \( j \) is 183 Soviet FTN industries; and

\[ B_j = f (P_{j}, C_{j}, K_{j}, AGR_{j}) \]  

(31)

where \( B_j \) is the intensity of Soviet IIT in 1985 and \( j \) is 172 Soviet FTN industries which are selected by excluding industries that are not classified at the three digit level.

The signs above the individual exogenous variables indicate the expected direction of influence.

It should be noted that information on product and industrial characteristics is required strictly for both countries involved in each bilateral transaction. It becomes less satisfactory to proxy both home and foreign country conditions with just home conditions.

21. Remember that Hypotheses 5 and 10 are virtually the same one, therefore, may be tested using the same proxy variable \( PD_j \).

22. In the present study \( B_j \) is an index for Soviet trade with the world, while it is possible to use \( B_j \) in the trade with each country group (e.g. COMECON, developed and \( d^j \) the dependent variable.)
(as with given third country conditions) for every bilateral transaction for a particular industry.

In the multilateral IIT of our industrial analysis, however, it is possible and necessary to use home country conditions (i.e. Soviet) to proxy average conditions internationally for a particular industry. Similarly, in the case in which Soviet conditions are not available, third country conditions (e.g. from US data) could be used.23

2. Data and Testing Methods

The foreign trade data utilized in the present study are the raw data on the Soviet Union and other countries reported in Soviet sources (annual issues of Vneshnyaya Torgovlya SSSR, 1975-1985, published by the Foreign Trade Ministry of the USSR). The official Soviet trade data are based on the Soviet Foreign Trade Classification (SFIC) or Foreign Trade Nomenclature (FTN) which are different from the SITC of Western countries, as explained in Chapter III above.

23. In this study, Soviet data, i.e. home country conditions are used for industrial analysis.
2.1 Conceptual Problems

One of the problems with using the raw data from Soviet sources is that traded amounts are measured in foreign trade ruble prices or valuta rubles, not by domestic prices (or hard currency prices). In Soviet foreign trade, moreover, different prices are used depending upon the regions and commodities in question.

In Soviet trade with COMECON countries, Transferable Ruble (TR) prices are used as clearing prices by the International Bank of Economic Cooperation (IBEC), the clearing bank of COMECON. Only 10-15 per cent of intra-COMECON trade is cleared in convertible currencies.

In both TR and convertible currencies cases, foreign trade prices are formulated on the basis of World Market Prices (WMPs). The principle of intra-COMECON foreign trade price formation has been changed several times. Since 1975, it has changed from a five-year, fixed-average formula (e.g. for the prices of 1971-75, the average prices of 1965-69 were used) to a five-year, moving-average formula (e.g. for the prices of 1976 and 1977, the average prices of 1971-75 and 1972-76 are used respectively). It must be noted that in practice, intra-COMECON prices are often not determined – exactly or at all – according to the stated general principle (J.M. van Brabant, 1985).
Hard currencies are used for the most part in Soviet trade with developed countries, and in about 40 per cent of Soviet trade with developing countries (D.T. Gullo, 1976).

In recording foreign trade results, Transferable Ruble (TR) trade is translated into foreign trade ruble or valuta ruble by official exchange rates (TR/ruble=1). J.M. van Brabant (1985) has pointed out that TR rates have deviated somewhat from those of valuta ruble since late 1977, when both the IBEC and USSR's Foreign Trade Bank started to peg the 'value' of the TR and ruble, respectively, against an identical basket of convertible currencies but using different weights.

Considering all of these factors, it is not easy to tell a priori what kind of effects calculating dependent variables, i.e. IIT indices from ruble price data has on the empirical results, taking into account the fact that U.S. dollar prices data are used for some independent variables, particularly in country analysis. It may simply be argued that in so far as the same foreign exchange rates are used for both exports and imports, it does not matter which prices data are used. This would be not only because the dependent variables are ratios of exports and imports, thereby cancelling out the effects of multiplying exchange rates, but also because U.S. dollar price data for some independent variables are also obtained from the Soviet raw data using the same official foreign exchange rates between the ruble and the U.S. dollar.
A more important problem with using raw data is that foreign trade prices or foreign trade rubles (valuta rubles) bear no relation to the analogous values in domestic prices. In order to get corresponding domestic prices from the foreign trade prices of each commodity or industry, we need each conversion coefficient or internal exchange rates. But, it is practically impossible to get or estimate each conversion coefficient for each industry due to the lack of data (Treml et al., 1972).

Fortunately, in the analysis of Soviet IIT, conversion to domestic prices is not necessarily preferred, since even domestic prices do not accurately reflect domestic supply-demand conditions. Rather, it can be said that foreign trade prices would better reflect the world market conditions that could be used for estimating domestic supply-demand conditions. In recent years, world market prices that have been used as a guide for formulating foreign trade prices are increasingly used as a benchmark for domestic price reform in planned economies (Hungary in particular).

---

24. A more fundamental problem is that optimal (shadow) domestic prices should be calculated in order to obtain optimal (shadow) internal exchange rates that reflect the relationship between valuta ruble and true domestic market conditions (Wolf, 1988).

25. In this connection, the following may be noted: "New exchange rates (the foreign trade multiplier or commercial rate), aside from most likely being closer to purchasing power parity, will now also have somewhat of a price-formation role in the domestic economy" (Wolf, 1988, p. 55).
2.2 Industrial Data

For some industrial data (for example, the capital labor ratio or consumer goods ratio), the 1966 Soviet Input-Output Tables are used. In cross-industry analysis, it is necessary to reconcile the foreign trade classification (FTN) with the input-output system. Fortunately we can use the method that was created by Treml (1972), where the FTN code was correlated with the 76 sector input-output classification.

For other industrial data, we might have used data of the US Bureau of Census data (e.g. Census of manufactures, 1972: Subject series).

There are many sources of country data, but, the data from the Handbook of Economic Statistics 1986 of the US Central Intelligence Agency, are preferred, especially for GNP and per capita income of each country. In the case of some data for developing countries that

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26. Even though later data from the 1976 tables (Treml et al, 1976, 1979) were published by the Joint Economic Committee of the US Congress reports for 1976 and 1979 respectively, the reconstructed 1966 tables with 76 sectors (Treml et al, 1972) are used in order to use the table of correlation of the foreign trade commodity code with the 76-sector Input-Output classification produced from 1966 tables. All of these tables are based on the reconstructed 1959 and 1966 Input-Output tables with 55 sectors by the same authors (Treml et al, 1973).

27. In the dissertation, these data are not used, since independent variables for which Soviet data do not exist are omitted from the beginning.
are missing, we use United Nations data (National Accounts Statistics: analysis of main aggregates, 1985; N.Y. 1988).

