Journal of International Economic
Integration 2(2), Autumn 1987, 63—88

Interregional Canadian Manufacturing Trade : An Empirical Analysis Of The Demand-Side Of The Factor Proportions Model

A.K.M. Shamsul Alam*
and
Shyam J. Kamath**

This paper investigates a number of hypotheses regarding the homotheticity of consumer preferences and the importance of demand conditions in explaining the volume and direction of Canadian inter—regional manufacturing trade using Canadian two—digit S.I.T.C. code data on eight manufacturing industries. The period covered is 1961—76 and the investigation uses data on the two largest Canadian provinces, Ontario and Quebec. The results indicate that the implications of the homotheticity of consumer preferences are not borne out with respect to inter—regional trade in a multicommodity situation. The tests conducted also reveal that the direction of trade can be explained from a knowledge of consumer preferences given that the supply side of the model explains the locational aspect of production.

The results fill a gap in the Factor Proportions model literature in international trade by investigating the role of the demand side with specific tests and throw considerable light on the conflicting results identified in the Leontief Paradox literature by indi ating that these results may be attributed to the existence of demand bias.

I. Introduction

Leontief's Paradox has been the focus of considerable testing in international trade research. The Ricardian and Heckscher—Ohlin (hereafter H—O) theories of comparative advantage have been modified to account for the various explanations put forward to

---

*School of Management, University of Lethbridge, Canada.

**Department of Economics, California State University, U.S.A.

The authors would like to thank J. Brox, J. Cuenca, R.C. Kumar, R. Kerton, A. Persky, W. R. Thirsk and R. Tremblay for their comments and suggestions. The first author is especially greateful to S. K. Ghosh for his comments and criticisms.

explain the paradox. Most of the explanations and the tests conducted to examine their validity have like the original Ricardian and H−O theories identified the ultimate source of comparative advantage of the supply side. The original Ricardian theory attributed trade to the existence of pretrade price differentials resulting from differential factor (labour) productivity ratios. The H−O theory attributed pretrade price differentials to the differential factor endowments of nations. Subsequent modifications to rationalize and test Leontief's paradoxical results with regard to the H−O theory were also supply−driven in testing for the effect of tariffs and other distortions, factor intensity reversals, R&D bias, human capital effects and third−factor (natural resource) effects.[1] Only Horiba (1979) attempted to test for the implications of demand−side bias for comparative−advantage models of trade. However, even Horiba effectively neutralized consumer preferences by his assumption that the consumption of a commodity in one region was a constant proportion of that in another region while testing the model using data on interregional U.S. manufacturing trade.

In this paper, we attempt to test for demand−side bias in the H−O model by examining the homotheticity of consumer preferences. The tests are conducted on Canadian interregional trade data for eight durable manufacturing industries over the sample period 1961−76. The tests are constructed so as to look beyond the supply−side versions of the H−O theory which effectively neutralise the role of the demand−side by the assumption of internationally identical and homothetic consumer preferences.

Section Ⅱ sets out the objectives, nature and scope of the study. Section Ⅲ discusses the theoretical framework and empirical specification of the tests. Some data and estimation problems are also discussed in this section. Empirical results are contained in Section Ⅴ. Section Ⅵ contains conclusions and discusses some limitations of the study.

---

1. The first systematic and pioneering attempt to test the H−O theory was that of Leontief (1953, 1956) which created the controversy over the tenability of the H−O theory. His work was followed by a series of studies for different countries with mixed results. The major studies include those of Vanek (1959), Minhas (1962), Leontief (1964), Hufbauer (1970), Baldwin (1971), Branson and Junz (1971), Leamer (1974), Harkness and Kyle (1975), Branson and Monoyios 1977), Harkness (1978), and Horiba (1979) for the U.S. ; Wahl (1961), Wilkinson (1968), williams (1970, 1977), Postner (1975), Bauman (1976) and Daly (1979) for Canada ; Tatemoto and Ichimura (1959) for Japan ; Bharadwaj (1962) and Bharadwaj (1967) for India ; Roskamp (1963), Roskamp and McMeekin (1968) and Stern (1976) for west Germany ; Stolper and Roskamp (1961) for East Germany ; and Hodd (1967) for the U.K. For a review of the Leontief Paradox literature see Baldwin (1971). For surveys of the H−O theory see Johnson (1968) and Stern (1975).

II. Objectives and Scope of the Study

The major objective of this paper is to examine the role of the demand side in Canada's interregional trade in durable manufacturing commodity groups. Interregional trade data has been used bacause tariffs and other major policy distortions are likely to be less important than in the international context.[2] The availability of the major data at the two-digit S.I.T.C. (Standard International Trade Classification) level was also a consideration even though here there were some problems in obtaining time series actual consumption data (discussed later). Additionally, to the best of our knowledge, there exists no study which examines the regional pattern of Canadian trade by emphasising the demand-side. Therefore, it is hoped that the results of such a study would be interesting for both researchers and policy-makers.

It may be pointed out here that our discussion focusses on the demand-side of the H-O (Factor Proportions) Model. To the extent that the implications carry over to the Ricardian Model, the results can be seen as examining the importance of demand-side effects on both theories. We avoid the issue of testing for the exact source of comparative advantage (whether of the Ricardian or H-O variety) by looking only at post-trade output production and consumption ratios. By doing so, we test for explicit implications of the homotheticity of consumer preferences pertaining to trade in a multicommodity situation.

Within the framework of the overall objective of this study, we investigate the following issues :

① We test for the homotheticity of consumer preferences for each selected commodity group in order to examine the validity of the commonly-held assumption of (internationally) identical and homothetic consumer preferences of the standard H O model.

② We test for the response of the scaled trade flow of each commodity across regions (from home to all other regions and vice versa) to changes in the aggregate consumption in all regions relative to home production. This allows us to examine the influence of demand conditions in the home region or rest of the regions on the interregional trade flow of each commodity.

③ We test whether the home consumption of a commodity in relation to its total

2. It is to be noted that interprovincial trade in Canada is subject to considerable non-tariff barriers (see Canada West Foundation Study 1985). To the extent that such barriers are important, the rationale for the choice of interregional data is undermined. It may however be instructive to note that Ohlin (1968) himself first applied his analysis to interregional trade, later extending it to international trade.

consumption (in all regions) behaves in the same way for each separate region. This enables us to examine whether or not the equilibrium consumption vector is strictly proportional between regions.

④ We compare the consumption pattern of all possible pairs of commodities in each region to test for differential demand conditions among the commodities.

