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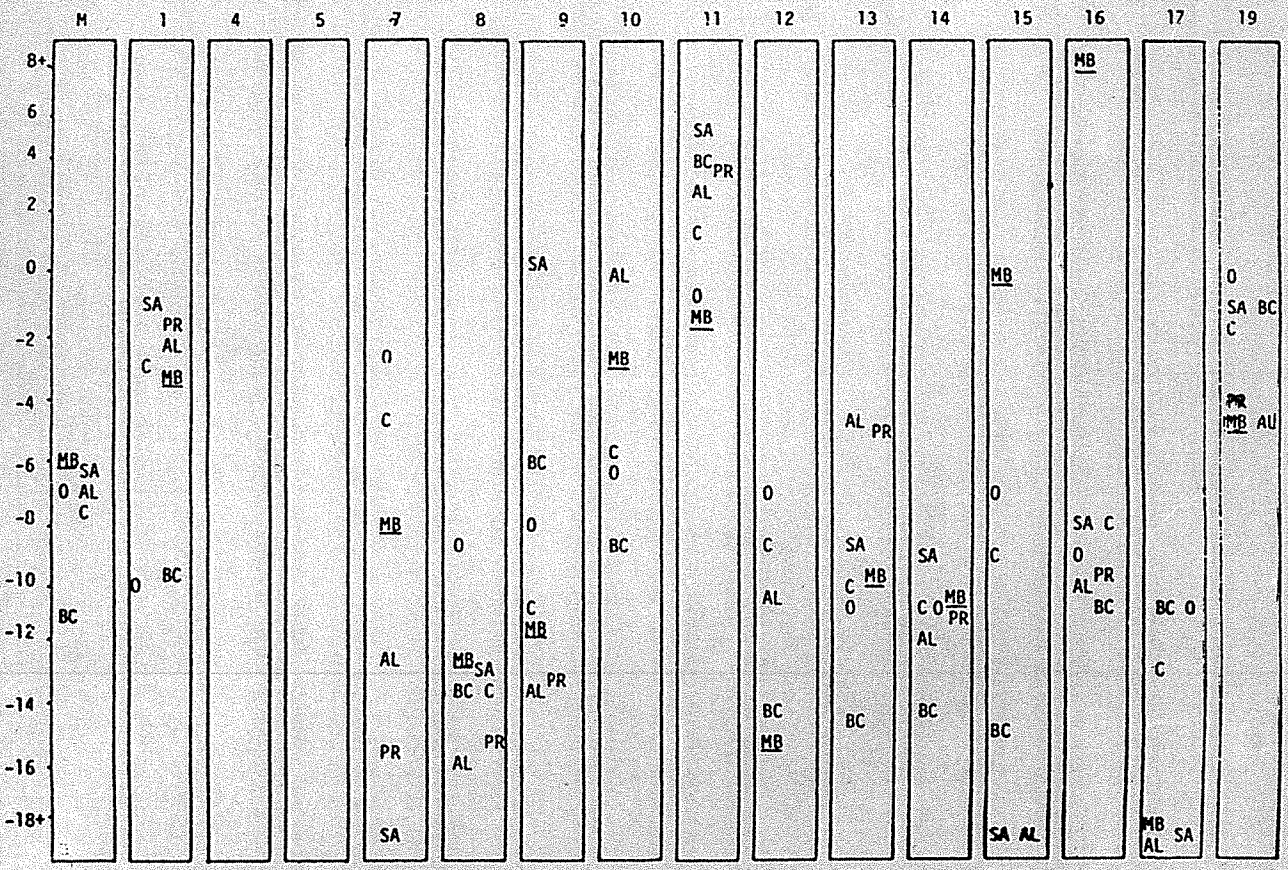

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Food Prices and the Distribution of Income

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The primary objective of this paper is to measure and compare the impact of rising food prices on consumers in different parts of the income distribution. Cost-of-living indexes based on the Stone-Geary utility function are estimated for each income quintile. The results indicate that over the period from 1971 to 1983 the cost of living did increase more for lower-income consumers than it did for higher-income consumers, and suggest that food price increases are the primary cause of this difference. Sensitivity analysis further indicates that high rates of food price inflation are income-regressive. The results also give an indication as to where the boundary for the target population of government assistance programs could be drawn, and suggest that over the period examined the purchasing power of lower-income consumers did not fall due to the indexation of government transfer payments with the general Consumer Price Index. They also suggest, however, that the general CPI may not be an appropriate indexing factor in the future for transfer payments targeted at lower-income consumers. The reason being that the CPI was only able to reflect the cost of living of lower-income consumers over the 1971 to 1983 period due to the offsetting errors resulting from ignoring both the unique spending patterns of lower-income consumers and the substitution effect in response to relative price changes.

1.1 INTRODUCTION

Increases in the cost of food have always been a concern of governments because food is a large and necessary item in most consumers' budgets. While increasing food prices tend to erode the purchasing power of all the consuming public, they are believed to have a particularly negative effect on lower income families because a greater proportion of their income is absorbed by food expenditures. For example, in 1978 low-income family units (poorest one-fifth) spent nearly twice (29 percent) as much of their disposable income on food as did

high-income family units (richest one-fifth) (16 percent)[1].

