AN EMPIRICAL TEST OF COMPETİTİVENESS FOR AN INDUSTRIALIZED COUNTRY : CANADA*

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1. Introduction

A new economic order is taking place. It started in the 1970s and has accelerated in the 1980s, more so with the demise of the Soviet economies. During this period, economies in the Far East generally, and Japan especially, have witnessed unprecedented rates of economic growth, while the old, established industrial countries in the West have, by comparison, stagnated. The old mass production techno-economic paradigm has already been started to be replaced with the new information technology in some high-technology sectors such as computers and microelectronics.

Canadian economy has been one of the most rapidly growing economy during the last a couple of decades although the relative manufacturing competitiveness of the country decreased vis-a-vis all countries including the United States since 1982/83. Because, relative unit labor costs unexpectedly rose between 1980-1983. This reflected a strong appreciation of the Canadian currency against non-dollar currencies even though it depreciated against the U.S dollar, which resulted a small loss of competitiveness vis -a- vis other countries including the United States. From 1983 to early 1986, this development was partially reversed and therefore relative labor costs started falling with the improvements in competitiveness, but continuoing loss of the third countries in the United States market still continued. From 1986 since the Canadian dollar began to rise against the U.S. dollar, the loss of competitiveness against the United States (not the other trade partners) again continued.

Canadian cost competitiveness has deteriorated since the mid of 1980s, relative unit labor costs and relative export prices have begun to rise. It resulted an appreciation of the Canadian dollar with a slower productivity growth and relatively more wage increases.

The practical problem is that almost 40 percent of (manufacturing) export of the country are automobile or auto parts and 90 percent of which are exported to the United

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States. As the United States demand for the Canadian car exports increase, the prices of Canadian commodities for export will increase, and this will of course result a highly appreciated exchange rate (Canadian dollar). If we add the world commodity price boom in the international markets, this will deteriorate the profit margins in the manufacturing sector an eventually crowd-out the manufactured doods. We sould keep in mind that, these problems are not on a dangerous level for the country, but just a caution that need to be taken seriously.

The new technologies have ushered in the institution of market globalization, and economies that are able to take advantage of these trends will be the successful ones. The question that arises now is: Does such globalization help the Canadian economy? Even though the U.S. economy has slowed down in the recent decades, it has still remained the world largest market. The argument follows that for any economy to succeed in the near future, it is necessary that it is able to compete well in this large U.S. market. The question for the Canadian economy then becomes: Is it competitive, in terms of the new technology goods, in the U.S. market? This paper attempts to answer this question.

2. Techno-Economic Paradigms: Old and New

A consensus is growing that there is a radical change in the industrial function. Some argue about the emergence of the Third Wave , others talk about the era of the Great Divide , still others theorize in terms of the techno-economic paradigms . The basic premise of all these theses is the same. In the last two decades, a substantial change has taken place that involves technology in an essential way. "The narrowest of these theses argue that a new techno-economic paradigm comes into being when the following three conditions are satisfied:(1) the price of the basic element in the new technology starts to fall continuously;(2) there is an ample supply of this element so that its demand, and applications do not face bottlenecks; and (3) the technology is pervasive, in the sense that it has applications in all fields. Once these conditions are satisfied, the new technology becomes profitable and develops its own momentum through the institutionalization of the vested interests of people who gain from its growth."(4)

(1) Toffler (1980), **The Third Wave**, New York, William Morrow and Co.

(2) Piore and Sabel (1984), **The Second Industrial Divide: Possibilities for Prosperity**, New York, Basic Books.

(3) Freeman and Perez (1988), "Structural Crisis of Adjustment, Business Cycle and Investment Behaviour", **Technical Change and Economic Growth**, Dosi et. al. eds., London, Printer Publishers, pp. 38-66; Diwan and Desai (1990), "Market Globalization and International Competitiveness: Implications for U.S. Business", **Issues in International Business**, Vol. 6, No. 2 (Spring), pp. 1-7; Diwan and Chakraborty (1991), **High Technology and International Competitiveness**, New York, Praeger. Diwan (1989), "Small Business and Economics of Flexible Manufacturing", **Small Business Economics**, Vol. 1, No. 2, pp. 101-109, analyses the implications of flexible manufacturing, an element of this paradigm, for conventional economics.

(4) Diwan and Chakraborty (1991), p. 6.

It is now recognized that the electronic and semiconductor-based technologies satisfy all these three conditions. The price of chips has been continuously falling while its processing speed and scale of integration has been increasing. Generally, the supply of these chips is largely available as desired, and they are now embedded in virtually every consumer and producer goods. This condition also ensures continuous cost reductions of goods and processes in which these technologies are embodied. Their pervasiveness enlarges old and establishes new markets for products. Cost reductions and enlarged markets make them competitive and are the necessary conditions for a self-perpetuating process.