In order to impliment our tests, we consider two of the largest and most industrialised regions in Canada, namely Ontario and Quebec and eight S.I.T.C. two-digit Canadian manufacturing industry groups. A two-region formulation is adopted-the home region (h) and all other regions (r). The latter partner region (r) is thus evaluated by the combination of all outside regions and this two-region formulation is adopted throughout. Our model is then formulated in terms of commodity specific estimable regression equation. We use time series data (with some caveats as noted below). Two sets of regression equations are tested-one, share equations for testing consumer preferences and two, trade flow equations for measuring the effect of demand conditions on commodity movements.

Ⅲ. Theoretical Framework and Empirical Specification of the Tests

(1) Theoretical Framework

In the H-O theory related literature, it is presupposed that the post-trade pattern of output under free trade conditions indicates the pattern of comparative advantage on the supply-side. This is reflected in the proportionately greater production of the good in which the home country has a comparative advantage compared to its trading partner. This illustrates that in the production process the home country (and likewise its trading partner) employs its abundant and cheaper factor of production which makes the commodity comparatively less costly and hence an exportable one. However, as Ohlin (1968) pointed out, on both theoretical and practical grounds the pattern of trade will also be determined by the differential demand conditions in the home region and the regions of its trading partners. To the extent that demand conditions or supply conditions dominate we can speak of demand and supply bias. The existence of such biases and of pre-trade interregional price differentials can be illustrated as follow.

Let q_i^h and q_i^r be the outputs of the ith commodity in the home and the rest of the trading regions (all other regions) respectively.[3] Before the opening of interregional

3. These outputs are evaluated as gross values, adjusted for inventories, orders, exports to other countries, imports from other countries, along with any policy impacts such as customs duties etc.

trade, we have the output proportions

$$\frac{q_i^h}{q_j^h} > \frac{q_i^r}{q_j^r} \tag{1}$$

implying that the home region is biased towards the production of the ith commodity (vis a vis jth commodity) in relation to all other regions.

Suppose the pre-trade consumption pattern of commodities is

$$\frac{c_i^h}{c_j^h} > \frac{c_i^r}{c_j^r} \tag{2}$$

where c_i^h and c_i^r denote the actual consumption of the ith commodity in the home and the rest of the regions respectively. In this case, the output proportions given in (1) may be due to the fact that production took place in the home region to meet the home demand for the commodities. Now, if the pre-trade price differentials are given by

$$\frac{p_i^h}{p_j^h} > \frac{p_i^r}{p_j^r} \tag{3}$$

(where p_i^h and p_i^r have identical meanings as above) then we can describe the situation as one of demand bias. If, on the other hand, the price situation is of the form,

$$\frac{p_i^r}{p_i^h} > \frac{p_j^r}{p_j^h} \tag{4}$$

this situation can be described as one of supply bias. The post-trade equilibrium output proportions in the absence of demand bias can then be characterized as

$$\frac{q_1^r}{q_1^h} < \frac{q_2^r}{q_2^h} \cdots\cdots < \frac{q_n^r}{q_r^h} \tag{5}$$

With trade, commodity prices will be interregionally equalized (in the absence of transport costs and policy distortions) and the adjustment of the output level of each commodity occurs at the expense of those of other commodities (due to the imperfect mobility of factors of production across regions and across industries). With changes in relative prices and output levels, consumption patterns will also change. Since the production level cannot be increased indefinitely because of factor immobility and demand conditions are determined by consumers preferences in terms of prices and incomes, net commodity flows across regions will depend on consumer utility functions. The rationale for this argument is predicated on the presumption that the post-trade production pattern already captures the locational aspect of production in terms of the relative prices of commodities and factors of production.

Thus there will be a net outflow (from home to all other regions) of commodity i if the inequality

$$\frac{q_i^r}{q_i^h} < \frac{c_i^r}{c_i^h} \tag{6}$$

holds and vice versa. But the volume and extent of commodity flows over time will depend on the relative strength of changes in consumption proportions among regions.

Horiba (1979) attempted to study the implications of the assumption of identical and homothetic consumer preferences for the pattern of interregional commodity flows in the U.S. Within the framework of a braodly specified general equilibrium model of an open economy with diversified production activities, he evaluated explicit and testable implications of homothetic consumer preferences for trade in a multicommodity situation. His empirical results demonstrated strong support for the nonparametric implications of homotheticity even though the parametric implications were contradicted.[4] However, Horiba effectively neutralized the nature of consumer preferences like his predecessors by his assumption that the consumption of a commodity in one region was a constant proportion of that in any other region. In his model therefore he had

$$c_i^h = uc_i^r \tag{7}$$

4. THe non-parametric implications of homotheticity tested by Horiba were (i) the ranking of trade flows scaled by the level of product in the respective regions conform to the ranking of output ratios, and (ii) the direction of trade is determined by the relative magnitude of output ratios in relation to consumption ratios. The parametric implication tested was that the slope of the linear relationship between the scaled trade flow and the output ratios is given by the aggregate production proportion corrected for trade imbalance. See Horiba (1979, p. 653) for a fuller discussion.

where u indicates the fixed factor of proportionality.

In order to get around the problems posed by Horiba's method and earlier studies, we incorporate in our tests the feature that consumer preferences for a commodity need not be identical between regions, being given by general non−homothetic considerations. Consequently, consumption relationships between regions and between pairs of commodities will be characterized by variable proportions rather than constant proportions. The demand conditions for each commodity in the region concerned is evaluated in terms of commodity prices and aggregate personal disposable income of the region. The implications for the interregional commodity flow is then examined.

(2) Assumptions and specifications of the Model

The standard assumptions of the H−O model characterize the model, namely identical and homogenous of degree one production functions for each commodity in all regions with diminishing marginal productivity for each factor ; non−reversibility of factor intensities ; perfect markets ; free trade with no policy distortions ; no transport costs ; incomplete specialization of each region in the production of commodities and complete interregional immobility of factors. We however do no adopt the traditional assumption of the identity of consumption patterns. Instead we allow for consumer preferences not being identical between regions and being nonhomothetic in commodities. This constitutes our major hypothesis and implies that

$$c_i^h = u_i c_i^r \tag{8}$$

where u_i is a variable factor of proportionality.