The primary objective of this paper is to measure and compare the impact of rising food prices on consumers in different parts of the income distribution. The approach adopted is to calculate cost-of-living indexes for each income quintile. Such indexes are different than the conventional consumer price index (CPI) statistics in that they show the cost of maintaining a fixed standard of living over time instead of the cost of buying a fixed basket of goods. By estimating them separately for each income quintile we are accounting for the unique spending patterns of consumers in the different income quintiles.

1.2 EMPIRICAL MODEL

In order to compute a cost-of-living (COL) index it is necessary to specify a particular utility function which represents consumers' preferences. The underlying utility function used in this paper is the Stone-Geary utility function[2].

$$(1)\quad U = \prod_{i=1}^{n} (q_i - \alpha_i)^{\beta_i} \quad \text{with}$$

$$\Sigma\beta_i = 1, 0 < \beta_i < 1, q_i > \alpha_i$$

Where U = the level of utility, n = the number of goods consumed, q_i = the quantity of the i^{th} good consumed, and αi and βi are parameters which can be interpreted as subsistence quantities and marginal budget shares on discretionary income, respectively.

The COL index corresponding to the Stone-Geary utility function is of the following form:

$$(2)\quad \frac{c(v^o,p^t)}{c(v^o,p^o)} = \frac{a^o}{y^o}\frac{a^t}{a^o} + \left(1 - \frac{a^o}{y^o}\right)\frac{b^t}{b^o}$$

The derivation of (2) is provided in Appendix A. Muellbauer (1974) has noted that this particular index is a weighted average of a^t/a^o and b^t/b^o.

Where $a^t/a^o = \dfrac{\Sigma p_i^t \alpha_i}{\Sigma p_i^o \alpha_i}$ is an arithmetic price index using "subsistence" purchases as weights, thus giving "necessities" high weights, and $b^t/b^o = \prod \left(\dfrac{p_i^t}{p_i}\right)^{\beta_i}$ is a geometric price index using marginal budget shares as weights, thus giving "luxuries" high weights. It is clear then that the COL index of a rich person will be dominated by b^t/b^o and the COL index of a poor person will be dominated by a^t/a^o.

It can be seen from (2) that the COL index is a function of the parameters α_i and β_i, prices p_i^o and p_i^t and expenditures in the base period, y^o. Given that we already have observations on prices and expenditures, we can determine α_i and β_i by estimating the system of demand equations corresponding to the Stone-Geary utility function.

1.3 ESTIMATION PROCEDURE AND DATA

The appropriate estimation procedure is largely dictated by the model specification. While the system of demand equations is linear in the variables it is non-linear in the parameters, involving the product of α_i and β_i. As a result, the equations are estimated as a non-linear, seemingly unrelated system, with the disturbance terms assumed to be normally distributed.

The actual estimation of the system is done with the econometrics package SHAZAM, which utilizes a maximum likelihood procedure[3]. Because a complete system of demand

maximum likelihood procedure[3]. Because a complete system of demand equations is being estimated, it is necessary to drop one of the equations from the estimation, or the system will be overdetermined.

In order to determine the effect of inflation on the cost-of-living of persons in different parts of the income distribution, the expenditure data are broken down by income quintile. A sample of expenditures for all quintiles is also used so that a general COL index can be constructed[4].

It should be noted that the lower-income quintiles are not equivalent to the low-income group which is used by Statistics Canada in the calculation of their experimental low-income CPI. The lower-income quintiles are likely to include a number of unattached individuals and smaller families which have per-capita incomes above the low-income cutoffs. Similarly, the higher income quintiles are likely to include some larger families which have per-capita incomes below the low-income cut-offs. The lower-income quintiles could have been made more consistent with the low-income group had the division into quintiles been done by ranking family income on a per-capita basis.

Expenditures on current consumption are disaggregated into the following eight commodity groups: food; housing; clothing; personal medical and health care; tobacco and alcoholic beverages; travel and transportation; recreation, reading and education; and miscellaneous expenditures. Clearly the disaggregation of expenditures involves a certain amount of judgment, and thus there is no magic in the number eight.

It should be noted that due to the level of aggregation within the housing grouping, the COL indexes of the lower-income quintiles should have a slight upward bias. The reason for this is that lower-income consumers utilize rental accommodation more than other consumers, and the rental accommodation CPI has increased more slowly than the aggregate housing CPI.

Using highly aggregated commodity groupings also obscures the substitution in consumption within categories. If we were to further disaggregate the data groups, however, we would be imposing a rather unrealistic restriction on the consumers' budgeting process. The high degree of aggregation makes the strong separability condition imposed by the Stone-Geary function more tenable. Further disaggregation would also add to already considerable computer costs. Nevertheless, it must be acknowledged that the additional benefit of adopting a COL index approach as opposed to a CPI approach is decreased by this high level of aggregation.

The expenditure data used in the estimations are unpublished micro family unit data from Statistics Canada's 1969, 1972, 1974, 1976 and 1978 Family Expenditure Surveys for eight cities[5]. Per-person expenditures are used, and they are derived by dividing each family unit's expenditures by its number of members[6].