2.3 Testing Methods

All of the above data are analyzed using simple ordinary least squares (OLS) estimation methods. Some authors use other methods (e.g. logit transformation of $B_j$ or the weighted least squares (WLS)). Recently, Balassa and Bawens (1988) used the Tobit procedure in order to take account of the zero observations in the dependant variable. But, as Greenaway and Milner (1986) pointed out, in light of the data deficiencies and proxy problems encountered in the cross-sectional work, it must be questioned whether such technical sophistication is merited.

3. Results

3.1 Country Study

The results of cross-country regression estimates are summarized in Table 1, Table 2 and Table 3, below.

The most striking result of cross-country regression analysis from the data in these tables is that COMECON integration has a strongly significantly positive effect on IIT. Thus, contrary to Pelzman's (1978) findings, these results indicate that economic
integration promotes IIT between socialist economies as well as market economies, as predicted in Hypothesis 3.

On the other hand, when the simple average of the intensity of Soviet IIT ($\bar{I}_k$) is used as the dependent variable, the market-type economies dummy variable (MET) has a negative coefficient at the significance level of 10 per cent, a different result from the positive sign that was expected in Hypothesis 9. One way of interpreting the result is to say that the plan failure and the planned use of market in Soviet trade with market economies lower IIT more than the plan itself lowers IIT in trade with planned economies. The implication is that in trade with market economies, the plan failure tends to deter rather than encourage IIT, thereby strengthening the deterrent effect of the planned use of market.

Another possible explanation for a negative sign of the market economy dummy is the existence of multicollinearity between the integration dummy variable and the market-type economies dummy variable, in which case Soviet IIT would be seen as more strongly influenced by the integration factor rather than the market-type economies factor. The integration factor alone explains more than 50 per cent of the variation of dependent variable in 'b-type equations' that use only the integration dummy variable as regressor (equations

28. Refer to Figure 1 in Chapter II for a frame of reference for a theory of Soviet IIT.
(1b), (2b), (3b), (1bl), (2bl), and (3bl)). When the other indices of the intensity of Soviet IIT—$\bar{B}_k$(weighted) or $\bar{B}_k$(adjusted)—are used as dependent variables, however, the market-type economies dummy variable (MET) shows no statistical significance. Thus, none of the three specifications supports Hypothesis 9, and one of them contradicts it.

Hypothesis 1 that the level of Soviet IIT with another countries will be higher, the smaller the difference in their respective levels of development is accepted at a high level of significance, only when $\bar{B}_k$ is the dependent variable {equations (1a), and (1e) in particular}.

Similarly, the market size (GNP) of Hypothesis 2 has a significantly positive effect on IIT only when the dependent variable is $\bar{B}_k$.

On the other hand, the border dummy variable of Hypothesis 4 has a positive coefficient at the 5 per cent significance level only when $\bar{B}_k$(weighted) is used as the dependent variable.

As seen in the tables, the original model that has five independent variables shows the highest level of $R^2$ in the equation (2a), i.e. when $\bar{B}_k$(weighted) is the dependent variable. On the other hand, the equation (1a) produces the highest significance levels of coefficients among three equations based on the original model. The
equation (3a) that uses $\tilde{B}_k$ (adjusted) as the dependent variable, however, shows statistically the worst fit in terms of both $R^2$ and the significance level of coefficients among those three equations.

In each type of equations, those labelled (b), (c), (d), and (e) are examples in which certain variables are omitted from the original model. As already mentioned above, in the b-type equations, the integration dummy variable alone explains more than 50 per cent of variation of the dependent variable at the one per cent significance level, which means that the level of Soviet IIT with other countries is predominantly determined by whether the Soviet Union conducts trade with COMECON countries or with non-COMECON countries.

Equations (1a1) through (1e1), equations (2a1) through (2e1) and equations (3a1) through (3e1) use log values of PCID and GNP as independent variables; as seen in the Tables, however, the results do not improve at all except for equation (3a1).

From these empirical findings it may be concluded that the independent variables for explaining determinants of cross country Soviet IIT show different statistical significance depending upon which indices are used as the dependent variable, except for the Integration Dummy Variable. On the other hand, independent variables derived from general theories of IIT explain Soviet IIT relatively well compared to the Market-Economy Dummy Variable that is unique to planned economies in terms of significance level. It is worth commenting that the $R^2$'s are not low in this empirical result in
comparison with the studies of market economies. It should be noted, however, that econometric studies about market economy's IIT are concentrated on industry hypotheses, and among a few econometric studies which concentrated only on country hypotheses, most of them are multi-country or multilateral studies, while the present dissertation is dealing with a single country and bilateral study.

Table 1
Country-Specific Determinants of Soviet IIT, 1985

Dependent Variable: $\bar{B}_k$

<table>
<thead>
<tr>
<th>Equations</th>
<th>Intercept</th>
<th>PCID</th>
<th>GNP</th>
<th>INT</th>
<th>MET</th>
<th>BORD</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1a)</td>
<td>0.064</td>
<td>-5.7E-06</td>
<td>1.5E-08</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.006</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>(3.8)**</td>
<td>(2.49)**</td>
<td>(2.08)**</td>
<td>(2.30)**</td>
<td>(1.49)*</td>
<td>(0.52)</td>
<td></td>
</tr>
<tr>
<td>(1b)</td>
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<td>---</td>
<td>---</td>
<td>0.08</td>
<td>---</td>
<td>---</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>(5.1)**</td>
<td></td>
<td></td>
<td>(6.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1c)</td>
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<td>---</td>
<td>---</td>
<td>0.62</td>
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<tr>
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<td>(1.64)*</td>
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<td>(4.80)</td>
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<td></td>
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</tr>
<tr>
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<td>---</td>
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<td>(2.01)**</td>
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<td>(4.94)**</td>
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<td></td>
<td></td>
</tr>
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<td>1.4E-08</td>
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<td>-0.02</td>
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<td>0.69</td>
</tr>
<tr>
<td></td>
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<td>(2.49)**</td>
<td>(2.04)**</td>
<td>(2.77)**</td>
<td>(1.63)*</td>
<td></td>
<td></td>
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<td>-0.004</td>
<td>0.008</td>
<td>0.05</td>
<td>-0.02</td>
<td>0.007</td>
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<td>(0.77)</td>
<td>(2.71)**</td>
<td>(2.65)**</td>
<td>(1.57)*</td>
<td>(0.53)</td>
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</tr>
<tr>
<td>(1bl)</td>
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<td>---</td>
<td>0.08</td>
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<td>---</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>(5.1)**</td>
<td></td>
<td></td>
<td>(6.24)</td>
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</tr>
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<td>0.07</td>
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</tr>
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<td>-0.002</td>
<td>0.006</td>
<td>0.07</td>
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<td>---</td>
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</tr>
<tr>
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<td>(0.41)</td>
<td>(2.20)**</td>
<td>(5.36)**</td>
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<td></td>
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</tr>
<tr>
<td>(1el)</td>
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<td>-0.004</td>
<td>0.007</td>
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<td>-0.02</td>
<td>---</td>
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<td>(2.71)**</td>
<td>(3.11)**</td>
<td>(1.70)*</td>
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<td></td>
</tr>
</tbody>
</table>

