

The Compositional Cohesion of the "Four Tiger's" Export Drive to the United States

Mitchell H. Kellman*

The unprecedented trade deficit in the U.S. balance of trade coupled with the persistent and lingering recession in the U.S., has seen a marked increase in protectionist sentiment in that country. The coincidence of the recent resurgence of exports from Korea, Taiwan, Hong Kong, and Singapore to the U.S. during this period has seemingly directed this "new protectionist" sentiment against the NIC Pacific Basin exporters. To some extent, there exists a perception that these countries are acting in tandem in promoting a unified "assault" on U.S. markets.

This paper examines the empirical basis for this perception. No statistical support was found for compositional homogeneity at the overall trade level. That is, these exporters tended to differ one from the other in a statistically significant manner in the product composition of their U.S.-bound exports. However, for sophisticated machinery, and products embodying a high R&D content, the homogeneity hypothesis was statistically supported. This leads one to examine further the effects of (U.S. owned) multinational corporations on inter-Pacific Basin exporters' export-compositional similarities.

I. Introduction

The past decade has been characterized by a resurgence of protectionist sentiment in the United States, as well as in the rest of the O.E.C.D. Much of the impetus for this development has been the fairly spectacular success of the New Industrial Countries (N.I.C.'s) in rapidly expanding their market shares in a fairly broad range of manufactured exports. This has been especially notable in the case of the so called "Gang of Four", or "Four Tigers" - South Korea, Taiwan, Hong Kong, and Singapore

* Department of International Economics, The City College of The City University of New York, U.S.A.

(henceforth "N.I.C.'s). The following table documents this increase in revealed competitiveness, as indicated by shares of all manufactured imports into the U.S. from 1965 to 1983.

TABLE 1 Shares of "Four Tigers" in U.S. Manufactured Import Market, 1965 to 1983*

	1965	1970	1975	1980	1983
	3.6	6.8	9.4	13.4	16.5

* Source : O.E.C.D. Series C, Trade by Commodities

The rapid gains documented in the above table have led to a widely held perception of an "invasion" of our markets by low-wage N.I.C. producers. While it is true that the share of the N.I.C.'s in general, and in particular, the "Four Tigers" in total world production and trade is still very small¹, the very rapid market penetration indicated in the above table has translated into fairly large market shares in particular markets. In the U.S., their share of all Traditional manufactured products² increased from 13.3% in 1965 to 43.4% in 1983. Not surprisingly, this "invasion" has evoked resistance. The demands for a cessation of the Generalized System of Preferences, a tightening up of the L.T.A., the placement of outright quotas on steel imports etc. have reached such a crescendo during the 1970's so as to have indicated to some the heralding in a new protectionist era in U.S. commercial international policy, reversing G.A.T.T. rounds, culminating in the Tokyo Round.

It is especially during periods of economic slowdown that trends become threats. The hapless 1970's, opening with the (Viet nam-War related) double-digit inflation, followed by the OPEC. I related world recession of the mid 70's, and ending with (again) energy-price related recession, has provided fertile ground for the acceptance and spread of the perception of a unified super export drive by The N.I.C.'s; building up to tidal wave proportions, about to inundate the manufacturing base of the Industrial World.

This paper explores the proposition that the N.I.C.'s in general, and the east Asian "Four Tigers" in particular, tend to act in a uniform manner in their export drives to the United States market. The tested hypothesis may be stated as follows. The manner in which the manufactured exports from each of the N.I.C.'s tend to penetrate the U. S. market reacts to changes in total U.S. income, and to changes in productive capacity

1. Lasserre, P., 1981, p.36

2. The commodity composition of each Product Group referred to in the text, or in tables are detailed in Appendix I.A. in Kellman and Carney, 1981, pp. 5-10.

in the individual exporters in a quantitatively similar manner.