With the exception of the "miscellaneous" grouping, the price data used are Statistics Canada's Consumer Price Indexes as found in the Agriculture Canada publication, Handbook of Food Expenditures, Prices and Consumption. In the case of the miscellaneous grouping, an implicit price index is calculated using the category "personal expenditures on financial, legal, and other services" in current and constant dollars from Statistics Canada's National Income and Expenditure Accounts, Catalogue No. 13-201.

In estimating the system of equations for each quintile, we are

compelled to assume that all income quintiles face the same relative prices. Note that this assumption allows the absolute prices facing the different income quintiles to vary so long as the degree of price discrimination does not change over time.

By estimating the system of equations for each income quintile we are implicitly assuming that each quintile has its own set of preferences, and that if households move from one quintile to another, they adopt the new quintiles' preferences. Using observations from different periods implies the assumption that the quintiles' preferences do not change during the period examined.

1.4 BASIC PARAMETER ESTIMATES AND ELASTICITIES

Estimates of the basic parameters for each income quintile and all quintiles are presented in Tables 1 and 2.

All except a few of the estimated committed quantities (the α's) are positive[7]. The exceptions are the first and second quintiles' travel and transportation; recreation, reading and education; and miscellaneous groupings; and the third quintile's recreation, reading and education. Only the third quintile's estimated committed quantity of recreation, reading, and education, however, is significantly less than zero in statistical terms.

While a negative sign does cause our interpretation of the α's as "subsistence" quantities to break down, it does not violate economic theory. Its effect in terms of elasticities is to make the demand for the good elastic.

As expected, committed purchases rise more slowly with income for necessary goods than they do for luxury goods. For example, the highest quintile's committed purchase of food is only about 17 percent higher than the lowest quintile's, while its committed purchase of clothing is almost 370 percent higher than the lowest quintile's.

With respect to the marginal budget shares in Table 2 the results are quite similar to those found in other studies. Their magnitudes in the "all quintiles" estimation range from 0.038 for personal, health and medical care to 0.337 for housing. With the exception of the personal, health and medical care; travel and transportation; and reading, recreation, and education groupings, the marginal budget shares do not vary much across income quintiles.

Own-price elasticities (uncompensated) and income elasticities for each income quintile and all quintiles are presented in Table 3.

The first row of Table 3 indicates that the own-price elasticity of food is lower for the first quintile (-0.38) than it is for the other four quintiles[8]. There are several reasons why consumers in the first quintile may not be as responsive as other consumers to food price changes. Either they cannot afford to have their money tied up in an inventory of food, or - as they may not have adequate freezer and storage space - they cannot stock up on food when prices are low and purchase less when prices are high. Two, due to lack of transportation or poor health, they are less mobile and therefore do less comparative shopping[9]. And three, they are simply less informed about food prices than consumers with higher incomes. It may be noted that these results indicating that low-income consumers are not as price sensitive as other consumers are consistent with those found in the marketing research literature on the "deal-prone" consumer[10].

TABLE 1

Committed Quantities (α_s) by Income Quintile And All Quintiles

	Income Quintile					All
	First	Second	Third	Fourth	Fifth	Quintiles
Food	393.91	393.90	384.90	416.62	463.21	410.50
Housing	434.83	434.80	416.24	474.66	537.29	459.50
Clothing	52.26	52.25	150.51	172.67	245.31	134.60
Personal, Health and Medical	61.60	61.59	93.48	105.73	140.97	92.60
Tobacco and Alcohol	37.75	37.75	50.06	46.98	77.54	50.00
Travel and Transportation	-45.75	-45.79	111.25	164.42	228.01	82.40
Recreation, Reading and Education	- 3.23	- 3.23	-29.21	65.48	145.88	35.10
Miscellaneous	- 4.47	- 4.47	25.47	21.98	34.66	14.60

TABLE 2

Marginal Budget Shares (β_s) By Income Quintile And All Quintiles

	Income Quintile					All
	First	Second	Third	Fourth	Fifth	Quintiles
Food	0.128	0.122	0.126	0.121	0.121	0.120
Housing	0.370	0.312	0.331	0.329	0.354	0.337
Clothing	0.079	0.089	0.070	0.083	0.087	0.082
Personal, Health and Medical	0.046	0.045	0.034	0.034	0.029	0.038
Tobacco and Alcohol	0.051	0.057	0.054	0.061	0.047	0.055
Travel and Transportation	0.181	0.241	0.219	0.228	0.227	0.221
Recreation, Reading and Education	0.106	0.096	0.131	0.103	0.095	0.105
Miscellaneous	0.039	0.038	0.035	0.041	0.039	0.042

TABLE 3

Own-Price Elasticities (Uncompensated) And Income Elasticities For Each Income Quintile And All Quintiles