* In equations (1al) through (1el), PCID and GNP are log-valued
* t-statistics in parentheses
* 10 per cent significance level
** 5 per cent significance level
*** 1 per cent significance level
Table 2
Country-Specific Determinants of Soviet IIT, 1985
Dependent Variable: $\bar{B}_k$(weighted)

<table>
<thead>
<tr>
<th>Equations</th>
<th>Intercept</th>
<th>PCID</th>
<th>GNP</th>
<th>INT</th>
<th>MET</th>
<th>BORD</th>
<th>$R^2$</th>
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<td>(2a)</td>
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<td>(3.0)**</td>
<td>(0.51)</td>
<td>(1.95)**</td>
<td></td>
</tr>
<tr>
<td>(2b)</td>
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<td>---</td>
<td>---</td>
<td>0.09</td>
<td>---</td>
<td>---</td>
<td>0.66</td>
</tr>
<tr>
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<td>(7.35)**</td>
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<td>(6.01)**</td>
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<td>(0.04)</td>
<td>(5.94)**</td>
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<td>(7.35)**</td>
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<td>(6.25)**</td>
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<td>(0.09)</td>
<td>(0.74)</td>
<td>(4.10)**</td>
<td>(0.85)</td>
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</table>

*a*In equations (2al) through (2el), PCID and GNP are log-valued

*b* t-statistics in parentheses
* 10 per cent significance level
** 5 per cent significance level
*** 1 per cent significance level
### Table 3
Country-Specific Determinants of Soviet IIT, 1985
Dependent Variable: $\bar{h}_k$(adjusted)

<table>
<thead>
<tr>
<th>Equations</th>
<th>Intercept</th>
<th>PCID</th>
<th>GNP</th>
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<th>MET</th>
<th>BORD</th>
<th>R²</th>
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<td>(1.39)</td>
<td>(2.5)**</td>
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<td>(1.30)</td>
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<tr>
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<td>0.53</td>
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<td>(5.6)**</td>
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<tr>
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<td>(0.13)</td>
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<td>(4.8)**</td>
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<td></td>
</tr>
<tr>
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<td>1.0E-08</td>
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<tr>
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<td>0.004</td>
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<td>0.027</td>
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<td></td>
<td>(1.1)</td>
<td>(0.5)</td>
<td>(1.94)**</td>
<td>(2.81)**</td>
<td>(0.30)</td>
<td>(1.51)</td>
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<tr>
<td></td>
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<td></td>
<td>(5.6)**</td>
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<td>(3cl)</td>
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<td>(0.01)</td>
<td>(0.47)</td>
<td></td>
<td>(5.05)**</td>
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<td>(3dl)</td>
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<td>(0.97)</td>
<td>(0.79)</td>
<td>(1.44)</td>
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<td>(3.5)**</td>
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*aIn equations (3al) through (3el), PCID and GNP are log-valued
b$t$-statistics in parentheses
* 10 per cent significance level
** 5 per cent significance level
*** 1 per cent significance level
3.2 Industry Study

Test results of the hypotheses by industry are summarized in Table 4, where it may be seen that product differentiation displays a positive coefficient at a high significance level, confirming the hypotheses 5 and 10 that relate the level of Soviet IIT to product differentiation and to efficiency calculation, respectively.

The capital-labor ratio, however, does not show a statistically significant coefficient, even though it has a positive sign, an effect that appears to be consistent with the mixed results of other studies about market economies.

On the other hand, the consumer-goods ratio has a negative coefficient at the significance level of 5 per cent, confirming Hypothesis 11 that explains a uniqueness of planned economies in terms of plan failure, because we already confirmed the fact that Market-Economy-Type dummy variable has a negative and significant sign, and consequently the fact that Soviet IIT appear to be greater in trade with Centrally Planned Economies (CPEs) than in trade with Market-type Economies (MEs). A negative coefficient of the consumer goods ratio could also mean, as argued by Marvel and Ray (1987), that the level of intra-industry trade is higher in intermediate goods than in consumer goods.

---

30. Recall that Hypothesis 11 depends on the test result of Hypothesis 9.
Aggregate Level variable shows a positive coefficient at the significance level of one per cent in equations (1d) and (2d)\textsuperscript{31}, which means that categorical aggregation could affect the level of IIT also in the Soviet case. As already mentioned, it does not necessarily mean that if more disaggregate data—i.e. four digit data—are used measurement errors would be diminished, since the main disaggregation at higher than the third digit is made at the fifth digit level in the Soviet case.

As seen in the above tables, there is no big difference in results between two equation groups—equation (1)'s and equation (2)'s—, which means that omission of industries that are not classified at the three digit level does not affect significantly the results.

$R^2$ appears to be very low in every equation, but compared to results of other studies about market economies (e.g. Ray (1986))\textsuperscript{32}, the level can not be said to be too low.

In the analysis by industry, therefore, it can be concluded that Soviet IIT primarily involves trade 1) in differentiated goods or

\textsuperscript{31} Equations (1d) and (2d) use three variables—Aggregate Level, Capital Labor Ratio, and Consumer Goods Ratio—as regressors. Therefore, the fact that only in these equations, Aggregate Level shows a significant level may be partially explained by the possible multicollinearity between the Product Differentiation dummy variable and the Aggregate Level variable.

\textsuperscript{32} See Table 10 in the appendix.
products for which it is more difficult to calculate efficiency in foreign trade planning, as reflected by the positive coefficient of Product Differentiation, and 2) trade in the goods that are more susceptible to plan failure or intermediate goods, as reflected by the negative consumer goods ratio.
### Table 4

**Cross Industry Determinants of Soviet IIT, 1985**

<table>
<thead>
<tr>
<th>Equations</th>
<th>Intercept</th>
<th>Product Differentiation</th>
<th>Aggregate Level</th>
<th>Capital Labor Ratio</th>
<th>Consumer Goods Ratio</th>
<th>R²</th>
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<tr>
<td>(1a)</td>
<td>0.243***</td>
<td>0.023</td>
<td>-0.015</td>
<td>0.172</td>
<td>-0.002</td>
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<td>(6.02)***</td>
<td>(1.91)**</td>
<td>(-0.54)</td>
<td>(0.18)</td>
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<td>(1b)</td>
<td>0.200***</td>
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<tr>
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<td>(7.29)***</td>
<td>(3.38)***</td>
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<tr>
<td>(1c)</td>
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<td>0.017</td>
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<tr>
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<td>(3.04)***</td>
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<td>(-2.09)**</td>
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<tr>
<td>(1d)</td>
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<td>---</td>
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<td>(2.40)***</td>
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<td>(0.21)</td>
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<tr>
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<td>(1.76)*</td>
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<td>(0.26)</td>
<td>(-1.93)**</td>
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</tr>
<tr>
<td>(2b)</td>
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<td>(6.83)***</td>
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<td>(2c)</td>
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<td>-0.001</td>
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<td>(-1.93)**</td>
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<tr>
<td>(2d)</td>
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<td>0.275</td>
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<td>0.08</td>
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<td>(3.05)***</td>
<td></td>
<td>(0.28)</td>
<td>(-1.90)**</td>
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</tr>
</tbody>
</table>
Table 4 (continued)