Our second major hypothesis is that the consumption relationships of each commodity differ along the time−axis as also across commodities in each region as given by

$$c_{i(t)}^h = u_{i(t)} \cdot c_{i(t)}^r \tag{9}$$

Adding $u_{i(t)} \cdot c_{i(t)}^h$ to both sides we can rewrite (9) as

$$\begin{aligned} c_{i(t)}^h &= \frac{u_{i(t)}}{l+u_i(t)} [c_{i(t)}^h + c_{i(t)}^r] \\ &= k_{i(t)} [c_{i(t)}^h + c_{i(t)}^r] \end{aligned} \tag{10}$$

where $k_{i(t)}$ indicates the proportion of the ith commodity consumed at home relative to its total consumption. Since $k_{i(t)}$ is determined by demand conditions, relation (10) provides a broader specification of consumer preferences in terms of post-trade prices of the commodities and income levels of the region under study.

A last hypothesis is that $k_{i(t)}$ is not stable over time which would then explain the pattern of commodity trade between regions on the time axis.

In order to practically test for the homotheticity of consumer preferences we assume that the expenditure structure (on all commodities in a region) can be explained by the function

$$E_j = E(P_1, P_2 \cdots\cdots P_n, Y_j) \tag{11}$$

where P_S indicates the prices of the commodities, Y_j the aggregate personal disposable income in region j and E_j the expenditure function in region j. Approximating the expenditure function to the second order by the general translog expenditure function, we get[5]

$$\begin{aligned} \log E_j = {} & \log \alpha_0 + \sum_i \alpha_i \log P_i + 1/2 \sum_i \sum_j v_{ij} \log P_i \log P_j \\ & + \sum_i v_{iy} \log Y \log P_i + \alpha_y \log Y + 1/2\, v_{yy} (\log Y)^2 \\ & (i, j = 1, 2 \cdots\cdots n) \end{aligned} \tag{12}$$

The share equation for each commodity corresponding to (12) can be written as

$$C_i^h = S_i^h = \alpha_i + V_{iy} \log Y + \sum_j V_{ij} \log P_j \tag{13}$$

$$(i, j = 1, 2, \cdots\cdots\cdots n)$$

The estimated coefficient V_{ij} will then allow for the testing of the homotheticity of consumer preferences. The relation will be homothetic if the income variable has no impact on the share variable, S_i^h. With null hypothesis $V_{ij} = 0$, at significant t-static will indicate non-homotheticity of the consumption structure.

To test for the existence of demand bias, trade flow equations can be derived in the following manner. Let e_i^h represent the net regional trade flow of the ith commodity from the home region to all other regions, where $e_i^h > 0$ implies outflow from the home region and vice versa. e_i^h can be expressed as the difference between output (q_i^h) and

---

5. See May and Denny (1978) for the use of the translog function for testing the homotheticity of production structures.

consumption (c_i^h) of the home region,

$$e_i^h = q_i^h - c_i^h \tag{14}$$

Replacing c_i^h by the relation in (10)

$$e_i^h = q_i^h - k_i \, (c_i^h + c_i^r) \tag{15}$$

Dividing both sides of (15) by q_i^h, we get the following trade flow equations

$$\frac{e_i^h}{q_i^h} = 1 - k_i \left[\frac{c_i^h + c_i^r}{q_i^h} \right] \tag{16}$$

or

$$T_i^h = 1 - k_i \left[\frac{c_i^h + c_i^r}{q^h} \right] \tag{17}$$

where T_i^h is the trade flow scaled by output to neutralize the effects of differing output levels. If aggregate demand is identical between regions with homothetic preferences, then the slope of the scaled trade flow relationship (17) should equal the aggregate production proportion corrected for trade imbalance. The estimated slope will also indicate the influence of demand bias in the trade flow of each commodity. No specific "a priori" signs can be assigned to the coefficients since the commodity flows can be into or out of the home region depending on relative regional market conditions. The estimated sign of the slope can however be used to explain the role of relative demand conditions at home on interregional commodity movements over time. This can be done on the general consensus that,

$$T_i^h \gtreqless O \text{ if } \frac{q_i^r}{q_i^h} \leq \frac{c_i^r}{c_i^h} \tag{17a}$$

as well as on the basis that the ranking pattern of the output ratio corresponds to that of the trade flows.

To test the hypothesis that the consumption proportions of the regions change over time the stability of k_i on the time axis can be examined. For computational purposes and to increase the explanatory power of the hypothesis, (17) can be reformulated as,[6]

$$T_i^h = 1 - k_i \frac{(c_i^h + c_i^r)}{q_i^h} - b_1 \frac{(c_i^h + c_i^r)}{q_i^h} \cdot t \qquad (18)$$

The significance level of b_1 can then be used to estimate the hypothesis of the stability of the k_i coefficient. With the null hypothesis as $b_1 = 0$, an estimated coefficient b_1 significantly different from zero will indicate instability.

In order to test our other major hypothesis of differential demand conditions across commodities within a region, the pairwise difference between the k coefficients $(k_i - k_j)$ can be used with null hypothesis $(k_i - k_j) = 0$ for $i, j = 1, 2, \cdots n$, $i \neq j$. The significance level of the difference for all possible pairs of commodities ($^nc_2$ pairs in each region) will illustrate the differential demand conditions for the commodities.

Finally, to test for the hypothesis that consumption patterns differ across regions the differences of the slope coefficient (k_i) for each commodity between regions can be examined with null hypothesis as $(k_i^h - k_i^r) = 0$. A significant difference will indicate that the interregional consumption pattern will differ.

(3) Data and Estimation Problems and Details

The sample period chosen for the study is 1961−76. Annual data on eight two−digit S. I. T. C. manufacturing industry groups for the provinces of Ontario and Quebec has been used . The selected industries are wood, furniture and fixtures, primary metal, metal fabrication, machinery, transportation equipment, electrical products and non−metallic industries. The regions and commodity groups have both been selected because of the relatively better availability of data. In addition, manufactures account for approximately three−fourths and two−thirds of the total goods produced in Ontario and Quebec respectively.

Problems in data collection however persist despite the careful choice of the sample period of the study. Data on gross output for all the years has been obtained from various issues of Statistics Canada's *Manufacturing Industries of Canada : National and Provincial areas* (catalogue #31−203). Data on personal disposal income of the regions has been obtained from *National Income and Expenditures Accounts* (Statistics Canada Catalogue #31−201).