If this proposition can be shown to be true, the implications are fairly wide ranging. A period of recovery and rapid economic growth in the United States will be expected to lead to an "explosion" of manufactured imports originating from the N.I.C.'s (or the "Four Tigers") as a whole, since they would all tend to expand their U.S. destined exports in tandem. Similarly, a recession in the U.S. would tend to have a broad gauge and similar depressing effect on N.I.C. exports in general.

A further implication of such a finding is that if indeed the structure underlying and explaining N.I.C. exports to the U.S. can be demonstrated to be uniform, then the application of product-specific Quantitative Restrictions, or tariffs (or alternatively the granting of product-specific preferences) should, in a practical sense, have a non-discriminatory effect. That is, such policies will tend to affect the exports of the various N.I.C.'s similarly, rather than constituting an especial burden (or bonus) for one or another of these countries.

A priori, one would expect not to find such a degree of statistical homogeneity, since the various N.I.C.'s tend to export different commodity mixes. This may be seen in the following set of tables :

TABLE 2a Commodity Composition of Four Tiger Manufactured
Exports to the United-States 1965

Products	(%)			
	Singapore	Hong Kong	S. Korea	Taiwan
Traditional	74.6	84.7	61.8	48.1
-Textiles	13.5	8.2	14.5	13.1
-Clothing	60.6	38.0	33.1	22.4
-Consumer Goods	0.4	38.4	14.2	12.6
Intermediate	20.1	1.3	34.7	40.6
Capital Goods	2.4	5.3	0.6	0.5
-Instruments	0.0	0.5	0.1	0.1
Raw Material Intensive	0.6	1.7	1.3	2.2
Non-Ferrous Metals	2.2	0.0	0.0	0.6

TABLE 2b Commodity Composition of Four Tiger Manufactured Exports to the United-States 1979

Products	(%)			
	Singapore	Hong Kong	S. Korea	Taiwan
Traditional	14.3	69.3	48.1	53.2
-Textiles	1.3	2.8	2.2	1.6
-Clothing	9.2	40.3	33.1	32.7
-Consumer Goods	3.8	26.3	33.1	18.9
Intermediate	0.8	1.0	14.3	6.3
Capital Goods	42.9	4.1	11.3	8.3
R&D Intensive	34.3	23.4	18.9	24.7
-Chemicals	0.0	0.0	0.1	0.8
-Pharmaceuticals	0.0	0.0	0.0	0.0
-Machinery	32.5	15.4	16.9	20.5
-Instruments	1.8	8.0	1.8	3.4
Raw Material Intensive	0.9	2.1	7.1	7.4
Non-Ferrous Metals	6.7	0.1	0.2	0.1

II. The Empirical Test

The conceptual test chosen hypothesizes that manufactured exports from the N.I.C.'s to the United States are determined, by a common underlying structural mechanism. The mechanism may be thought of as consisting of a modified Keynesian framework in which imports are a function of national income ; as well as a function of the national income of the exporter. While the former part of this specification is quite standard³, the latter may require some justification. In the case of poor, developing countries, the capacity of the manufacturing sector may at any point in time constitute a barrier

3. The empirical literature abounds with examples of (variants) of this specification, explaining trade flows (either totally or primarily) in terms of levels of national income. The voluminous literature testing the Linder Hypothesis (e.g. Kennedy and Mchugh, 1983) relate bilateral trade vectors to levels of percapita income in both trade partners. The even more voluminous literature dealing with the estimates of price and income elasticities of world trade flows, pioneered by Houthakker and Magee (1969) typically relates trade vectors to price and an income variable. Generally, while the income variable is consistently correct in sign and statistically significant, this is not typically true of the price variable (e.g. see summary table in E. Phaup (1981)). A further example of this typical specification is in Leamer and Stern (1960), Equation 6-1, p.149 and in Chenery 1960), p. 634.

to further expansion of manufactured exports at that time. Another theoretical explanation for the inclusion of this variable (the Gross Domestic Product of the exporting country) is the operation of the taste-similarity (Linder) hypothesis. Here, as per capital incomes of two economies become more similar over time, opportunities for profitable trade between them are created. Since all N.I.C.'s are poorer than the United States, an expansion of their National Income should tend to increase the taste overlap associated with the representative demands in both exporters (N.I.C.'s) and the importer (the U. S.).