\(^a\) Dependent variable: \(B_j\) with the world in 1985

\(^b\) \(j = 183\) Soviet FTN industries for equation (1)'s

\(j = 172\) Soviet FTN industries for equation (2)'s, where industries that are not classified at three digit are omitted

\(^c\) \(t\)-statistics in parentheses

* 10 per cent significance level

** 5 per cent significance level

*** 1 per cent significance level
CHAPTER V
THE INTERTEMPORAL PATTERN OF SOVIET IIT

In the present chapter, changes in the level of Soviet IIT over time, from 1975 to 1985, will be examined through data for particular three years (1975, 1980 and 1985). These particular years are chosen because they correspond to the end year of the 9th, 10th and 11th Five Year Plans, respectively. More recent years were not chosen, in order to focus on more typical Soviet-type foreign trade behavior not affected by the program of restructuring (Perestroika) of the Soviet economy under Gorbachev. Soviet IIT shows different intertemporal patterns not only between country groups but also between industry groups. In this respect, an examination of the time series of Soviet IIT from 1975 to 1985 will complement the econometric study of 1985 alone in Chapter IV.

1. Intertemporal Pattern of Soviet IIT with The World in General

Pelzman (1978) showed that the level of Soviet IIT was below 40 per cent in its trade with the world during the period of 1958–1973. The present study finds that the level had decreased during the period of 1975–1985. The level measured by the $\bar{B}_k$ (weighted)
index shows a dramatic drop from 31.7 per cent in 1975 to 21.9 per cent in 1985 as seen in Table 6. The same tendency is found in the level measured by the $B_k$ (adjusted) index because it drops from 35.7 per cent in 1975 to 22.6 per cent in 1985, as seen in Table 7. According to the simple index ($\bar{B}_k$), however, the level showed a mixed result, i.e. it slightly decreased from 27.7 per cent in 1975 to 25.3 per cent in 1980 and then rebound to 26.2 per cent in 1985 (see Table 5). The reason why those indices show different trends seems to be that between 1980 and 1985, Soviet IIT decreased in major traded goods with major trading partners, whereas Soviet IIT increased in many other minor traded goods with other minor trading partners during the same period of time. This result directly contradicts what was initially expected before the empirical result was obtained. Many existing studies showed that there has been an observed tendency for average levels of IIT to increase over the postwar period in the market economies.\textsuperscript{33} According to Pelzman's paper, Soviet IIT decreased from 38 per cent in 1958 to 32 per cent in 1973. Our findings mean that this downward trend has continued and even strengthened since 1975.

Why has Soviet IIT decreased, while those of developed and developing countries have increased during this period? One possible

\textsuperscript{33} For instance, US IIT increased from 47 per cent in 1963 to 53 per cent in 1980 (F. Miroomand, 1988).
explanation is that a deliberate success of foreign trade planning and/or recentralization of the Soviet economy in the period of late seventies and early eighties resulted in the low level of IIT, implying that Soviet foreign trade planning has succeeded in following the comparative advantage principle for increasing efficiency of foreign trade. Another explanation is that it resulted from a failure of planning involving an increased (unplanned or forced) use of market forces in foreign trade field. Still another explanation is that the increased use of market forces resulting from increased autonomy of enterprises in foreign trade participation led to the decrease in IIT.

As already mentioned in Chapter II, however, until as recently as 1985, Soviet foreign trade had not been decentralized (but recentralized), so that the monopoly system controlled by the state still discouraged the competitive behavior of enterprises in domestic and international markets. This downward trend of Soviet IIT therefore seems to be more consistent with the first two explanations.

Nevertheless, the result matches the initial expectation that Soviet intra-industry specialization will be still far below that found by Balassa (1966) and by Grubel and Lloyd (1975) for the five Common Market countries and Australia. 34

34. This also matches the conclusions of general theories of IIT that were covered in the theory part of Chapter II.
Dohan (1979) pointed out a very unique pattern of Soviet IIT (in the form of intra-subbranch specialization according to his terminology), that advanced equipments are imported from the West and standard Soviet equipment are exported from the same subbranch to Eastern Europe and to developing countries. As a result, "unit price differentials for simultaneously exported and imported equipment items is widely observed through Soviet machinery trade, reflecting the effective use of the foreign sector as a means of upgrading the quality and diversity of domestically consumed goods while continuing to produce somewhat simpler and outmoded versions" (Dohan, 1979, pp. 360-1).

The Soviet Union, like other countries, has a higher level of IIT in manufactured goods than other industries (see Table 8). It is very surprising, however, that FTN section 2 (i.e. fuels, mineral raw materials, and metals) shows a very high level of IIT compared to other countries, a finding that can be explained mainly by the reexport of basic raw materials. 35

On the other hand, FTN section 1 (i.e. machinery & equipment) shows a downward trend in the level of IIT during the period. It is not clear whether this is due to a decrease in 'disguised' or

35. This will be explained again in section 4 of this chapter.
'illusory' IIT\textsuperscript{36} or to a decrease in genuine IIT caused either by planning success in exploiting comparative advantage in Soviet foreign trade or by planning failure involving increased use of a genuine market.

2. Intertemporal Pattern of Soviet IIT with COMECON Countries

In the same paper of Pelzman (1978), he found that Soviet IIT with COMECON countries is much less than IIT with the world in general. He argues that these low figures can be used as further proof of Soviet intentions to induce a development within COMECON based on comparative advantage, i.e. based on the establishment and maintenance of the Soviet Union as the main supplier of raw materials and energy and as the main buyer of Eastern European equipment. He added that very high levels of IIT were found in the machinery and equipment and chemical sectors, and concluded that there is a tendency toward limited intra-industry specialization which is in fact consistent with Soviet attempts to press for further economic integration\textsuperscript{37} within COMECON especially after the 25th Session of

\textsuperscript{36} This is 'disguised' or 'illusory' in the sense that the intra subbranch specialization is exactly consistent with Soviet comparative advantage so that this is not a genuine IIT in its traditional meaning.

\textsuperscript{37} He argued that these results confirm the basic specialization assumption inferred in the customs union theory.
COMECON in 1971\textsuperscript{38}.