Data on actual consumption and the volume of trade flow is hovever available for

6. See Koutsoyiannis (1977) p. 279 for a discussion.

only two years, viz. 1967 and 1974. Hence, data for the two variables has been generated for the years 1961−70 and 1971−76 on the basis of these two years respectively. This has been done on the presumption that the approximately middle year of the decade represents the average trend of the variables. Therefore, a linear relationship between output and consumption level has been used. Trade flow data is then generated as $e_i^h = q_i^h - c_i^h$. This poses a serious limitation of the study given the hypothesis of homotheticity being tested. For an unbiased test, actual consumption and trade flow data over a longer time period needs to be used. However, the nonavailability of such data has forced us to adopt second−best methods. The 1967 and 1974 data used is from the Dominion Bureau of Statistics (now Statistics Canada) and Statistics Canada's *Destination of Shipments of Manufacturers* (Catalogue #31−522).

The price data used is the industry selling price index obtained from Statistics Canada's (and the Dominion Bureau's) *Industry Selling Price Indexes* (Catalogue #62−011). Data on metal fabricating, machinery transportation equipment and electrical products is incomplete in order to meet the secrecy requirements of the Statistics Act. Consequently, for these industries, the price indices have been computed as the simple average of the indices of their main sub−divisions.

In estimating the various equations OLS techniques have been used. In some cases, GLS techniques have been used to avoid autocorrelation and other violations of the CLR assumptions, but the results obtained are very similar to those using OLS. Consequently, to maintain uniformity in the interpretation of coefficients across regions and commodities, the OLS results have been reported throughout with minor exceptions.

In order to test for homotheticity a stepwise regression procedure has been employed. For computational convenience, the semilog share equation (13) with appropriate error term has been estimated. For the other tests, equation (18) has been estimated with error term with CLR properties added.

IV. Empirical Results

The results of running the empirical analogs of equations (13) and (18) and the various tests conducted are summarized by Tables 1 to 8. A brief discussion of the findings follows.

(1) Share Equation Results

Tables 1 and 2 show the results for Ontario and Quebec respectively for the share equation (13) estimated with a stepwise procedure. Against the null hypothesis of $V_{iy}=0$ (implying that consumer preferences are homothetic), the coefficient is found to be significantly different from zero in most cases.

From Table 1 it can be seen that out of eight commodities, four are significant at the 1% level (metal fabrication, machinery, transportation and electrical products), two are significant at the 5% level (wood and non-metalic products), one at the 10% level (furniture and fixtures) and the last one is significant at the 20% level (primary metal products). Among the eight coefficients, two exhibit a positive sign (machinery and transportation) while the rest exhibit negative signs. These results imply that for the commodities considered in the sample for the province of Ontario, consumer preferences are non-homothetic in nature.

From Table 2 it is evident that in Quebec consumer preferences are non-homothetic in all commodities except one (machinery)[7]. Out of the eight commodities, six are significant at the 1% level (wood, metal fabrication and non-metallic products) or the 5% level (primary metal, transportation and electrical products). Furniture and fixtures is significant at the 10% level if we consider income alone as the independent variable. With regard to signs, three estimated coefficients of the income variable have negative signs (wood, metal fabrication and non-metallic products) while the rest have positive signs.

Thus, based on Tables 1 and 2, the generalization can be made that consumer preferences are non-homothetic and are not homogenous of any degree for the the regions and time-periods considered in this study.

(2) Trade Flow Equation Results

Tables 3 and 4 allow us to test the hypothesis of stability of the consumption pattern within regions over time as well as the changing structure of home consumption relative to all regions. The effect of the changing consumption pattern on the trade flow is also indicated here. The explanatory power of the regression equations is very satisfactory with high R^2 and F values.

Against the null hypothesis of $b_i = 0$ it is evident that for Ontario (Table 3) the b_i coefficient is significantly different from zero at the 1% level for seven groups except for the transportation group where it is significant at the 5% level. The results are similar for Quebec (Table 4) except that there it is the furniture and fixtures group which is significant at the 5% level all other industries being significant at the 1% level. This clearly indicates the instability of the proportionality coeffficient K_i over time supporting our alternate hypothesis.

7. The autocorrelation problem indicated by the "d" values has been corrected for using GLS techniques. However, the results are found to be similar except in the case of Ontario in Table 1 for non-metallic industries. Hence GLS results are reported in this one case.

TABLE 1

SHARE EQUATIONS, FOR TESTING NON-HOMOTHETIC CONSUMERS PREFERENCES FOR ONTARIO

INDUSTRY GROUPS	INT a_i	INCOME v_{iy}	PWD a_{i1}	Pfufx a_{i2}	Pmet a_{i3}	Pmefe a_{i4}	Pmach a_{i5}	Ptpte a_{i6}	PePD a_{i7}	Pnmet a_{i8}	R^2 (F)	d
* Wood (WD)	.22841	−.06636	.026116	.014261	−.17204	−.23428	−.01005	−.2983	.11214	.0568	.968	3.3827(1)
	(1.8927)d	(−2.55)b	(4.255)a	(1.1031)x	(−3.368)b	(−3.558)b	(−.0605)x	(−2.019)c	(1.354)x	(.8615)x	(20.69)	
* Furniture and Fixture (Fufx)	.28215	−.03516	−.00795	.21419	−.09413	.01857	.011798	−.262	.1136	.1136	.857	2.6023
	(3.3986)b	(−1.964)c	(−.44238)x	(2.251)c	(−2.679)b	(.41)x	(.10318)x	(−2.578)b	(−.7589)x	(2.504)b	(4.006)	
Primary metal (met)	.15666	−.0637			−.4299	1.0399				−.4356	.858	1.7228
	(2.4746)b	(−1.3977)d			(−2.936)b	(6.744)a				(−2.29)b	(8.15)	
Metal Fabricating (mefc)	.32129	−0637	−.05569	−.2045	.316						.938	2.7946
	(14.826)a	(−3.359)a	(−2.387)b	(−3.9118)a	(6.1164)a						(41.92)	
Machinery (mach)	−.009531	.0777	−.11683								.575	1.6796
	(−.4396)x	(4.033)a	(−3.722)a								(13.85)	
Transportation (tpte)	−.30933	.2136				−1.4603	1.273				.726	1.3782
	(1.538)d	(3.263)a				(−4.418)a	(2.867)b				(8.217)	
Electrical Products (ePD)	.20604	−.01749									.432	1.2214
	(8.8899)a	(−3.2643)a									(10.65)	
(2)Non-metallic (non-met)	.07725	−.01667	.0289		−.1576	.16305					.9978	2.40
	(13.67)a	(−2.703)b	(3.376)a		(−12.475)a	(14.13)a					(12.73)	

a = significant at 1% level
b = significant at 5% level
c = significant at 10% level
d = significant at 20% level
x = is not significant

(1) significant with GLS, also,sign remains same
(2) estimated with GLS.
* with stepwise procedure, the function relates to y and PWD only.
– In the parentheses, the 't' and 'F' values are indicated.