One can discern now two different, old and new, techno-economic paradigms which may also be considered as two different paths to economic development and growth:[5] (i) the old, traversed by the Western countries in the past 50 years whose most successful example has been the U.S., and (ii) the new, traversed by the Pacific and East Asian countries in the last 20 years, with Japan being the most successful case.

The old techno-economic paradigm has been defined by oil energy, product standardization and mass scale production. The features of standardization and mass production has ensured cost reduction through economies of scale. These techniques have been pervasive indeed, and as a result, one has witnessed the growth of mass markets, such as mass media, mass transit systems, mass education and mass consumption. The mass production techniques are based on massive capital investment and large unskilled labor inputs. Underdevelopment, in this paradigm, is considered analogous to lack of capital.

The new techno-economic paradigm, on the other hand, is determined by information technologies that involve segmented markets, customized production and economies of scope. The continuously changing technologies are science-based and require both R&D and skilled labor in addition to capital in which these technologies are embodied. Furthermore, these technologies are international in the sense that the production process can be carried on in different parts of the world in the face of globalizing markets. Such "market segmentation and globalization go together and set a dynamic process of self-propagation."[6] There are also more entry points in the new paradigm, and many newly-industrializing countries can, and do enter.

The world market is, at present, composed of the products from both these paradigms. However, the standardized products from the old paradigm are facing a shrinkage in demand, both from the change in consumption patterns and the competition

(5) Diwan (1991), "RI Has to Choose Path for Industrial Growth", **Jakarta Post**, June 5th, p. 4, has compared these two paths to two escalators. Developing the necessary infrastructure is akin to getting up on the escalator. Once one gets up on the escalator, one moves up, as if effortlessly. The infrastructure for the two paths are different and so are the social and production relations between capital and labor. Firms also have different paths; See Diwan (1989).

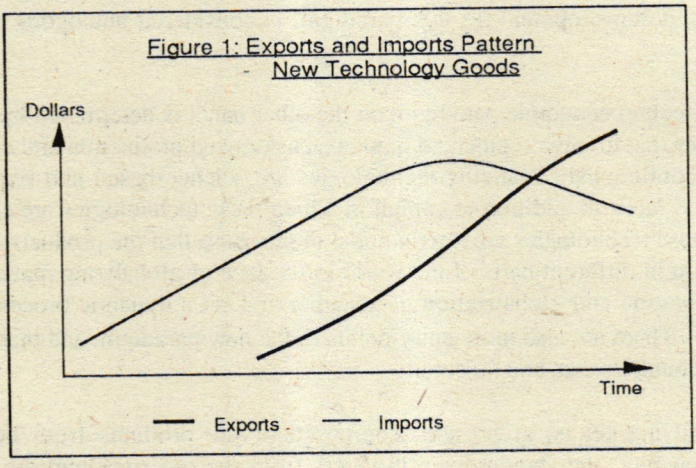
(6) Diwan and Chakraborty (1991), p. 6.

from products of the new paradigm. It is, thus, no accident that major U.S. corporations which has been established over so many decades, such as General Motors, IBM and Westinghouse are losing profits as well as market shares. On the other hand, products from the new paradigms are growing at a rapid rate. Major Japanese firms such as Mitsubishi, Toyota, Matsushita and Nippon have now become large corporations in the world. As world trade grows, products from the new paradigm are also increasingly forming its larger part.

3. Hypotheses

If the above hypothesis is accepted, the question about Canada's competitiveness needs further elaboration. The question becomes: can Canada compete in the new paradigm? For this to happen, it is necessary that Canada produces goods in this paradigm and exports them. In turn, to be able to produce these goods, the economy has to develop the necessary and related infra-structures. In the initial stages, many of these goods have to be imported to be used for production purposes, and eventually over time, the country will be capable of producing and exporting these goods. In addition, since the market for these goods are expanding, exports will grow at a faster rate than imports, so that it will generate a trade surplus in these goods, as illustrated in Figure 1.