The documentary results summarized in Table 5, 6 and 7 show that the trend found by Pelzman continued throughout the period, 1975-85. That is, the $\tilde{B}$ (weighted) index decreased from 28.8 per cent in 1975 to 21.6 per cent in 1980 and then further decreased to 15.4 per cent in 1985. The $\tilde{B}$ index and $\tilde{B}$ (adjusted) index show the same trends. This result is exactly opposite to our initial expectation that because of a slowdown in the momentum towards improved coordination of planning within COMECON in the late 1970s\textsuperscript{39}, Soviet IIT with COMECON would increase as a result of unsuccessful implementation of the 'Complex Programme'.

One possible explanation of the downward trend could be found in the fact that, as a result of the decline in East-West trade since late 1970s, many goods which had been dependent on East-West trade with lower levels of IIT have been traded increasingly within COMECON countries. Another explanation is that, as seen in Table 8, the decline of Soviet IIT with COMECON countries was led by the decline of

\textsuperscript{38} In 1971, the Complex Programme of Socialist Integration was endorsed in order to reinforce economic integration based on comparative advantage.

\textsuperscript{39} See Alan H. Smith (1983), pp. 184-196. He noted that even though further Agreed Investment Plans were to be concluded for 1981 to 1985 and for 1986 to 1990 on the basis of the Long-Term Target Programmes for five major sectors of the economy (fuel, energy and raw materials; machine-building; agriculture; transport; industrial consumer goods), the volume of investment agreed for 1981 to 1985 was minimal.
IIT in the commodity group FTN 1, i.e. machinery and equipment, that was not the main target area of the Complex Programme.

3. Intertemporal Pattern of Soviet IIT with Developed Countries

This aspect was neglected in Pelzman's paper. However, he argued implicitly that Soviet IIT with developed countries was more intense than with COMECON countries, based on the higher figures for the world than for COMECON between 1958-1973. As already mentioned in chapter III, in comparing different groups of countries, the same number of countries should be analyzed in order to eliminate any bias resulting from geographical aggregation that causes the tendency toward a higher level of IIT the more countries are considered in calculating a group average IIT level. Therefore, nine COMECON countries (Cuba, Vietnam and Mongolia, in addition to the six East European countries) are compared with nine developed countries (Belgium and The Netherlands in addition to the "G7" countries). From this normalized comparison we obtained a result that is diametrically opposed to what could be inferred from Pelzman's paper. Surprisingly enough, the average level of Soviet IIT with developed countries is much lower than with COMECON countries (in 1985 the weighted B index in trade with developed countries is only 3.3 per cent while the index is 20 per cent in trade with COMECON countries). This result is consistent with the empirical finding in Chapter IV, where the Market Economy Dummy has a negative and significant sign along with a
significantly positive coefficient of the Integration dummy variable.\textsuperscript{40}

On the other hand, Soviet IIT with developed countries did not experience any significant change during this period, because all indices—$\bar{b}$, $\bar{b}$ (weighted) and $\bar{b}$ (adjusted)—remain around the level of 10, 3 and 3 per cent, respectively. Therefore, it seems that negative factors for East-West trade—for example, the 1973 oil crisis, the Soviet Union’s invasion of Afghanistan in 1979 and the 1981 declaration of marshall law in Poland—did not have any effect on Soviet IIT with developed countries during the period of 1975-1985. Contrary to the result, it might have been anticipated that the trade embargo of Western countries would have a negative impact, not only on Soviet trade in general but also on Soviet IIT.

Finally, as seen in Table 8, in Soviet trade with developed countries, FTN sections 3, 4 and 9 show a relatively high level of IIT, which may mean that in these industry groups, the Soviet economy displays supply and demand conditions similar to developed economies. However, in the section 2, Soviet IIT is generated at a very low level, which may be interpreted as evidence that, in this industry group, comparative advantage is being exploited in trade with developed countries.

\textsuperscript{40} In addition, it may be also noted that the variable PCI indicating the level of development has an insignificant coefficient, even though it is positive.
4. Intertemporal Pattern of Soviet IIT with Developing Countries

According to the general theories of IIT, the level of Soviet IIT with developing countries is expected to be low. If we consider the fact that the USSR is more similar to developing countries than developed countries in the area of foreign trade, however, an a priori prediction about the level of Soviet IIT with developing countries is not so easy to make. 41

As Dohan (1979) already pointed out, a particularly striking fact in Soviet foreign trade is the large scale of simultaneous imports and exports of basic raw materials, instead of the manufactured goods that are the main objects of IIT of developed countries. It happens due to the Soviet Union’s reexport of similar commodities. The argument is confirmed by the finding that FTN section 2 shows the highest level of IIT in trade with developing countries (see Table 8).

A large part of the Soviet reexport trade seems to arise from bilateral trading and economic arrangements with COMECON and with developing countries, which in essence places the USSR in the position of a broker. Simultaneous trade in agricultural and other products (such as lead) in the 1970’s arose from the USSR honoring long-term

41. This amounts to asking the question of whether the Linder hypothesis can be applied to trade with or between developing countries.
supply contracts with Eastern Europe, despite growing domestic shortages.

Simultaneous import and export also results from the lack of multilateralism in Soviet trade relations in a situation in which the USSR already has adequate domestic supplies of the goods available for exports, simultaneously importing similar goods from a bilateral trading partner—coal, zinc, cotton, caustic soda, and rolled metals. In this case, the USSR acts as a broker by importing the goods in payment, while exporting similar commodities to third countries—for example, importing cotton fiber and natural gas from Afghanistan and zinc from Poland.

Another similar case is the resale of commodities received in payment for earlier technical assistance to developing countries (e.g., oil from Iraq and Algeria).

Locational advantage and economizing on transportation costs is another traditional factor in Soviet "reexport" trade. For instance, natural gas imports from Iran to southern Russia and coal imports from Poland into northwest Russia belong to such trade. Also, as economic activity increases in eastern Siberia, locational advantages will become a more important factor in Soviet "reexport" trade.

This "locational advantage hypothesis" is confirmed by empirical findings of Chapter IV since the Board Dummy variable shows a positive and significant coefficient, especially in the case of $\bar{B}(\text{weighted})$ and $\bar{B}(\text{adjusted})$. 
On the other hand, as seen in the table 5, 6, and 7, Soviet IIT with developing countries is lower than with developed countries according to $\bar{B}$, whereas the weighted $\bar{B}$ index and the adjusted $\bar{B}$ index show the opposite results. One of the reasons for this discrepancy in the results seems to be that in trade with developing countries, Soviet IIT is generated in major traded goods whereas in the trade with developed countries Soviet IIT is generated in minor traded goods.

During the period of 1975-1985, in terms of the $\bar{B}$(weighted) measure, IIT with developing countries initially decreased from 13.4 per cent in 1975 to 5.8 per cent in 1980 but rebounded later to 9.0 per cent in 1985, and the simple $\bar{B}$ index and adjusted $\bar{B}$ index show the same trends.

Table 8 answers partially the question of whether there is any change in Soviet pattern of IIT with developing countries during this period, especially in the area of basic raw materials, or commodity group FTN 2 (i.e. whether there is any change in the pattern of Soviet reexport). It shows that the reexport of basic raw materials in trade with developing countries is in a downward trend.