TABLE 2

SHARE EQUATIONS, FOR TESTING NON−HOMOTHETIC CONSUMERS PREFERENCES FOR QUEBEC

INDUSTRY GROUPS	INT a_i	INCOME v_{iy}	PWD a_{i1}	Pufx a_{i2}	Pmet a_{i3}	Pmefe a_{i4}	Pmach a_{i5}	Ptpte a_{i6}	PrPD a_{i7}	Pnmet a_{i8}	R^2 (F)	d
Wood (WD)	.0776	−.15585	.30414								.747	1.1811
	(1.5736)x	(−3.5915)a	(4.56)a								(12.89)	
Furniture and	.07678	.00479	.037854		−.0587						.546	2.6168
Fixture (Fufx)	(6.122)a	(.30722)x(1)	(2.8104)b		(−3.234)a						(5.34)	
Primary metal	.30018	.09918				.43269				−.6966	.738	2.0156
(met)	(8.373)a	(3.0519)b				(5.0453)a				(−5.76)a	(9.31)	
Metal Fabricating	.14343	−1.16073					.33824				.563	.8664
(mefc)	(2.757)b	(−3.9489)a					(3.5878)a				(8.36)	
Machinery (mach)	.023249	.013125									.104	.9382
	(.5475)x	(1.2758)x									(1.628)	
Transportation	.07964	.33178		−.61109							.3017	.7150
(tpte)	(.5108)x	(2.3424)b		(−2.355)b							(5.5439)	
Electrical	.2254	.10516	−.14215	.20571		−.12653			−.17246		.452	1.4066
Products (ePD)	(1.9006)x	(2.35)b	(−2.3014)b	(1.1592)x		(−1.1017)x			(−1.2391)x		(1.65)	
Non−metallic	.11548	−.20407					.3988				.64	.7596 (2)
(non−met)	(1.876)c	(−4.2354)a					(3.574)a				(12.77)	

a = significant at 1% level
b = significant at 5% level
c = significant at 10% level
x = is not significant

(1) significant at 10% level with income only.
(2) with GLS same interpretations.
— In the parentheses 't' and 'F' values are indicated.

TABLE 3

TRADE FLOW EQUATIONS : (OLS ESTIMATES) FOR ONTARIO

Industry Groups	INT	k_i	b_i	R^2 (F)	d
Wood	−.0431	− .05353 (−1.9558)[c]	− .001336 (−3.2414)[a]	0.825 (30.59)	1.3561
Furniture and Fistures	.99422	− .3952 (−4.8839)[a]	− .00237 (−9.1069)[a]	0.904 (61.254)	1.5478
Primary Metals	−.26339	.27611 (2.2443)[b]	− .004667 (−6.4783)[a]	.773 (22.156)	1.479
Metal Fabricating	.10082	.046146 (.54638)x*	.001643 (4.7544)[a]	.7086 (15.806)	.92
Machinery	.37169	− .01777 (−2.4410)x**	.0022699 (3.9971)[a]	.7109 (15.987)	.8931
Transportation Equipment	.70520	− .26096 (−2.7065)[b]	− .0020408 (−2.1259)[c]	.837 (33.304)	.886[(1)]
Electrical Products	.19696	.10839 (3.6621)[a]	− .0012458 (−8.3241)[a]	.842 (34.658)	.9878[(1)]
Non−metallic Products	.030930	.023289 (.966)x*	.0010257 (5.839)[a]	.7369 (18.205)	.8781

a = significant at 1% level
b = significant at 5% level
c = significant at 10% level
x = not significant
x* =is not significant with GLS
x** = signifiicant at 5% level with GLS
(1) indicates significance with GLS
t and F values are indicated in parantheses

TABLE 4

TRADE FLOW EQUATIONS FOR QUEBEC : (OLS ESTIMATES)

Industry groups	INT	K_i	b_i	R^2 (F)	d
Wood	.33027	−.04789	−.0012986	.841	.6338[(1)]
		(−2.0721)[c]	(−3.5523)[a]	(34.326)	
Furniture and Fixture	.89653	−.25303	.0017021	.831	.5610[(1)]
		(−3.6708)[a]	(2.9879)[b]	(31.998)	
Primary metal	.19419	−.046245	.002041	.698	.7845
		(−1.3205) x**	(4.7834)[a]	(15.04)	
Metal Fabricating	.081056	−.010705	.0002345	.795	1.3401
		(−2.4411)[b]	(5.8398)[a]	(25.13)	
Machinery	−.18096	.00899	−.0014506	.76	.9993[(1)]
		(6.4363)[a]	(−6.4363)[a]	(20.71)	
Transportation	−.63069	−.04683	.003935	.68	.7954[(1)]
		(−1.989)[c]	(3.7526)[a]	(13.78)	
Electrical Products	−.065035	.006604	.000342	.763	.9893
		(1.1074) x*	(6.2813)[a]	(21.006)	
Non−metallic Products	.02177	−.083208	.004715	.75	1.6281
		(−1.4925)[d]	(4.9504)[a]	(19.405)	

a = significant at 1% level , (1) = indicates significant with GLS, also
b = significant at 5% level
c = significant at 10% level
d = significant at 20% level
x = is not significant
x* = is not significant with GLS, also.
x** = significant with GLS.
− In the Parentheses, the 't' and 'F' values are indicated.

The positive or negative sign of the b_i coefficient also indicates the changing pattern of the coefficient k_i which in turn reflects the changing pattern of the consumption level for different commodities within each region. For Ontario, the sign of b_i is positive for three commodities (metal fabricating, machinery and non-metallic industries) and has negative signs for the rest. In Quebec, the sign is negative for two groups (wood and machinery) and positive for the others.

The sign and significance of the coefficient k_i itself implicitly explains the changing structure of home consumption to the total consumption of that commodity in all regions (relative to its domestic output), $\frac{c_i^h + c_i^r}{q_i^h}$. The coefficient k_i directly indicates the effect of $\frac{c_i^h + c_i^r}{q_i^h}$ on the scaled trade flow (T_i^h). A significant positive (negative) sign indicates changes in the scaled trade flow in the same (inverse) direction.