Figure 1: Exports and Imports Pattern
New Technology Goods



These arguments can be further refined in the form of the following hypotheses:

(i) The imports of new technology goods increase at a decreasing rate with a non-linear growth path, such that,

$$dM_N/dt > 0 \text{ and } d^2M_N/dt^2 < 0$$

where M stands for imports, subscript N for new technology goods and t for time.

ii) The development of production capacity in Canada means that it will be able to export these goods eventually leading to a positive trade balance in new technology goods. This implies that export elasticity is greater than import elasticity, i.e.,

$$e_{XN} > e_{MN}$$

where e stands for elasticity and X for exports.

iii) The argument that trade in new technology goods should be growing at a faster rate, implies that the export and import elasticities of income for the new technology goods should also be greater than the economy's total export and import elasticities of income. Mathematically, this can be written as,

$$e_{XN} > e_{XT} \text{ and } e_{MN} > e_{MT}$$

where subscript T stands for the total economy.

iv) The argument that new technology goods are sold in segmented markets where quality of the product is an important consideration translates into the proposition that exports and imports of new technology goods are determined by income rather than by price. Mathematically,

$$\partial X_N / \partial P \text{ and } \partial M_N / \partial P \text{ are small and not significant,}$$

where P refers to the price of these goods.

Thus, the question pertaining to the Canada's competitiveness reduces to testing the following hypotheses:

(i) $dM_N/dt > 0$, $d^2M_N/dt^2 < 0$;
(ii) $e_{XN} > e_{MN}$;
(iii) $e_{XN} > e_{XT}$ and $e_{MN} > e_{MT}$;
(iv) $\partial X_N / \partial P$ and $\partial M_N / \partial P$ are small and not significant.

4. Theory

To test the above hypotheses, one has to define economic relationships that describe and explain: (i) The time profile of imports of new technology goods, MN. This is rather straightforward since all it involves are the data on the relevant imports over ti-

me. (ii) What determines the growth and decline of imports and exports of new technology goods as well as of the country as a whole so that the various elasticities can be derived.

Economic theory explains exports and imports of commodities and their aggregates in terms of their demand and supply. Since our interest is in the demand elasticities of income and price, we can, therefore, formulate a standard demand relation, which is,

$$D = f(Y, P) \quad \text{with} \quad f_Y > 0 \quad \text{and} \quad f_P < 0$$

where D, Y, P, f_Y and f_P refer to demand, income, price and partial derivatives with respect to income and price, respectively.

What is important here, is the precise definitions of demand, income and price. Standard trade theory argues that the domestic income and the international purchasing power of the local currency determines the demand for imports of either a single commodity, or of the aggregate. Mathematically, this argument amounts to:

$$D_{Mi} = f(Y_{Ca}, P_E) \quad \text{with} \quad f_{YCa} > 0 \quad \text{and} \quad f_{PE} < 0; \qquad i = N, T$$

where D_M, Y_{Ca} and P_E refer to import demand,Canada's GNP and purchase price of the Canadian dollar (Canadian real exchange rate) respectively. N is the aggregate of new technology goods imports, and T of total imports of which N is a part.

Similarly, classical trade theory argues that exports are determined by income of the importing countries and the purchasing price of the local currency. Since the U.S. forms a large part of the global market as a whole and in terms of new technology goods, the U.S. GNP is taken to determine total exports and exports of these new technology goods as well. This argument can be expressed mathematically as:

$$S_{Xi} = f(Y_{US}, P_E) \quad \text{with} \quad f_{YUS} > 0 \quad \text{and} \quad f_{PE} > 0; \qquad i = N, T$$

where S_X, Y_{US} refer to export supply and U.S. GNP. Once again, N and T stands for the new technology goods exports and total exports, respectively.

Following our logic and convention, the time profile and the import and export functions can be further specified as follows:

(1) $M_N = d_0 + d_1\, t + d_2\, t^2; \qquad d_1 > 0,\ d_2 < 0$

(2) $M_N = a_0 + a_1\, Y_{Ca} + a_2\, P_E; \qquad a_1 > 0, a_2 < 0$

(3) $X_N = b_0 + b_1\, Y_{US} + b_2\, P_E; \qquad b_1 > 0, b_2 > 0$

(4) $M_T = A_0 + A_1\, Y_{Ca} + A_2\, P_E; \qquad A_1 > 0, A_2 < 0$

(5) $X_T = B_0 + B_1\, Y_{US} + B_2\, P_E; \qquad B_1 > 0, B_2 > 0$

Coefficients A_i, B_i refer to the economy as a whole, while a_i, b_i and d_i relate to the new technology goods sector.

5. Data

Variables M_T and X_T refer to the economy as a whole; Canada's total imports and total exports from all its international partners, respectively. The concepts of total imports and exports are very straightforward. However, the idea of exports and imports of "new technology goods" is rather new. There are no separate data collected for these goods, namely M_N and X_N which refer to their import and export sectors, respectively. In our analysis, new technology imports are necessary to develop the production and export potential of these goods, and it is reasonable that they should come from all countries who produce and promote new technologies, namely, the OECD countries. Therefore, the data for M_N are taken for the 25 member countries of OECD. On the other hand, the data for X_N have been restricted to the US market only for the reasons that have been mentioned earlier, namely because the U. S. market forms a large part of the global market, and because its imports of new technology goods from Canada are consistently increasing.