For the same reason as in the case of Soviet IIT with developed countries, we deal with only 9 countries that are selected according to the size of total trade with the USSR in 1985—Afghanistan, India, Iraq, Syria, Egypt, Libya, Argentina, Iran and Turkey.
### Table 5

Intertemporal Pattern of Soviet IIT during 1975-85

<table>
<thead>
<tr>
<th>Country</th>
<th>$E_k$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Bulgaria</td>
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<tr>
<td>Hungary</td>
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<td>E.Germany</td>
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<td>Romania</td>
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<td>Czech.</td>
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<tr>
<td>E.European COMECON</td>
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</tr>
<tr>
<td>Non E.E.COMECON</td>
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<td>COMECON General</td>
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<td>Developed Countries</td>
<td>9.9</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>0.0</td>
</tr>
<tr>
<td>India</td>
<td>5.2</td>
</tr>
<tr>
<td>Iraq</td>
<td>0.0</td>
</tr>
<tr>
<td>Syria</td>
<td>0.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>4.1</td>
</tr>
<tr>
<td>Libya</td>
<td>0.0</td>
</tr>
<tr>
<td>Argentina</td>
<td>5.7</td>
</tr>
<tr>
<td>Iran</td>
<td>1.9</td>
</tr>
<tr>
<td>Turkey</td>
<td>3.0</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>7.8</td>
</tr>
<tr>
<td>World</td>
<td>27.7</td>
</tr>
</tbody>
</table>
Table 6
Intertemporal Pattern of Soviet IIT during 1975-85

<table>
<thead>
<tr>
<th>Country</th>
<th>$\beta_k$ (weighted) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>13.2</td>
</tr>
<tr>
<td>Hungary</td>
<td>13.8</td>
</tr>
<tr>
<td>E.Germany</td>
<td>12.6</td>
</tr>
<tr>
<td>Poland</td>
<td>19.4</td>
</tr>
<tr>
<td>Romania</td>
<td>12.8</td>
</tr>
<tr>
<td>Czech.</td>
<td>17.8</td>
</tr>
<tr>
<td>E.European COMECON</td>
<td>28.8</td>
</tr>
<tr>
<td>Cuba</td>
<td>0.3</td>
</tr>
<tr>
<td>Vietnam</td>
<td>0.3</td>
</tr>
<tr>
<td>Mongolia</td>
<td>1.3</td>
</tr>
<tr>
<td>Non E.E.COMECON</td>
<td>3.7</td>
</tr>
<tr>
<td>COMECON General</td>
<td>28.8</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>8.2</td>
</tr>
<tr>
<td>China</td>
<td>0.0</td>
</tr>
<tr>
<td>N.Korea</td>
<td>4.3</td>
</tr>
<tr>
<td>Non COMECON Socialist</td>
<td>14.4</td>
</tr>
<tr>
<td>Socialist Countries</td>
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</tr>
<tr>
<td>Canada</td>
<td>0.0</td>
</tr>
<tr>
<td>U.K.</td>
<td>5.3</td>
</tr>
<tr>
<td>Italy</td>
<td>1.7</td>
</tr>
<tr>
<td>W.Germany</td>
<td>2.8</td>
</tr>
<tr>
<td>France</td>
<td>1.8</td>
</tr>
<tr>
<td>Japan</td>
<td>0.5</td>
</tr>
<tr>
<td>USA</td>
<td>1.5</td>
</tr>
<tr>
<td>G7 Countries</td>
<td>2.8</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4.7</td>
</tr>
<tr>
<td>Developed Countries</td>
<td>3.0</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>0.0</td>
</tr>
<tr>
<td>India</td>
<td>3.0</td>
</tr>
<tr>
<td>Iraq</td>
<td>0.0</td>
</tr>
<tr>
<td>Syria</td>
<td>0.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>6.5</td>
</tr>
<tr>
<td>Libya</td>
<td>0.0</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.0</td>
</tr>
<tr>
<td>Iran</td>
<td>0.0</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.0</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>13.4</td>
</tr>
<tr>
<td>World</td>
<td>31.7</td>
</tr>
<tr>
<td>Country</td>
<td>$\bar{B}_k$ (adjusted)(%)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>13.8</td>
</tr>
<tr>
<td>Hungary</td>
<td>14.1</td>
</tr>
<tr>
<td>E.Germany</td>
<td>13.9</td>
</tr>
<tr>
<td>Poland</td>
<td>20.7</td>
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<tr>
<td>Romania</td>
<td>17.3</td>
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<tr>
<td>Czech.</td>
<td>18.8</td>
</tr>
<tr>
<td>E.European COMECON</td>
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<tr>
<td>Cuba</td>
<td>0.4</td>
</tr>
<tr>
<td>Vietnam</td>
<td>0.5</td>
</tr>
<tr>
<td>Mongolia</td>
<td>2.2</td>
</tr>
<tr>
<td>Non E.E.COMECON</td>
<td>4.1</td>
</tr>
<tr>
<td>COMECON General</td>
<td>29.3</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>9.3</td>
</tr>
<tr>
<td>China</td>
<td>0.0</td>
</tr>
<tr>
<td>N.Korea</td>
<td>4.8</td>
</tr>
<tr>
<td>Non COMECON Socialist</td>
<td>15.3</td>
</tr>
<tr>
<td>Socialist Countries</td>
<td>29.2</td>
</tr>
<tr>
<td>Canada</td>
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</tr>
<tr>
<td>U.K.</td>
<td>5.4</td>
</tr>
<tr>
<td>Italy</td>
<td>1.8</td>
</tr>
<tr>
<td>W.Germany</td>
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</tr>
<tr>
<td>France</td>
<td>2.1</td>
</tr>
<tr>
<td>Japan</td>
<td>0.6</td>
</tr>
<tr>
<td>USA</td>
<td>7.7</td>
</tr>
<tr>
<td>G7 Countries</td>
<td>3.9</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.7</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5.7</td>
</tr>
<tr>
<td>Developed Countries</td>
<td>4.0</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>0.0</td>
</tr>
<tr>
<td>India</td>
<td>4.1</td>
</tr>
<tr>
<td>Iraq</td>
<td>0.0</td>
</tr>
<tr>
<td>Syria</td>
<td>0.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>10.8</td>
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<tr>
<td>Libya</td>
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<tr>
<td>Argentina</td>
<td>0.0</td>
</tr>
<tr>
<td>Iran</td>
<td>0.0</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.0</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>19.2</td>
</tr>
<tr>
<td>World</td>
<td>35.7</td>
</tr>
</tbody>
</table>
Table 8

Soviet IIT* by Country Groups and by Industry Groups during the period of 1975–1985