The model tested is the following :

$$\text{Log}(X_{i,u.s.}) = a + b_1 \text{Log}(GDP_i) + b_2 \text{Log}(GDP_{u.s.})$$

Where X is the value of manufactured exports in constant U.S. dollars from (N.I.C.) country to the United States.

The model is estimated both as unrestricted time-series for each of the seven N.I.C.'s for the 1970's (1968-1977) and in the context of a pooled cross-country time series specification. In general, if the computer F-Statistic does not exceed the tabulated value, with proper degrees of freedom, then the null hypothesis may be accepted, and the pooling is legitimate.⁴ the statistical hypothesis then implies that the various exporting countries are from the same population and may be viewed as a single group.

Given the specification, the first task is to choose a proper estimating technique. The first step was to estimate over the period 1968 to 1977 each country's parameters separately ; using ordinary least squares (in logs).

The results are in the following table ; the figures in parenthesis are t_2 Statistics.

TABLE 3
Estimated Parameters from Unrestricted
O.L.S., 1968 to 1977

	b1	b2	D.W.	\bar{R}^2
Hong Kong	3.78 (0.82)	-15.99 (1.79)	1.20	.94
S. Korea	-1.81 (0.70)	-3.03 (0.51)	1.02	.91
Singapore	1.83 (0.81)	-8.63 (1.71)	0.89	.68
Taiwan	4.18 (1.30)	1.52 (0.22)	0.63	.90

4. See Maddala, *Econometrics*, Chapter 14 for detailed description of the test.

The low Durban-watson (D.W.) statistics suggest the presence of positive serial correlation in each of the seven country-series, which, in turn, implies that the resultant coefficients are inaccurate estimates. In order to correct for the serial correlation, each regression was reestimated using a first and second order autocorrelation (GLS) correction. The Durban-Watson statistic associated with each set of estimates are given below in table 4:

TABLE 4
Durban-Watson Statistics from
Individual Country Regressions

Country	OLS	GLS with First Order Autocorrelation Correction	GLS with Second Order Autocorrelation Correction
Hong Kong	1.20	1.20	1.96
S. Korea	1.02	1.15	1.83
Singapore	0.89	1.08	2.03
Taiwan	0.63	1.15	1.98

From the results summarized in Table 4, there was a clear improvement in the accuracy of the estimated parameters when a generalized least square procedure with a second order autocorrelation correction was applied. The Durban Watson Statistics suggest that the bias associated with serial correlation is not serious when this estimated procedure is utilized. It was therefore decided to choose a pooling technique which corrects for second order serial correlation—the "Kmenta" pooling technique.⁵

The results are in the following tables:

TABLE 5
Estimated Parameters from Pooled Least Squares
With Second Order Autocorrelation Correction

b_1	b_2	\bar{R}^2
0.63	8.57	.992
(5.80)	(1.43)	

The figures in parenthesis are t statistics

5. This technique is described in Jan Kmenta's text, *Elements of Econometrics* section 12.2 It provides GLS estimates by correcting both for second order autocorrelation and for correlation among categories (in this case, countries). The basic idea is to use OLS for each category to get preliminary estimates. The resultant residuals are used to compute p . Then the original variables are nsformen transformed as in the Cochrane-Orcutt approach:

$$X_{it} = X_{it} - P_2 X_{i,t-2}$$

The findings indicated that during the 1970's, every 10% increase in the N.I.C.'s real Gross Domestic product was associated with a 6% increase in their exports to the U. S., while each 10% increase in the U.S.'s real GDP was associated with an 86% increase in these exports. While this last figure may seem high, it is reasonable, since during this relatively stagnant period for the U.S. economy, the "Four Tigers" succeeded in substantially enlarging their share of the U.S. import-market. Thus, this model which explains real manufactures, this model which explains real manufactured exports from the N.I.C.'s to the U.S. in terms of the expansion of both the U.S. market, and the productive capacities of the N.I.C.'s appears good. The coefficients are significantly positive export flows are left unexplained. For the purpose of examining the structural homogeneity of the N.I.C.'s as a single group, the model would appear to be quite reasonable.