	Own Price Elasticities (Uncompensated)					
	Income Quintile					All
	First	Second	Third	Fourth	Fifth	Quintiles
Food	-0.38	-0.42	-0.43	-0.42	-0.42	-0.41
Housing	-0.71	-0.71	-0.73	-0.71	-0.74	-0.72
Clothing	-0.72	-0.82	-0.51	-0.54	-0.50	-0.58
Personal, Health and Medical	-0.55	-0.65	-0.45	-0.42	-0.35	-0.47
Tobacco and Alcohol	-0.68	-0.79	-0.70	-0.74	-0.62	-0.71
Travel and Transportation	-1.17	-1.07	-0.84	-0.80	-0.76	-0.87
Recreation, Reading and Education	-1.02	-1.01	-1.11	-0.78	-0.64	-0.87
Miscellaneous	-1.10	-1.05	-0.70	-0.77	-0.70	-0.83
	Income Elasticities					
Food	0.43	0.49	0.54	0.54	0.58	0.49
Housing	0.93	0.93	1.01	1.04	1.14	0.99
Clothing	1.18	1.06	0.78	0.84	0.81	0.93
Personal, Health and Medical	0.82	0.79	0.62	0.63	0.54	0.68
Tobacco and Alcohol	1.13	1.09	1.15	1.32	1.09	1.17
Travel and Transport	2.51	1.77	1.42	1.39	1.35	1.61
Recreation, Reading and Education	2.08	1.57	2.04	1.39	1.16	1.63
Miscellaneous	2.43	1.52	1.40	1.57	1.50	1.76

With regard to the other own-price elasticities, that of housing appears to be independent of the level of income. The demands for the remaining goods, however, tend to be more elastic for the lower-income consumers. This is particularly true with respect to the last three in Table 3; travel and transportation; recreation, reading, and education; and miscellaneous goods and services. One possible explanation is that low- and high-income consumers tend to purchase these commodities in different forms, which may have better or worse alternatives to substitution. Another may be that lower-income consumers are more price-conscious because of their tighter budget constraints.

Yet a third possible explanation is that the higher-income consumers feel they have a higher opportunity cost of time and thus do less comparative shopping.

Drawing on the income elasticities under the "all quintiles" column in Table 3, it is possible to classify the first four commodity groups as necessities (because they have income elasticities less than one), and the last four as luxuries. With the exception of food and housing, all of the commodity groups' income elasticities tend to decrease as income increases. A plausible explanation of the positive relationship between the level of income and the income elasticity of food may be the fact that higher-income consumers devote a substantially greater proportion of their food expenditures to food consumed away from home, which tends to be more price elastic[11]. For housing it may be related to either the different types of housing, which low- and high-income consumers utilize (e.g., rented vs. owned accommodation), or lower-income consumers not having the same access to financial capital.

It should be noted that these results describing the relationships between the levels of income and the various income and price elasticities may simply be forced by the model's restrictions and Engel's Law[12].

Generally speaking, the magnitude of the own-price and income elasticities are consistent with those found in other studies which have estimated complete systems of demand equations.

1.5 COST-OF-LIVING INDEXES

Non-food and all-item COL indexes are reported in Table 4. A food COL subindex is not reported because when only one commodity group is included in a subgroup, its COL index analogue is simply the raw price series, i.e., the food CPI. One can speak in terms of a COL subindex only if there are two or more commodity groups within the subgroup[13].

The results indicate that over the period from 1971 to 1984 the difference between the income quintiles' non-food COL subindex is only of a random nature. This suggests that the relatively heavier burden placed on lower-income consumers by rising necessary non-food-item prices is roughly offset by the relatively lighter burden resulting from rising luxury non-food-item prices.

When the food and non-food groups are aggregated, the resulting all-item COL indexes show that the overall cost-of-living for consumers in the bottom two quintiles is statistically higher (at the 90 percent confidence level) than that for consumers in the top three quintiles[14]. To maintain their 1971 standard of living in 1983 consumers in the first, second, third, fourth, and fifth quintiles had to increase their expenditures by 176 percent, 173 percent, 167 percent, 165 percent and 163 percent, respectively. This indicates that lower-income consumers are more burdened by inflation than higher-income consumers. The fact that aggregate non-food-price increases are not regressive over this period suggests that it is the food-price increases which impart the "anti-poor" bias.

Although the results are by no means directly comparable, it is interesting to note that the all-item COL indexes are consistent with the results of a study done by Afriat

TABLE 4

Cost-Of-Living Indexes For Non-Food And All-Items
By Income Quintile And All Quintiles (1971 = 1.00)

	Year	Income Quintile					All Quintiles
		First	Second	Third	Fourth	Fifth	
Non-Food	1971	1.00	1.00	1.00	1.00	1.00	1.00
	1972	1.03	1.03	1.03	1.03	1.03	1.03
	1973	1.08	1.08	1.08	1.08	1.08	1.08
	1974	1.17	1.17	1.17	1.17	1.17	1.17
	1975	1.28	1.28	1.28	1.28	1.28	1.28
	1976	1.39	1.39	1.38	1.39	1.39	1.39
	1977	1.49	1.48	1.47	1.47	1.47	1.48
	1978	1.57	1.56	1.55	1.56	1.56	1.56
	1979	1.69	1.67	1.67	1.67	1.67	1.67
	1980	1.83	1.81	1.81	1.81	1.82	1.82
	1981	2.06	2.03	2.03	2.03	2.04	2.04
	1982	2.27	2.24	2.23	2.24	2.24	2.25
	1983	2.39	2.36	2.36	2.36	2.38	2.37
All-Items	1971	1.00	1.00	1.00	1.00	1.00	1.00
	1972	1.05	1.05	1.04	1.04	1.05	1.04
	1973	1.13	1.13	1.11	1.11	1.12	1.11
	1974	1.25	1.25	1.23	1.23	1.23	1.23
	1975	1.39	1.39	1.37	1.36	1.36	1.37
	1976	1.49	1.49	1.47	1.47	1.47	1.47
	1977	1.60	1.60	1.57	1.57	1.57	1.58
	1978	1.75	1.73	1.70	1.70	1.69	1.70
	1979	1.91	1.89	1.85	1.85	1.84	1.85
	1980	2.09	2.08	2.04	2.02	2.01	2.04
	1981	2.35	2.34	2.28	2.27	2.26	2.29
	1982	2.61	2.58	2.53	2.51	2.49	2.53
	1983	2.76	2.73	2.67	2.65	2.63	2.67