M_N and X_N define the value of imports and exports of new technology goods, consistent with the new paradigm. Quantifying these variables poses a number of conceptual questions. What are new technology goods? How does one distinguish the new from the old technologies? Since the new technologies are growing over time, how does one take into consideration such change? Many of these questions have been discussed at length by other scholars. Diwan and Chakraborty (1991) have argued that "high technologies" form the primary technological base of these new technology goods. They distinguish between product-based and occupation-mix based definitions and develop a definition based on two different rankings derived from the (i) ratio of technology-oriented workers to total workers, and (ii) proportion of R&D expenditure to sales. On that basis, they have determined 29, three-digit SIC industries that form the U.S. high-technology sector.(7)

We have followed Diwan and Chakraborty (1991) and Diwan and Filpo (1992) and defined the new technology sector to comprise of four Standard International Trade Classification (SITC) of industries, they are namely:

(i) SITC section 5: chemicals and related products;
(ii) SITC section 6: manufactured goods;
(iii) SITC section 7: machinery and transport equipment; and
(iv) SITC section 8: miscellaneous manufactured articles.

(7) Diwan and Chakraborty (1991) also compare and analyze different methodologies to classify the high-technology sectors.

Since all industries are undergoing continuous change, any kind of aggregation will be composed of some old and some new technologies. Short of going over every product individually, whatever classification adopted will certainly contain some kind of error since this is the nature of quantification and classification. Our hope is that some of the excluded new technologies operative in other than these three industries will compensate for some of the old technologies included here, so that the aggregate still represents a meaningful proxy to the new technology goods sector.

In this paper, however, P_E is defined as the Canada's terms of trade as a proxy to the purchasing price of local currency, and is obtained from the International Financial Statistics Yearbook (IMF). Our analysis, therefore, involves the following variables: M_T, M_N, X_T, X_N, Y_{Ca}, Y_{US}, P_E and t. The data for M_T, X_T and P_E are collected from various issues of International Financial Statistics (IMF). The M_N and X_N data are collected from various issues of Foreign Trade by Commodities and Direction of Trade Statistics (OECD). Finally, the data for Y_{Ca} and P_{US} are collected from various issues of Statistical Abstract of the United States and official Economic Surveys of OECD for Canada. Annual data are used from 1970 to 1990 and all the variables are measured in 1980 constant U.S. dollars.

Table 1 gives the ratios of M_N/M_T and X_N/X_T (in percentage) over time.

Table 1: Share of New Technology Goods in Total Trade (%)

	1970	1975	1980	1985	1990
M_N/M_T	39.82	47.50	45.77	62.00	62.68
X_N/X_T	3.19	5.31	9.27	11.48	12.44

Source: Calculated from the estimation results.

Table 1 confirms our general idea that Canada has been developing its export potential by importing new technology goods. Thus, the imports of new technology goods as a percentage of total imports have increased from 1977 to 1980 and declined from 1980 to 1985 and again very sharply increased between 1985 and 1990 while the rate has decreased towards the 1990s. On the other hand, the ratio of new technology exports to total exports have grown by virtually 4 times from 1977.

6. Testing the Hypotheses

We have argued that the question of Canada's competitiveness can be formulated in the following hypotheses:

(i) $d_1 > 0$ and $d_2 < 0$;
(ii) $b_1 > a_1$;
(iii) $a_1 > A_1$ and $b_1 > B_1$.

In order to test these hypotheses, we have followed the standard practice of estimating functions (1) to (5) for the Canada's time series data by the Ordinary Least Squares (OLS) method, using the Hildreth-Lu procedure for correction of first order serial correlation where necessary, and assuming all the necessary and relevant assumptions about the random term. All the variables are measured in natural logarithms and the results of the estimation are given as follows, with the t-statistics given in parentheses:

$$(1') \quad M_N = \underset{(-8.0749)}{-30.8849} + \underset{(8.0266)}{31.0024}\ t - \underset{(-7.9771)}{0.7779}\ t^2$$

$$R^2a = 0.9876; \quad D.W. = 2.1180$$

$$(2') \quad M_N = \underset{(1.8144)}{3.5194} + \underset{(28.7971)}{1.1945}\ Y_{Ca} - \underset{(-4.9432)}{1.8216}\ P_E$$