The question explored here is to what extent are the results summarized in the equation above, typical and representative of those pertaining to each of the N.I.C.'s in our sample. This was examined by applying an F-test to the sum of squared residuals from the pooled model and to the individual country (unrestricted) regressions.

The following test was applied :

- Let D = Number of countries
 N = Number of observations in each country
 KU = Number of independent variables in each individual category (including the constant)
 KP = The number of independent variables in the pooled regression.

Then DFU = The number of degrees of freedom of each country regression = $D * (N - KU)$

DFR = The number of additional restrictions in pooling = $D * KU - KP$

$SSRP$ = Sum of Squared Residuals of pooled regressions.

$SSRU$ = Sum of SSR's of each country regression

and

$F = ((SSRP - SSRU) / DFR) (SSRU / DFU)$

Critical $F = 3.23$

The calculated value of $F = 8.25$. Therefore it was concluded that the export drives of the four exporters did not respond in unison to the macroeconomic, cyclical impetus of either the U.S. market demand, or the newly created productive capacities of their respective economies.

III. Traditional Versus High—Technology Product Categories

It was found in the previous section that one could not reject the hypothesis that each of the N.I.C.'s exports to the U.S. reacted to economic cyclical patterns in a non-uniform, exporter-specific manner. It is still possible, however, that inter-N.I.C. homogeneity may apply for certain product categories.

On the one hand, the country-specific heterogeneity in export reactions could primarily reflect differences in commodity compositions in the respective export bundles. In such a case, it may be that exports of specific product groups do tend to react in a homogeneous fashion. In order to explore the applicability of this situation, the exports of each of the N.I.C.'s were divided into several product groups.

The F-test comparing the results from the pooled regression to those of the individual country, unrestricted estimates made for each of the product groups (for each respective exporter) are presented in the following tables :

TABLE 6 F-Statistics for Selected Product Groups

Product Groups	F-Statistic
Traditional Goods	28.90
-Textiles	22.28
-Clothing	12.73
-Consumer Goods	10.44
R & D Intensive Goods	0.97
Machinery	1.36

The results are quite interesting. The exporter-specific peculiarities in export reactions to economic cyclical conditions are seen to primarily reflect the traditional, labor intensive commodities—textiles, clothing and consumer goods. Since in fact these goods currently constitute the bulk of N.I.C. exports, the heterogeneity found to characterize this group of products is certainly sufficient to explain the results documented in the earlier section.

The most interesting part of these findings, however, are those associated with the "high-technology" spectrum of products. Here the hypothesis of all—N.I.C. uniformity cannot be rejected. That is, the expansion of exports of these products tended to respond to both changing macroeconomic stimuli (in both exporter's and importer's markets) in a statistically similar manner.

As may be noted from Tables 2a and 2b above, these export categories are the most

rapidly growing ones in the N.I.C.'s. It has been noted elsewhere that the shift of labor intensive, traditional manufactures away from the Asian N.I.C.'s in favor of the poorer (lower wage) ASEAN countries is expected to continue and accelerate during the next decade. An examination of the actual shares in the U.S. import markets in Tables 7 below in fact clearly supports the statement that the greatest share gains for the N.I.C.'s are indeed in the less traditional range of products, and that this trend has been a steady one :

TABLE 7 "Four Tigers" 'Shares of United-States' Import Market 1970 to 1980 (%)