Thus in turn indicates lesser (greater) changes in home consumption relative to output. For Ontario, three k_i's are not significant (metal fabrication, machinery and non-metallic industries) while the rest are significant at either the 1% (furniture and fixtures and electrical products), 5% (metal and transportation) or 10% level (wood). The coefficient exhibits a negative signs for four industries (wood, furniture and fixtures, machinery and transportation) and exhibits positive signs for the other four. In the case of Quebec (Table 4), the K_i coefficient is significant for all but two groups (electrical and metal industries). Using GLS the metal industry coefficient becomes significant. The coefficient exhibits a positive sign for only one group (electrical products), but is insignificant and exhibits a positive and significant sign for all other groups.[8] The sign of the intercept term indicates the initial direction of trade flow of each commodity group. It is negative for two groups (wood and metal products) in Ontario and positive for the others. But the negative sign for the metal industry does not conform to the data since there is a net outflow of this commodity from the home region throughout the sample period. The obtained sign can however be reconciled with the data by looking at the signs of k_i and b_i which are positive and negative respectively. This indicates that since the consumption ratio is decreasing over time, there is a net outflow of the commodity instead of an inflow. In the case of Quebec, the intercept term is negative for three groups (machinery, transportation and electrical products) and positive for the rest. The sign of the intercept for the non-metallic group does not conform to the data (which indicates an inflow). Once again this sign can be rationalized by looking at K_i and b_i which

8. In order to avoid autocorrelation problems we have separately used the GLS technique but the results are broadly similar except in the case of the machinery industry in Ontario the coefficient of which became significant at the 5% level. For all other regressions OLS results are reported.

exhibit negative and positive signs respectively. This implies that the increasing consumption ratio for this commodity in Quebec results in a net inflow despite the tendency for it to flow outwards.

It is clear from the above that consumer preferences change over time and the parametric implications of the H−O model are rejected on this count.

The coefficients k_i obtained in Table 3 and 4 are also used to test the remaining hypothesis regarding the variability of consumption proportions across commodities in a region and for each commodity across regions. In order to test for the variability of consumption patterns across commodities, the null hypothesis is $(k_i - k_j) = 0$. The results for Ontario are given in Table 6. Out of twenty−eight (${}^{8}c_2$) possible tests for pairs of coefficients, twenty−four are significant at the 1% level, two are significant at the 5% level, one at the the 10% level and one is insignificant. The results for Quebec in Table 6 indicate that twenty−one pairs of coefficient differences are significantly different from zero at the 1% level, three at the 5% level, one at the 20% level and the other three are insignificant. Therefore, it can be seen that the individual commodities indicate different types of consumption structures.

To examine whether the equilibrium consumption among regions is strictly proportional among regions we use the t−statistic to test for the differences of the coefficients for Ontario and Quebec for each commodity using the null hypothesis $(k_i^{Ont} - k_j^{Que}) = 0$. Table 7 shows that the coefficients are significantly different between the provinces for seven commodity groups excluding the wood industry thus rejecting the null hypothesis.

With regard to the non−parametric implications of the H−O theory, Table 8 provides a means to test for these implications. The ranking of the scaled trade flows $\frac{e_i^h}{q_i^h}$ with the ranking of output ratios, $\frac{q_i^f}{q_i^h}$ and the examination of the direction of trade as given by the sign of $\frac{e^h}{q_i^h}$ as compared to that of the difference $\left(\frac{q_i^f - C_i^f}{q_i^h - C_i^h}\right)$ similar to the basis of (17a) would indicate the role of demand bias in explaining the direction of trade. For Ontario, it can be seen from the table that the ranking of the scaled trade flows and output ratios follow a pattern of being inverse to each other indicating conformity with the implications of the H−O theory. However, in the case of Quebec this is not born out for the primary metal, metal fabrication, electrical products and non−metallic products industries. This would seem to cast doubt on the non−parametric implications of the H−O theory at least for Quebec.

With regard to the difference between the output and consumption ratios explaining the direction of trade, the results are consistent with the importance of demand conditions. For both Ontario and Quebec, it can be seen that if $\left(\frac{q_i^f}{q_i^h} - \frac{C_i^f}{c_i^h}\right) > 0$ the commodity

TABLE 5

TESTING THE DIFFERENCE OF THE PAIR OF COEFFICIENTS OF THE COMMODITIES : ONTARIO

Null Hypothesis ; H_0 : $(K_i - K_j) = 0$

K_i \ K_j	K_{WD}	X_{fudx}	K_{met}	K_{mefc}	K_{mach}	K_{tpte}	K_{ePD}	K_{nmet}
K_{WD}		.34167	−.3296	−.0997	−.0357	.20743	−.1619	−.07682
		(15.99)^{a}	(−10.462)^{a}	(−4.49)^{a}	(−1.8389)^{c}	(8.278)^{a}	(−16.066)^{a}	(−8.4245)^{a}
K_{FUFX}			−.63131	−.44135	−.37743	−.13424	−.5036	−.4185
			(−8.235)^{a}	(−15.093)^{a}	(−13.869)^{a}	(−4.266)^{a}	(−23.379)^{a}	(−19.8256)^{a}
K_{met}				.22996	.29388	.53707	.16772	.2528
				(6.16406)^{a}	(8.2228)^{a}	(13.7437)^{a}	(5.3017)^{a}	(8.0664)^{a}
K_{mefc}					.06392	.307106	−.06224	.02286
					(2.2928)^{b}	(9.5837)^{a}	(−2.7821)^{a}	(1.04096)^{x}
K_{mach}						.24318	.126162	−.04101
						(8.0513)^{a}	(6.42106)^{a}	(−2.1389)^{b}
K_{tpte}							−.36935	−.28425
							(−14.648)^{a}	(−11.4401)^{a}
K_{ePD}								.085101
								(8.91709)^{a}
K_{nmet}								

a = significant at 1% level

b = significant at 5% level

c = significant at 10% level

– upper value shows the differece of the coefficients and the values in the parentheses indicate 't' values.