(1977), who adopted quite a different approach to measuring the impact of price increases in different income groups. Also using Statistics Canada's data, Afriat showed that over the period from 1961 to 1974, lower-income consumers bore a slightly heavier burden from price increases than higher-income consumers. He did not break his "inflation rates" down by commodity groups.

To determine the sensitivity of the first and fifth quintiles' all-item COL indexes to the rate of food-price inflation, three additional food-price series are considered. The effects of food prices increasing at compound rates of 10 percent, 15 percent, and 20 percent beginning in 1971, are presented in Table 5. Non-food prices in each scenario rise at the same rate as in the base case.

TABLE 5

First and Fifth Quintile's All-Items COL Indexes With Food Price Inflation of 10%, 15% and 20% (1971 = 1.00)

	Year	10%	15%	20%
First Quintile	1971	1.00	1.00	1.00
	1972	1.06	1.06	1.08
	1973	1.14	1.14	1.17
	1974	1.23	1.27	1.32
	1975	1.36	1.41	1.49
	1976	1.48	1.57	1.67
	1977	1.60	1.72	1.87
	1978	1.73	1.85	2.07
	1979	1.88	2.05	2.32
	1980	2.05	2.29	2.62
	1981	2.24	2.55	2.97
	1982	2.44	2.83	3.34
	1983	2.61	3.05	3.65
Fifth Quintile	1971	1.00	1.00	1.00
	1972	1.05	1.06	1.06
	1973	1.12	1.14	1.15
	1974	1.22	1.25	1.28
	1975	1.34	1.39	1.44
	1976	1.46	1.53	1.60
	1977	1.57	1.65	1.76
	1978	1.68	1.79	1.92
	1979	1.82	1.96	2.14
	1980	1.99	2.18	2.40
	1981	2.17	2.42	2.71
	1982	2.36	2.68	3.03
	1983	2.52	2.89	3.30

If over the period from 1971 to 1983 food-price inflation had been at a constant rate of 10 percent, the COL of consumers in the first and fifth quintiles would have increased 161 percent and 152 percent, respectively, over their 1971 levels. With rates of food-price inflation of 15 percent and 20 percent, the corresponding increases would have been 205 percent and 265 percent in the first quintile's aggregate COL index, and 189 percent and 230 percent in the fifth quintile's. A better insight into the differential effect of rising food prices can be gained by noting the changing spread between the first and fifth quintiles' all-item indexes with each increase in the rate of food-price inflation. In the 10 percent scenario, the spread between the first and fifth quintile's all-item indexes is 9 percentage points in 1983. The spread increases to 16, however, in the 15 percent scenario, and to 35 in the 20 percent scenario.

One caveat which should be noted before ending this discussion of the results is that the calculated COL indexes do not capture the substitution within the commodity groups. As a result, the indexes in Tables 4 and 5 are likely to underestimate the regressive effects of rising prices because lower-income consumers tend to have less scope for substitution within commodity groups than higher-income consumers. They also underestimate the upward bias which can be attributed to the Consumer Price Index.

1.6 POLICY IMPLICATIONS

The above empirical results indicate that consumers in the first and second income quintiles do bear a heavier burden from rising food prices than do other consumers. The issue of whether they should be assisted in carrying this heavier burden is a political one. If the government deems it appropriate to assist these consumers it has a number of policy options from which to choose (e.g., price subsidies, food stamps, in-kind transfers, cash transfers). The most economically efficient of these options is likely to be a straight income transfer.

A second policy implication concerns the distinction between the first and second quintile as a unit and the third, fourth and fifth quintiles as a unit in terms of the relative burden created by inflation. This distinction may be useful in the design of assistance programs because it gives an indication as to where the boundary for the target population could be logically drawn.

Perhaps the most controversial policy implication to be drawn from the above results concerns the indexation of income transfers to lower-income consumers. The Consumer Price Index for the average consumer is currently used to revise income-transfers under various programs (e.g., Canada Pension Plan, Canada Assistance Plan, Old Age Security, benefits to veterans) in order to compensate the predominantly lower-income recipients for the decrease in their purchasing power resulting from inflation.

There has been considerable debate as to whether the CPI accurately reflects changes in the cost-of-living of lower-income consumers. Studies by Muellbauer (1974) and Irvine and McCarthy (1980) for the United Kingdom, by Holister and Palmer (1973) and Mirer (1974) for the United States, and by Shorrocks and Marlin (1982) for Canada all indicate an adverse inflation experience for low-income consumers vis-a-vis the average consumer. Other similar investigations done for Canada, however, suggest a different reality. Maslove and Rowley (1975), Walford (1978), and Statistics Canada (1980) discovered no systematic difference in the inflation experience between low- and average-income consumers.