1970	1974	1975	1976	1977	1980
All Products					
6.8	9.5	9.4	12.0	12.3	13.4
Traditional Products					
22.5	30.2	33.1	39.1	39.4	43.3
Capital Goods					
2.0	4.1	3.2	3.9	4.2	4.6
R & D Intensive Goods					
5.2	11.5	9.8	12.0	13.4	15.0

An examination of the tables above indicate the persistent manner in which these N.I.C.'s have successfully penetrated the U.S. market for manufacturers at the expense (primarily) of O.E.C.D. exporters. While the greatest shares are still in the traditional, labor intensive products ; the trend is clearly away from this group of products. Thus, presently available data indicate that the market shares of the Four Tigers in traditional goods remained flat through 1983. On the other hand, their respective market shares in capital goods and in goods intensive in R&D continued their rapid climb throughout the OPEC I recession of the early 1980's. This was in marked contrast to the OPEC I recession of the mid 1970's when the intensified export efforts of the O.E.C.D. exporters temporarily decreased the import-market share growth. Thus, the N.I.C. export drive in these more sophisticated groups of products has become more recession-proof.

The implications of these findings is that the export behavior of the N.I.C.'s, viewed from the perspective of the United States, will become more unified. That is, it will become more and more true that as the shift to more sophisticated, high value added, "product-cycle" exports continues in these countries, their collective behavior will more closely approximate " typical or representative behavior.

It is tempting to offer a tentative explanation of the phenomenon observed. Two

explanations come to mind. First, the LTA and other restrictive trade arrangements have focused primarily on the low-wage, traditional product spectrum. This may have tended to affect the exports of these products from each N.I.C., depending upon the relative severity of the administrative restrictions upon the export potential of each. On the other hand, the "high-technology" spectrum has not (yet) been seriously affected by "voluntary agreements" and other various QR's ; so that the N.I.C.'s (both the resident multinational corporations and the local firms) tended to uniformly avail themselves of universally available state of the art technological developments.

The findings support the hypothesis that the international transfer of technology tends to be of higher order of magnitude in high-technology industries, than in others—including the "footloose" industries such as typify textile manufacture. Such a high degree international factor mobility would tend to nullify the applicability of the Heckscher-Ohlin-Samuelson, factor-cost based explanation of the structure of international trade.

IV. Conclusion

The manner in which manufactured exports from the New Industrializing Countries to the U.S. reacted to changes in basic demand trends in the U.S. and to expanding productive capacities within the developing countries themselves was dominated by exporter-specific individual country peculiarities. This was found to reflect primarily exports of the low-wage, labor intensive traditional commodities, suggesting that those exports were especially affected by administrative structural rigidities, which precluded rapid and flexible quantity adjustments to changing economic opportunities and conditions. Hence, the response elicited from each of the N.I.C.'s traditional exports to the recovery in the U.S. from the mid 1970's recession differed markedly from on N.I.C. to the next.

On the other hand, a high degree of inter N.I.C. uniformity was found in the case of the exports of R&D intensive, and capital goods. For these goods, the quantity response to changing economic climates associated with the cyclical performance of the U.S. economy, tended not to differ from one N.I.C. to another. This suggests both that the technology utilized in each was similar ; and that the industries producing these goods in the N.I.C.'s were behaving in a competitive way, flexibility shifting resources in rapid response to changing price conditions, both domestically and abroad. The only other reasonable explanation of the high degree of inter-country homogeneity found, is to assume a high level of collusive behavior between the high-tech producers in the

various N.I.C.'s.

It would seem that, as the weight of these products continue to increase in the export bundle of the N.I.C.'s, the choice of technology and the choice of location of respective productive functions within and among the N.I.C.'s, will tend to less and less be affected by relative primary factor availabilities (and costs). This follows from the observation that although the various N.I.C.'s do indeed differ greatly among themselves in relative factor availabilities (labor/land, and capital/labor in S. Korea vs Singapore), nevertheless shifts in the U.S. aggregate demand elicited similar supply responses in these countries.