TABLE 6

TESTING THE DIFFERENCE OF THE PAIR OF COEFFICIENTS OF THE COMMODITIES : QUEBEC

Null Hypothesis : H_o : $(K_i - K_j) = 0$

K_i \ K_j	K_{WD}	K_{fufx}	K_{met}	K_{mefc}	K_{mach}	K_{tpte}	K_{ePD}	K_{nmet}
K_{WD}		.20515 (11.2869)[a]	−.00165 (−.1569)[x]	−.03718 (−6.323)[a]	−.05689 (−9.8266)[a]	−.001065 (−.12912)[x]	−.05449 (−9.1318)[a]	.03317 (2.3407)[b]
K_{FUFX}			−.20678 (−10.698)[a]	−.24233 (−14.0347)[a]	−.26202 (−15.203)[a]	−.2062 (−11.3241)[a]	−.25963 (−15.011)[a]	−.16982 (−7.6624)[d]
K_{met}				−.03554 (−4.0279)[a]	−.05524 (−6.3046)[a]	.000581 (.05507)[x]	.052849 (5.9509)[a]	.036963 (2.2457)[b]
K_{mefc}					−.0197001 (−17.1467)[a]	.036121 (6.03359)[a]	−.0173094 (−9.3398)[a]	.072503 (5.186068)[a]
K_{mach}						.05582 (9.46799)[a]	.0023907 (1.5628)[d]	.0922031 (6.61349)[a]
K_{tpte}							−.0534304 (−8.80057)[a]	.036382 (2.4047)[b]
K_{ePD}								.089812 (6.40749)[a]
K_{nmet}								

a = significant at 1% level
b = significant at 5% level
c = significant at 10% level
d = significant at 20% level

– upper value shows the differences of coefficients and the values in the parentheses indicate 't' values.

TABLE 7

TESTING THE DIFFERENCE OF THE CO-EFFICIENTS OF ith COMMODITY ACROSS REGIONS (ONTARIO VS QUEBEC)

Null hypothesis, H_0 : $(K_i^{ont} - K_i^{Q}) = 0$, where Ont = Ontario, Q = Quebec

Industry Groups (i)	$K_i^{Ont} - K_i^{Q}$
Wood (WD)	−.005639 (−.62963)[x]
Furniture and Fixture	−.14217 (−5.3499)[a]
Primary metal	.322355 (10.0801)[a]
Metal fabricating	.056851 (2.6889)[b]
Machinery	−.026767 (−1.4703)[d]
Transportation	−.214134 (−8.630016)[a]
Electrical Products	.101785 (13.4854)[a]
Non-metallic	.106497 (7.01336)[a]

a = significant at 1% level

b = significant at 5% level

d = significant at 20% level

x = is not significant

– The values in the parentheses indicate 't' values.

TABLE 8

RANK ORDERING OF $\frac{q_i^r}{q_i^h}$, $\frac{c_i^r}{c_i^h}$ *and* $\frac{e_i^h}{q_i^h}$, *ONTARIO AND AND QUEBEC*

	ONTARIO						*QUEBEC*					
Industry Groups	q_i^r/q_i^h (1)	Rank of (1)	c_i^r/a_i^h (2)	Rank of (2)	e_i^h/q_i^h (3)	Rank of (3)	q_i^r/q_i^h (4)	Rank of (4)	c_i^r/c_i^h (5)	Rank of (5)	e_i^h/q_i^h (6)	Rank of (6)
Wood	3.6916	1	2.47	1	−.349	8	2.80	6	3.246	5	.104	2
Furniture and Fixture	1.059	3	1.39	2	.1385	5	1.656	8	2.6072	7	.262	1
Primary Metal	.4916	5	.639	8	.0892	7	3.839	3	4.125	2	.053	3
Metal Fabricating	.6843	4	1.109	6	.2019	4	3.145	4	3.34	4	.045	4
Machinery	.4014	7	1.243	4	.3174	3	4.469	2	3.526	3	−.2047	7
Transportation	.2733	8	.96	7	.3503	1	8.39	1	4.315	1	−.773	8
Electrical Product	.4672	6	1.226	5	.3404	2	2.82	5	2.716	6	−.0286	5
Non−metallic Products	1.07	2	1.29	3	.0971	6	2.78	7	2.37	8	−.130	6

will flow into the home region from other regions. Thus the difference between the output and consumption ratios explains the direction of trade thus underlining the importance of demand conditions. Putting these results together the following picture emerges. Since the net commodity flow has been scaled to neutralize the effects of differing output levels and the production structure exhibits constant returns to scale, the result that the consumption structure is non−homothetic implies that the knowledge of consumer preferences is instrumental in explaining the proportionate net commodity flow. The non−parametric implications also indicate that demand conditions are important for explaining the direction of trade. Thus the supply−side of the model explains the locational aspect of production but the demand side is instrumental in explaining the magnitude and direction of trade among regions.

V. Conclusions

In this paper we have examined the testable implications of the homotheticity of identical consumer preference for the pattern of interregional trade in a multicommodity situation as well and thus examined the role of demand conditions in the traditional H−O theory of comparative advantage.

Our work is similar to Horiba's (1979) seminal work but goes beyond his study by allowing consumer preferences to be non−neutral unlike his work. We formulate and test a number of hypotheses regarding the homotheticity of consumer preferences and the importance of demand conditions in explaining the volume and direction of trade. We utilize time−series data for the period 1961−76 on eight Canadian two−digit S.I.T.C. code manufacturing industries and test the hypotheses for two of the largest Canadian provinces, Ontario and Quebec. Our results reveal that the implications of homotheticity of consumer preferences are not borne out with respect to commodities, regions and over time. Using a series of tests we also find that the direction of trade can be explained from a knowledge of consumer preferences given that the supply side of the model explains the locational aspect of production. Our results thus throw considerable light on the conflicting results identified in the Leontief Paradox literature by indicating that these results, at least in the case of Canadian interregional trade for the time period studied may be attributed to the existence of demand bias.[9]

9. No similar study has been done to investigate the implications of the H−O theory for Canadian interregional trade. In an international context, Wahl (1961), Wilkinson (1968) and Bauman (1976) examined Canadian−U.S. bilateral trade and found evidence consistent with Leontief's paradox. While there is no reason to expect the H−O theory to hold for every bilateral relationship as examined in these studies, our results in the multicommodity and multilateral context of interregional trade would seem to indicate the applicability of the neo−factor proportions theory modified to account for demand conditions.

References

Baldwin, R.E. (1971). "The Determinants of the Commodity structure of U.S. Trade," *American Economic Review*, March, 61, pp. 126-46.

Basevi, G. (1966). "The United states Tariff Structure : Estimates of Effective Rates of Protection of United States Industries and Industrial Labor," *Review of Economics and Statistics*, May, 43, pp.