<table>
<thead>
<tr>
<th>FTN 1 Digit</th>
<th>COMECON 75 80 85</th>
<th>DEVELOPED 75 80 85</th>
<th>DEVELOPING 75 80 85</th>
<th>WORLD 75 80 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Machinery &amp; Equipment</td>
<td>41 36 33</td>
<td>13 5.4 4.3</td>
<td>12 3.7 3.8</td>
<td>35 35 31</td>
</tr>
<tr>
<td>2. Fuels, Mineral raw materials, &amp; Metals</td>
<td>40 15 24</td>
<td>2.1 2.7 9.2</td>
<td>22 16 14</td>
<td>34 25 31</td>
</tr>
<tr>
<td>3. Chemical products, Fertilizers, &amp; Rubber</td>
<td>21 18 14</td>
<td>15 13 15</td>
<td>0.1 2.9 5.1</td>
<td>30 29 27</td>
</tr>
<tr>
<td>4. Construction materials &amp; components</td>
<td>14 8.1 7.6</td>
<td>7.9 6.2 14</td>
<td>1.3 1.4 0.0</td>
<td>19 16 22</td>
</tr>
<tr>
<td>5. Raw materials of vegetables &amp; animal origin(except food stuffs)</td>
<td>21 23 19</td>
<td>14 11 15</td>
<td>0.0 0.0 1.6</td>
<td>28 28 34</td>
</tr>
<tr>
<td>6. Live animals (except those for slaughter)</td>
<td>0.0 0.0 0.0</td>
<td>0.0 0.0 73</td>
<td>0.0 0.0 0.0</td>
<td>8.9 33 36</td>
</tr>
<tr>
<td>7. Raw materials for food commodities</td>
<td>13 23 25</td>
<td>2.7 0.5 0.0</td>
<td>0.2 0.3 0.5</td>
<td>9.0 2.4 2.8</td>
</tr>
<tr>
<td>8. Food commodities</td>
<td>13 8.6 20</td>
<td>0.0 21 9.2</td>
<td>6.8 1.8 8.2</td>
<td>19 18 27</td>
</tr>
<tr>
<td>9. Industrial products for mass consumption</td>
<td>17 17 16</td>
<td>10 16 18</td>
<td>9.6 9.8 11</td>
<td>28 22 21</td>
</tr>
<tr>
<td>Total</td>
<td>25 22 22</td>
<td>9.9 9.8 11</td>
<td>7.8 5.1 5.7</td>
<td>28 25 26</td>
</tr>
</tbody>
</table>

* measured by \( \bar{E}_{jk} \) simple average within the j group industry.
CHAPTER VI

CONCLUSION

This dissertation has analyzed the Intra-Industry Trade model as it applies to Soviet foreign trade. In order to explain the unique pattern of Soviet Intra-Industry Trade, and because none of the previous studies tried to explain systematically the sources of Soviet Intra-Industry Trade, a model or conceptual framework for a planned economy like the Soviet was established. The basic assumptions of the model are (i) that centralized economic planning itself deters Intra-Industry Trade, and (ii) that planning failure/ resort to market forces, on the other hand, encourages Intra-Industry Trade in some cases: discourages in other cases; and encourages both Intra- and Inter-Industry Trade in still other cases, finally (iii) that planned use of market discourages Intra-Industry Trade. From these basic assumptions, four new hypotheses unique to planned economies were derived and three of them were tested by two different regression equations set up to explain the country-specific and industry-specific characteristics, respectively of Soviet Intra-Industry Trade. Eight other hypotheses common to both market economies and planned economies were also tested.
As far as the cross-country analysis is concerned, the main conclusions are as follows:

First, the level of Soviet IIT is determined predominantly by the integration factor (i.e. whether the Soviet Union conducts trade with COMECON countries, or non-COMECON countries),

Second, the level of Soviet IIT is higher in trade with COMECON countries than with non-COMECON countries, which directly contradicts the argument of Pelzman's previous study.

Third, independent variables for explaining cross country determinants of Soviet IIT show different statistical significance depending upon which indices are used as the dependent variable, except for Integration Dummy Variable.

Fourth, independent variables derived from general IIT theories explain Soviet IIT better than the variable unique to planned economies (i.e. Market Economy Dummy) in terms of significance level.

As far as the cross-industry analysis is concerned, on the other hand, it can be concluded that Soviet IIT primarily involves 1) trade in differentiated goods or products for which it is more difficult to calculate efficiency in foreign trade planning, as reflected by the positive coefficient of the Product Differentiation variable, and 2) trade in the goods that are more easily subject to plan failure or intermediate goods, as reflected by the negative coefficient of Consumer Goods Ratio.
These findings enable us to conclude that Soviet IIT appears to be explained relatively well by the determinants similar to those of market economies' IIT.

One of the striking empirical findings of this dissertation, and one of the contributions it makes to the existing literature, is the fact that the level of IIT for the Soviet Union has diminished from 1975 to 1985. Previous literature concludes that the level of IIT has gradually increased in market economies during the postwar period.

The unique aspect of the methodology of the dissertation lies in the fact that in order to eliminate effects of geographical aggregation which appeared to be more evident in the Soviet case, the same number of countries are selected for comparison between country groups in the documentary study. The conclusion from this group comparison is consistent with the results of more rigorous regression analyses.

For a dependent variable in regression analysis, the Grubel-Lloyd index $B_j$ is calculated from the Soviet raw data for three selected years. The model is tested by analyzing bilateral cross-country hypotheses for thirty countries and cross-industry hypotheses for 182 industries using regression methods, respectively. This methodological aspect suggests several inherent limitations of the dissertation:

First, the small sample size for the country study could lead us to question the reliability of the results. Thus, a future study
using a larger sample size would be beneficial. The simultaneous analysis of country study and industry study would also be an alternative.

Second, the time-series study of the Soviet IIT could produce more reliable results by extending covered years beyond the three representative years selected.

Thirdly, if more recent data of the Soviet input-output tables had been available, more reliable result of cross-industry analysis could have been obtained.

Fourth, and more importantly, the basic question of to what extent the Soviet raw data that this study is based on can reflect the true demand-supply relations of the Soviet economy remains controversial.

Finally, some important aspects of Soviet IIT, such as the significance of the reexport of primary products and geographical aggregation or industrial cooperation with COMECON and developed countries of a form similar to multinational corporations in the West, were omitted in the regression analyses due mainly to deficiency of data and the proxy problem.

Despite these limitations, the study complements the conclusion of Rosefielde (1973) that Soviet foreign trade planning has succeeded in achieving Heckscher-Ohlin consistent results in the sense that the average level of Soviet IIT remains low relative to that of market economies. But the study also provides evidence
against his conclusion to the extent that the average level of Soviet IIT (about 30 per cent) is not low at all in absolute magnitude.