The results of this investigation come down in favour of the first group of studies. It does not necessarily follow, however, that the current indexation procedure results in the underpayment of income transfers to lower-income consumers. Over the period 1971-1983 the general CPI rose 177 percent. The COL indexes calculated for the first and second income quintiles in this study rose by 176 percent and 173 percent, respectively, over the same period. As a result, contrary to the claim of Shorrocks and Marlin, it does not appear that lower-income recipients of government income transfers were underpaid by about $2.8 billion (in 1980 prices) over roughly the same period.

The use of the CPI as a

cost-of-living index has actually led to an overpayment of benefits to the extent it has been used to revise income transfers, wages, etc. which have been received by consumers in the top three income quintiles. Its application in the revision of the income tax regime has also likely resulted in reduced government revenue.

As indicated above, the general CPI has historically been a good measure of cost-of-living increases for lower-income consumers. However, this has simply been because of two offsetting errors in its calculation (i.e., ignoring both the unique spending patterns of lower-income consumers and the substitution effect in response to relative price changes). It is therefore not clear that the general CPI will continue to be the appropriate index for revising government transfer payments to lower-income consumers if the government's objective is to maintain their purchasing power. A better index may be a more refined version of the type developed in this paper. The following section highlights some of the more promising areas for improvement.

1.7 LIMITATIONS OF THE EMPIRICAL MODEL

There are three main limitations in the empirical model used in this study. The first concerns the treatment of family-unit structure. Differences in the characteristics of family units are handled very crudely by using per-person expenditures. The non-linear relationship between family size and expenditures is not taken into account, nor are family composition, age, or education. One simple method of making the model more realistic in this respect would be to limit the data set to family units with particular characteristics (e.g., two adults with one or more children). This method, of course, has the disadvantage of making the results applicable only to the particular subset of consumers. A more attractive approach is explored by Pollak and Wales (1981) who outline five general procedures for incorporating demographic variables directly into complete demand system. The procedures they consider are demographic translating; demographic scaling; the "Gorman procedure," a specification which includes both translating and scaling as special cases; the "reverse Gorman procedure," and a specification called "the modified Prais-Houthakker procedure."

The second limitation concerns the high level of aggregation within the commodity groups. For instance, if housing were broken down into rental and owned accommodation components, and transportation into public and private transportation components, the resulting COL indexes would give a better picture of the overall effect of inflation on the different income quintiles. A more general functional form (e.g., Translog or Generalized Leontief), would probably be required to do this, however, in order to avoid imposing unrealistic restrictions on the consumers' budgeting process. It may be noted that further disaggregation and the use of a more sophisticated functional form would be likely to add significantly to already considerable computer costs.

The third limitation, and possibly the least serious, concerns the static nature of the model used. Stocks of goods are implicitly assumed to be held constant. This is a problem because consumers in different quintiles are likely to draw on their stock of goods in different ways and at different rates. The best way to address this problem would be to utilize one of the

dynamic approaches to estimating systems of demand equations which abound in the economic literature (e.g., Houthakker and Taylor's Dynamic State-Adjustment Model).

1.8 SUMMARY AND CONCLUSIONS

The primary objective of this paper is to measure and compare the impact of rising food prices on consumers in different parts of the income distribution. The approach adopted is to calculate cost-of-living (COL) indexes specific to each income quintile.

The COL indexes are developed by first postulating a specific utility function which represents consumers' preferences, then estimating the corresponding system of demand equations for each income quintile. The estimated parameters are then used along with the appropriate consumer price index (CPI) statistics to calculate the COL indexes.

These COL indexes are different than conventional CPIs in that they take the unique spending patterns of the different quintiles into account, and show the cost of maintaining a fixed standard of living over time instead of the cost of buying a fixed basket of goods.

The resulting COL indexes show that over the period from 1971 to 1983 aggregate non-food prices did not place a greater burden on lower-income consumers than on higher-income consumers. When the food and non-food groups are aggregated, the resulting all-item COL indexes indicate that the overall COL is higher for lower-income consumers. This observation suggests that over the period from 1971 to 1983 food-price increases were regressive with respect to income.

To determine the sensitivity of the first and fifth income quintiles' all-item COL indexes to the price of food, three hypothetical rates of food-price inflation are examined - 10 percent, 15 percent and 20 percent during the period from 1971 to 1983. The results confirm the conclusion that food-price increases tend to be regressive, and that they become more regressive as the rate of increase rises.

Perhaps the most significant policy implication to be drawn from this study is with regard to the procedure for indexing transfer payments targeted at lower-income consumers. The empirical results indicate that the general Consumer Price Index was a good measure of cost-of-living increases for lower-income consumers over the period 1970 to 1983. This is in contrast to the results of an earlier study by Shorrocks and Marlin (1982) which suggests that low-income recipients of government transfer payments were underpaid by about $2.8 billion (in 1980 prices) due to the use of the CPI as an indexing factor over roughly the same period.

A close inspection of the results reveals that the CPI was an appropriate indexing factor due to the offsetting errors resulting from ignoring both the unique spending patterns of lower-income consumers and the substitution effect in response to relative price changes. This raises the issue of whether the CPI will continue to be the appropriate index for revising government transfer payments targeted at lower-income consumers.