These findings suggest that once some minimal level of human-capital stock is attained—a threshold presumably attained by the N.I.C.'s—supply side frictions tend to lose their effects in slowing down or preventing the introduction (by either multinational or domestic firms) of the latest and most efficient technologies. Thus the "high-tech", R & D intensive industries will increasingly become the new "super footloose" industries in the developing world.

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Appendix *Patterns and Determinants of Manufactured Export Success of the New Industrialized countries: The commodity Composition of the Export Product Groups*
(from M.Kellman and R. Carney)

The data observations are in \$1000 U.S. They are organized at the three digit S.I. T.C. codes and the descriptions for each product group.

Traditional Goods :

-Textiles :

- 651 Textiles Yarn and Thread
- 652 Cotton Fabrics, Woven
- 653 Textiles Fabrics, Woven. Other than Cotton
- 654 Tulle, Lace Embroidery
- 655 Special Textile Fabrics
- 656 Made Up Articles, Chiefly of Textile Materials
- 657 Floor Coverings

-Clothing :

- 841 Clothing (Except Fur)
- 842 Fur Clothing
- 851 Footwear

-Consumer Goods :

- 553 Perfumery and Cosmetics
- 554 Soaps
- 696 Cultery
- 821 Furniture
- 831 Travel Goods
- 891 Musical Instruments
- 892 Printed Matter
- 893 Articles of Artificial Plastic
- 894 Toys
- 895 Office Supplies
- 897 Jewelery
- 899 Manufactured Articles, N.E.S.

Intermediate Goods :

- 512 Organic Chemicals
- 521 Mineral Tar
- 531 Synthetic Organic Dyestuffs
- 533 Paints

- 551 Essential Oils
- 561 Fertilizers, Manufactured
- 599 Chemical Products, N.E.S.
- 611 Leather
- 631 Plywood Boards
- 641 Paper
- 661 Cement
- 662 Clay Construction Materials
- 664 Glass
- 671 Pig Iron
- 672 Ingots of Iron and Steel
- 673 Iron and Steel Bars
- 674 Universals, Plates and Sheets of Iron or Steel
- 675 Strips of Iron or Steel
- 676 Rails
- 677 Iron and Steel Wire
- 678 Pipes and Fittings
- 679 Castings
- 812 Plumbing Fixtures
- Capital Goods :
 - 712 Agricultural Machinery
 - 715 Metalworking Machinery
 - 717 Textile and Leather Machinery
 - 718 Machines for Special Industries
 - 719 Machinery, N.E.S.
 - 729 Other Electrical Machinery
- Transportation Equipment
 - 731 Railway Vehicles
 - 732 Road Motor Vehicles
 - 733 Road Vehicles, N.E.S.
 - 735 Ships
- R&D Intensive Products
 - Chemicals
 - 513 Inorganic Chemicals
 - 514 Other Inorganic Chemicals
 - 581 Plactic Materials
 - 571 Explosives

862 Photographic Supplies

-Pharmaceuticals

541 Medicinal Products

-Machinery

711 Power Generating Machinery

714 Office Machines

722 Electric Power Machinery

723 Equipment for Distributing Electricity

724 Telecommunication Equipment

725 Domestic Electrical Equipment

716 Medical Electrical Apparatus

734 Aircraft

-Instruments

861 Scientific Instruments

864 Watches and Clocks

Raw Material Products

612 Manufacturers of Leather

613 Fur Skins

629 Articles of Rubber

632 Wood Manufactures

642 Articles Made of paper

663 Mineral Manufactures, N.E.S.

665 Glassware

666 Pottery

691 Finished Structural Parts, N.E.S.

692 Metal Containers

693 Wire Products

694 Nails

695 Hand Tools

698 Metal Manufactures, N.E.S.

Non-Ferrous Metals

681 Silver

682 Copper

683 Nickel

684 Aluminum

685 Lead

686 Zinc

- 687 Tin
- 688 Uranium
- 689 Miscellaneous Non-Ferrous Base Metals