$$R^2a = 0.9858; \quad D.W. = 2.1569$$

$$(3') \quad X_N = \underset{(0.1566)}{1.0979} + \underset{(7.4406)}{1.0781}\ Y_{US} + \underset{(-0.6225)}{0.8482}\ P_E$$

$$R^2a = 0.8337; \quad D.W. = 1.9564$$

$$(4') \quad M_T = \underset{(2.7923)}{4.3749} + \underset{(12.8805)}{0.7223}\ Y_{Ca} + \underset{(-3.2047)}{0.9820}\ P_E$$

$$R^2a = 0.9063; \quad D.W. = 1.8428$$

$$(5') \quad X_T = \underset{(3.5733)}{7.1136} + \underset{(8.4387)}{0.5874}\ Y_{US} - \underset{(-2.7238)}{1.0968}\ P_E$$

$$R^2a = 0.8111; \quad D.W. = 1.5292$$

Statistically, all these results are satisfactory. t-statistics, in parenthesis, show the statistically significance of the coefficients very highly, except the intercept and the price coefficients for exports of new technology goods. R^2a is high in all of the equations sho-

wing a rather good fit of the data to the theory. Also, Durbin-Watson (D.W.) statistics are in acceptable range.

All these results are consistent with the hypotheses. (i) However, the imports of Canada's new technology goods increase at a decreasing rate by time; i.e., d_1 (31.0024) > 0 and d_2 (-0.7779) < 0; both coefficients are highly significant. (ii) Export elasticity of income is less than import elasticity of income for Canada's new technology goods; i.e., b_1 (1.0781) < a_1 (1.1945); both coefficients are significant, but this is not an expected result by the theory. (iii) Import elasticity of income for new technology goods is greater than import elasticity of income for the economy's total import; i.e., a_1 (1.1945) > A_1 (0.7223); both are significant. (iv) Export elasticity of income for new technology goods is greater than export elasticity of income for the economy's total import; i.e., b_1 (1.0781) > B_1 (0.5874); both coefficients are again significant.

For ease of comparison, the income and price elasticities for both the import and export sectors and their respective t-statistics are reproduced below:

Table 2 : Trade Elasticities

Sector	Type	Income Elasticities	Price Elasticities
Imports	$N(a_i)$	1.19 (28.80)	-1.82 (-4.94)
	$T(A_i)$	0.72 (12.88)	0.98 (-3.20)
Exports	$N(b_i)$	1.08 (7.44)	-0.85 (-0.62)
	$T(B_i)$	0.59 (8.44)	-1.1 (-2.72)

Source : From the estimmation results. N and T, as indicated in the text, refere to new technology goods and total economy, respectively.

7. Conclusion

A development path may be considered as an escalator. In the past, this escalator was defined by the methods of mass production society exemplified by the U.S.

Recently, a new techno-economic paradigm has come into play. It is propelled by new microchip based information technologies that create segmented, yet global markets, customized products and economies of scope. Its most successful example is Japan, and this escalator may be considered as an Asian development path. These new technologies are science-based and change continuously. Entry onto this escalator requires capital and R&D intensity as well as skilled labor and a management system where labor is an asset and not a cost. This is a faster moving escalator, and countries that get on this escalator have the best chances for income and export growth.

To test Canada's competitiveness, this paper has set up three stringent tests: (i) imports of new technology goods are increasing at a decreasing rate, (ii) income elasticity of exports of new technology goods is higher than the income elasticity of imports of such goods, and (iii) income elasticity of both imports and exports of new technology goods is higher than those of total imports and exports. These hypotheses have been tested by econometric methods for Canada's export and import yearly data for the period, 1970 to 1990.

Almost all the coefficients are found statistically significant, except one price elasticity. Although three out of four conditions above are met by the results, significance of all the coefficients related to price makes the result ambiguous pertaining to the importance of "quality" and "price". Therefore, this result has shown that both criteria, "quality" and "price", are important for the competitiveness of Canada, which is of course not expected by the theory. Because, as remembered, the argument at the beginning of the paper was that quality of the product is more important than the price of it, meaning that exports and imports of new technology goods are determined by "income" rather than by "price".

The results suggest that Canada is competitive, and has developed the capacity to export new technology goods. The good signals about Canada's competitiveness in new technology goods should be followed up by further policy formulations for sustained growth of the country by recognizing the nature of the new techno-economic paradigm. The new technologies are changing continuously so that investment in these technologies and the infrastructure for their development should be a conscious and also an on-going process. The entry levels to the escalator come from major investments in the new infrastructure for these technologies; R&D, skill formation and new capital goods. Since Canada is already one of the "seven developed countries", it will relatively be easier to catch up with the new paradigm with the condition that it needs to change the old institutions that has to do with cultural, economic and political environment.

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