NOTES

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[1] Statistics Canada, Urban Family Expenditures in Canada, 1978, Catalogue No. 62-550.

[2] Studies which have compared the COL indexes of the Stone-Geary function and more sophisticated functions like the Generalized Linear Expenditure System, Indirect Addilog and Translog, have shown little difference in the resulting index numbers. See L.R. Christensen and S. Braithwaite.

[3] See K.J. White Econometrica, January 1978.

[4] It is not feasible to use the sum of the quintile observations in determining the general COL index because such a large data set requires too much computer memory for the estimation procedure used. Since the aggregate data file is ordered by income level, a systematic sample is taken (i.e., every second observation). The general COL index parameters are generated by a sample of 11,722 observations, and each quintile's index parameters by 4689 observations.

[5] The eight cities surveyed are St. John's, Halifax, Montreal, Ottawa, Toronto, Winnipeg, Edmonton, and Vancouver. For a detailed discussion of the expenditure data see Appendix B.

[6] Clearly the use of per-person expenditures is a very crude method of accounting for differences in family size. Not only does family size influence expenditures in a non-linear fashion, but its effect is different on different commodity groups. A more thorough treatment of household structure would also consider such things as family composition, age, and education.

[7] It should be noted that the commodity groups travel, and transportation; and recreation, reading, and education are highly influenced by purchases of durable goods, which are not well modeled with the static approach used in this study.

[8] This difference is not statistically tested because the expression for the own-price elasticity is non-linear in α and β .

[9] In 1978, 51.5 percent of the family units in the first quintile had heads over 65 years of age. The corresponding figures for the second, third, fourth, and fifth quintiles were 18.1 percent, 7.4 percent, 4.3 percent and 4.1 percent respectively. See Statistics Canada, unpublished national estimates.

[10] See F. Webster and R. Blattberg, et al.

[11] In 1978, consumers in the highest quintile spent an average of 37 percent of their food bill for food consumed away from home, while those in the lowest quintile spent only 18 percent. See Statistics Canada, Family Expenditure in Cana-

da, 1978, Catalogue No. 62-548.

[12] An inverse relationship exists in the linear expenditure system between the price and income elasticities and the budget shares. In the case of food, this means that since the mean budget share decreases as income increases, the measured elasticities increase as income increases.

[13] It is possible to talk only in terms of a subgroup's COL index if the subgroup's preferences are separable from those of other subgroups. In other words, if food and clothing are two subgroups, the choice of how to divide a given food expenditure among different food items must be independent of the choice of how to divide a given clothing expenditure among different clothing items. If the subgroup's preferences are not separable, the COL subindex will vary with variations in the prices of goods in other subgroups. It is also possible to combine the individual COL subindexes into the aggregate or overall COL index only if the preferences represented by the utility function are homothetic. The Stone-Geary utility function used in this study imposes both the strong separability and homotheticity (with respect to a point not necessarily the origin) conditions on the consumer's preferences. The homotheticity condition is not as restrictive in this study as it would normally be, however, because the demand equations are estimated separately for each income quintile.

[14] The significance of the differences between the various quintiles' cost-of-living indexes in any particular year are not easily determined given that the α's and β's enter the formula for the cost-of-living indexes in a nonlinear fashion. The differences are statistically tested by first assuming that the α's and β's are drawn from a multivariate normal distribution, i.e.,

$$(\alpha,\beta) \sim N(\hat{\alpha},\hat{\beta}; \text{cov } \alpha,\beta).$$

A Monte Carlo random sample of $n = 200$ is then drawn from the distribution for each quintile. The observations for various pairs of quintiles are then substituted into a function D, where D is defined as the difference between the two quintiles' cost-of-living indexes in the year 1983. The resulting values of D are then grouped into cells and displayed as histograms which appear to be close to normally distributed upon inspection. When D corresponds to the second and third quintiles the mean is statistically different from zero at the 90 percent confidence level.

BIBLIOGRAPHY

Afriat, S. N., The Price Index, Cambridge, Cambridge University Press, 1977.

Agriculture Canada, Handbook of Food Expenditures, Prices and Consumption, 1983.

Alcaly, R. and A. Kleverick, "Food Prices in Relation to Income Levels in New York City," Journal of Business Vol. 44, October, 1971, pp. 390-397.

Asimakoupulos, A., "Review Articles: The Canadian Consumer Price Index," Canadian Journal of Economics and Political Science, August, 1963, pp. 366-385.

Barten, A., "Maximum Likelihood Estimation of a Complete System of Demand Equations," European Economic Review, Fall, 1969, pp. 7-73.

Blackorby, C., and R. Russell, "Indices and Subindices of the Cost of Living and Standard of Living," International Economic Review, Vol. 19, No. 1, February, 1978, pp. 229-240.

Blattberg, R., et al., "Identifying the Deal Prone Segment," Journal of Marketing Research, Vol. 15, August, 1978, pp. 369-377.

Braithwaite, S. D., "The Substitution Bias of the Laspeyres Price Index: An Analysis Using Estimated Cost-of-Living Indexes," The American Economic Review, March, 1980, pp. 64-77.

Cameron, C., "Food Price Increases and Inflation," Canadian Public Policy, Spring, 1980, pp. 300-306.