Bauman, H. (1976). "Structural Characteristics of Canada's Pattern of Trade," *Canaidan Journal of Economics*, August, 9, pp. 408-24

Bharadwaj, R. (1962). "Factor Proportions and the Structure of Indo-U.S. Trade," *Indian Economic Journal*, October, 10, pp. 105-16

Bharadwaj, R. and J. Bhagwati (1967). "Human Capital and the Pattern of Foreign Trade : The Indian Case," *Indian Economic Review*, October, 2, pp. 117-42.

Branson, W.H. and H.B. Junz (1971). "Trends in U.S. Trade and Comparative Advantage," *Brookings Papers on Economic Activity*, 2,, pp. 285-338.

Branson, W.H. and N. Monoyios (1977). "Factor Inputs in U.S. Trade," *Journal of International Economics*, May, 7, pp. 111-31.

Canada West Foundation (1985). *The Canadian Common Market, International Trade and International Competitiveness*, Calgary.

Daly, D.J. (1979). *Canada's Comparative Advantage*, Ottawa : Economic Council of Canada, Series No. 135.

Dominion Bureau of Statistics (1967). *Destination of Shipments of Manufactures*, Catalogue #31-504.

Dominion Bureau of Statistics (various issues). *Industry Selling Price Indexes*, Catalogue #62-528, occasional, 1956-68.

Gruber, W. , D. Mehta and R. Vernon (1967). "The R&D Factor in International Trade and International Investment of U.S. Industries," *Journal of Political Economy*, February, 75, pp. 20-37.

Harkness, J. (1978). "Factor Abundance and Comparative Advantage," *American Economic Review*, September, 69, pp. 784-800.

Harkness, J. and J.F. Kyle (1975). "Factors Influencing U.S. Comparative Advantage," *Journal of International Economics*, May 5, pp. 154-65.

Hodd, M. (1967). An Empirical Investigation of the Heckscher-Ohlin Theory," *Economica*, February, 34, pp. 20-39.

Horiba, Y. (1979). "Testing the Demand Side of Comparative Advantage Models," *American Economic Review*, September, 69, pp. 650-61.

Hufbauer, G.C. (1970). "The Impact of National Characteristics and Technology on the commodity composition of Trade in Manufactured Goods," in Raymond Vernon (ed.), *The Technology Factor in International Trade*, New York, pp. 145−231.

Johnson, H.G. (1968). *Comparative Costs and Commercial Policy Theory for a Developing World Economy*, Stockholm.

Keesing, D.B. (1966). "Labour Skills and Comparative Advantage," *American Economic Review*, May, 56, pp. 249−55.

Keesing, D.B. (1967). "The Impact of Research and Development on United States Trade," *Journal of Political Economy*, February, 75, pp. 38−52.

Koutsoyiannis, A. (1977). *Theory of Econometrics*, 2nd edn. , London.

Leamer, E.E. (1974). "The Commodity Composition of International Trade in Manufactures : An Empirical Analysis," *Oxford Economic Papers*, November, 34, pp. 340−74.

Leontief, W.W. (1953). "Domestic Production and Foreign Trade : The American Capital Position Re−examined," *Proceedings of the American Philosophical Society*, September, 97, pp. 332−49.

Leontief, W.W. (1956). "Factor Proportions and the Structure of American Trade : Further Theoretical and Empirical Analysis," *Review of Economics and Statistics*, November, 38, pp. 368−407.

Leontief, W.W. (1964). "International Factor Costs and Factor Use," *American Economic Review*, June, 54, pp. 335−45.

May, J.D. and M. Denny (1978). "Homothecity and Real Value Added in Canadian Manufacturing," in Fuss, M. and D. McFadden (eds.), *Production Economics : A Dual Approach to Theory and Applications*, Amsterdam, pp. 53−70.

Minhas, B.S. (1962). "The Homohypallagic Production Function, Factor−Intensity Reversals and the Heckscher−Ohlin Theorem," *Journal of Political Economy*, April, 70, pp. 138−56.

Ohlin, B. (1968). *Interregional and International Trade*, Revised edition, Cambridge, Mass.

Postner, H. (1975). *Factor Contents in Canadian Trade : An Input−Output Analysis*, Ottawa : Economic Council of Canada.

Roskamp, K.W. (1963). "Factor Proportions and Foreign Trade : The Case of west Germany," *Weltwirtschaftliches Archiv*, 92 (part II), pp. 319−26.

Roskamp, K.W. and G. McMeekin (1968). "Factor Proportions, Human Capital and Foreign Trade : The Case of West Germany Reconsidered," *Quarterly Journal of Economics*, February, 82, pp. 152−60.

Statistics Canada (various issues). *Manufacturing Industries of Canada : National and Provincial Areas*, Catalogue #31−203, 1961~76.

Statistics Canada (1975). *Destination Of Shipments of Manufactures*, Catalogue #31-522 (occasional).

Statistics Canada (various issues). *National Income and Expenditure Accounts*, Catalogue #13-210, 1961-76, annual.

Statistics Canada (various issues). *Prices and Price Indexes*, Catalogue #62-002.

Statistics Canada (Various issues). *Industry Price Indexes*, Catalogue #62-011.

Stern, S.M. (1975). "Testing Trade Theories," in P.B. Kenen (ed.), *International Trade and Finance : Frontiers of Research*, Cambridge.

Stern, S.M. (1976). "Some Evidence on the Factor Content of West Germany's Foreign Trade," *Journal of Political Economy*, February, 84, pp. 131-41.

Stolper, W. and K.W. Roskamp (1961). "An Input-output Table for East Germany, with Applications to Foreign Trade," *Bulletin of the Oxford Institute of Economics and Statistics*, November, 23, pp. 379-92.

Tatemoto, M. and S. Ichimura (1959). "Factor Proportions and Foreign Trade : The Case of Japan,"*Review of Economics and Statistics*, November, 41, pp. 442-46.

Vanek, J. (1959). "The Natural Resource Content of Foreign Trade, 1870-1955, and the Relative Abudance of Natural Resources in the United States," *Review of Economics and Statistics*, May, 41, pp. 146-53.

Wahl, D.F. (1961). "Capital and Labour Requirements for Canada's Foreign Trade," *Canadian Journal of Economics and Political Science*, August, 27, pp. 349-58.

Wilkinson, B.W. (1968). *Canada's International Trade : An Analysis of Recent Trends and Patterns*, Montreal.

Williams, J.R. (1970). "The Resource Content in International Trade," *Canadian Journal of Economics*, February, 3, pp. 111-22.

Williams, J.R. (1977). "Commodity Trade and the Factor Proportions Theorem," *Canadian Journal of Economics*, 10, pp. 282-88.