It may be argued that the dissertation has made contributions not only to comparative applied economics in the Soviet area with respect to theory, measurement and empirical evidence but also to the policy analysis of Soviet foreign trade, a subject with which this dissertation did not concern itself. It now appears likely that the Soviet economy will move to one degree or another toward a market-oriented economy, in which case foreign economic relations can be expected to play a more important role and COMECON will have different characteristics. If this prospect turns out to be correct, then the application of Intra-Industry Trade model to Soviet trade will be even more justified in the future than today.
APPENDIX A

A Table Relevant to Chapter II
Table 9

Intra Customs Union IIT by SITC for Selected EEC and COMECON Countries 1977

<table>
<thead>
<tr>
<th>SITC section</th>
<th>Bel./Lux.</th>
<th>France</th>
<th>Italy</th>
<th>Netherlands</th>
<th>U.K. West</th>
<th>EEC Germ. average</th>
<th>Czecho-Slovakia</th>
<th>Hungary</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>74</td>
<td>72</td>
<td>60</td>
<td>68</td>
<td>80</td>
<td>73</td>
<td>71</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>73</td>
<td>58</td>
<td>68</td>
<td>70</td>
<td>78</td>
<td>69</td>
<td>47</td>
</tr>
<tr>
<td>7</td>
<td>74</td>
<td>82</td>
<td>80</td>
<td>67</td>
<td>76</td>
<td>65</td>
<td>74</td>
<td>66</td>
</tr>
<tr>
<td>8</td>
<td>60</td>
<td>72</td>
<td>38</td>
<td>64</td>
<td>73</td>
<td>72</td>
<td>52</td>
<td>63</td>
</tr>
<tr>
<td>5-8</td>
<td>68</td>
<td>75</td>
<td>59</td>
<td>67</td>
<td>75</td>
<td>72</td>
<td>66</td>
<td>55</td>
</tr>
</tbody>
</table>


Note: Simple unweighted $B_j$ indices are calculated at the 3 digit of each SITC section used.
APPENDIX B

A Table Relevant to Chapter IV
Table 10
Determinants of U.S. Intra-Industry Trade

<table>
<thead>
<tr>
<th>Equation</th>
<th>Intercept</th>
<th>SDI</th>
<th>CGR</th>
<th>IR</th>
<th>KLR</th>
<th>MPS</th>
<th>lnDS</th>
<th>FFCR</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1a)</td>
<td>0.46</td>
<td>-0.309</td>
<td>0.138</td>
<td>-0.026</td>
<td>-0.002</td>
<td>0.19</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.63)</td>
<td>(-4.34)</td>
<td>(1.34)</td>
<td>(-2.77)</td>
<td>(-0.90)</td>
<td>(2.13)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1b)</td>
<td>0.46</td>
<td>-0.216</td>
<td>0.092</td>
<td>-0.029</td>
<td>-0.0002</td>
<td>0.17</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.49)</td>
<td>(-3.66)</td>
<td>(0.85)</td>
<td>(-2.91)</td>
<td>(-0.72)</td>
<td>(1.99)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1c)</td>
<td>0.01</td>
<td>-0.292</td>
<td>0.145</td>
<td>-0.033</td>
<td>-0.0008</td>
<td>0.060</td>
<td>0.33</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(-4.17)</td>
<td>(1.44)</td>
<td>(-3.44)</td>
<td>(-2.80)</td>
<td>(3.47)</td>
<td>(3.49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1d)</td>
<td>0.01</td>
<td>-0.258</td>
<td>0.100</td>
<td>-0.008</td>
<td>0.049</td>
<td>0.23</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(-3.66)</td>
<td>(2.19)</td>
<td>(-2.47)</td>
<td>(2.81)</td>
<td>(2.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Notes:  

a Dependent variable is 2 \( \min \left( x_i, m_i \right) / \left( x_i + m_i \right) \) from 314 U.S. four digit S.I.C. industries, and 1972 U.S. imports \( m_i \) and exports \( x_i \).

b t-statistics in parentheses.

c SDI: Sectoral Dispersion Index  
CGR: Consumer Goods Ratio  
IR: Inventory Ratio  
KLR: Capital Labor Ratio  
MPS: Midpoint Plant Shipments  
lnDS: \( \ln(\text{Domestic Shipments}) \)  
FFCR: Four-Firm Concentration Ratio
APPENDIX C

A Table Relevant to Chapter IV and V
### Table 11
Cross Section Soviet IIT by Major Country Groups in 1985
(selected three digit FTN)

<table>
<thead>
<tr>
<th>FTN</th>
<th>Industry</th>
<th>COM</th>
<th>DED</th>
<th>DNG</th>
<th>WORLD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Metal-cutting machine tools &amp; spare parts</td>
<td>31.6</td>
<td>9.7</td>
<td>58.9</td>
<td>26.3</td>
</tr>
<tr>
<td>110</td>
<td>Power equipment</td>
<td>70.2</td>
<td>12.1</td>
<td>0.0</td>
<td>58.1</td>
</tr>
<tr>
<td>121</td>
<td>Crushing, grinding &amp; concentrating equipment</td>
<td>40.7</td>
<td>0.5</td>
<td>0.0</td>
<td>40.7</td>
</tr>
<tr>
<td>128</td>
<td>Oil-drilling equipment</td>
<td>83.4</td>
<td>0.0</td>
<td>0.0</td>
<td>69.1</td>
</tr>
<tr>
<td>153</td>
<td>Equipment for the building-materials industry</td>
<td>50.8</td>
<td>0.0</td>
<td>0.0</td>
<td>44.4</td>
</tr>
<tr>
<td>154</td>
<td>Excavators &amp; road building equipment</td>
<td>97.6</td>
<td>0.0</td>
<td>0.0</td>
<td>72.5</td>
</tr>
<tr>
<td>174</td>
<td>Instrument</td>
<td>41.5</td>
<td>27.1</td>
<td>0.0</td>
<td>96.2</td>
</tr>
<tr>
<td>180</td>
<td>Tractors &amp; spare parts</td>
<td>1.9</td>
<td>0.0</td>
<td>0.0</td>
<td>5.3</td>
</tr>
<tr>
<td>191</td>
<td>Motor transport &amp; garage equipment</td>
<td>62.9</td>
<td>0.1</td>
<td>0.5</td>
<td>71.9</td>
</tr>
<tr>
<td>200</td>
<td>Hard coal</td>
<td>0.0</td>
<td>0.0</td>
<td>28.1</td>
<td>25.2</td>
</tr>
<tr>
<td>266</td>
<td>Pipes</td>
<td>64.5</td>
<td>0.4</td>
<td>94.6</td>
<td>14.8</td>
</tr>
<tr>
<td>304</td>
<td>Plastics &amp; materials for production of plastics</td>
<td>96.7</td>
<td>25.8</td>
<td>0.0</td>
<td>6.1</td>
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*B	ext{COM} : IIT index in trade withCOMECON countries
B	ext{DED} : IIT index in trade with developed countries
B	ext{DNG} : IIT index in trade with developing countries
B	ext{WORLD} : IIT index with the world
* More detailed data by industry and country in three years are available upon request to the author.
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