Christensen, L. and M. Manser, "Cost-of-Living Indexes and Price Indexes for U.S. Meat and Produce, 1947-1971," in N. Terleckyj, ed., Household Behaviour and Consumption, National Bureau of Economic Research Studies in Income and Wealth, Vol. 40, New York, 1975.

Deaton, A. and J. Muellbauer, Economics and Consumer Behaviour, Cambridge, Cambridge University Press, 1980.

Fisher, G., M. McAleer and D. Whistler, "Interest Rates and Durability in the Linear Expenditure Family," Canadian Journal of Economics, Fall, 1981, pp. 331-341.

Goldberger, A. and T. Gamaletsor, "A Cross-Country Comparison of Consumer Expenditure Patterns," European Economic Review, Spring, 1970, pp. 357-400.

Green, R., Z. Hassan and S. Johnson, "Alternative Estimates of Static and Dynamic Demand Systems for Canada," American Journal of Agricultural Economics, February, 1978, pp. 93-107.

Hassan, Z., S. Johnson, and R. Finley, "An Intertemporal Comparison of Price and Income Elasticities for Food," Canadian Journal of Agricultural Economics, Fall, 1975, pp. 47-58.

Hollister, R. and J. Palmer, "The Impact of Inflation on the Poor," in Redistribution to the Rich and the Poor, eds. K. E. Boulding and M. Pfaff, Belmont, 1973.

Irvine, I. and C. McCarthy, "Further Evidence on Inflation and Redistribution in the United Kingdom," Economic Journal, March, 1980, pp. 907-911.

Klein, L. and H. Rubin, "A Constant-Utility Index of the Cost of Living," Review of Economic Studies, Vol. 15, 1947, pp. 84-87.

Manga, P., "The Effect of Inflation on Household Expenditures," Discussion Paper, Anti-Inflation Board, 1977.

Maslove, A. and J. Rowley, "Inflation and Redistribution," Canadian Journal of Economics, August, 1975, pp. 399-409.

Mirer, T., Inflation and the Consumer in 1974, Staff Study for the Sub-Committee on Consumer Economics, Joint Economics Committee, Section VI, U.S. Congress, Washington, D.C., 1974.

Muellbauer, J., "Prices and Inequality: The United Kingdom Experience," The Economic Journal, March, 1974, pp. 32-54.

Penchavel, J., "Constant-Utility Index Numbers of Real Wages: Revised Estimates," American Economic Review, March, 1979, pp. 240-243.

Phlips, L., Applied Consumption Analysis, Amsterdam and Oxford, North-Holland, 1974.

Podoluk, J., "Poverty and Income Adequacy," Reflections on Canadian Incomes, Ottawa, Economic Council of Canada, 1980.

Pollak, R., "Additive Utility Functions and Linear Engel Curves," Review of Economic Studies, October, 1971, pp. 401-414.

Pollak, R. and T. Wales, "Estimation of Complete Demand Systems from Household Budget Data: The Linear and Quadratic Expenditure Systems," American Economic Review, June, 1978, pp. 348-359.

Pollak, R. and T. Wales, "Estimation of the Linear Expenditure System," Econometrica, October, 1969, pp. 611-628.

Pollak, R. and T. Wales, "Demographic Variables in Demand Analysis," Econometrica, November, 1981.

Shorrocks, A. and E. Marlin, "Inflation and Low Incomes," Canadian Public Policy, Summer, 1982, pp. 338-345.

Statistics Canada, Income Distribution by Size in Canada, 1969, 1979, Catalogue No. 13-207.

Statistics Canada, Urban Family Expenditures in Canada, 1969, Catalogue No. 62-537.

Statistics Canada, Urban Family Expenditures in Canada, 1972, Catalogue No. 62-541.

Statistics Canada, Urban Family Expenditures in Canada, 1974, Catalogue No. 62-544.

Statistics Canada, Urban Family Expenditures in Canada, 1976, Catalogue No. 62-547.

Statistics Canada, Urban Family Expenditures in Canada, 1978, Catalogue No. 62-550.

Statistics Canada, Income of Spending Units and Economic Families: A Study of Concepts and Relationships, Consumer Income and Expenditure Division, December, 1980.

Statistics Canada, An Experimental Consumer Price Index for Low-Income Families and Unattached Individuals, Supplement to Catalogue No. 62-010.

Walford, G., "Experimental Study: A Consumer Price Index for Low-Income Families," Canadian Statistical Review, Statistics Canada, April, 1978, Catalogue No. 11-003E.

Wallace, T.D. and A. Hussain, "The Use of Error Components in Combining Cross Section with Time Series Data," Econometrica, January, 1969.

Webster, F., "The 'Deal Prone' Consumer," Journal of Marketing Research, Vol. 2, May, 1965, pp. 186-189.

White, K.J., "A General Computer Program for Econometric Methods - SHAZAM," Econometrica, January, 1978.

APPENDIX A

DERIVATION OF THE STONE-GEARY COST-OF-LIVING INDEX

To compute a cost-of-living (COL) index, a particular utility function representing consumers' preferences must be specified. The utility function's unique COL index can then be derived in four steps. The first step requires solving a simple constrained maximization problem:

(1) max. $u(q)$ subject to $pq=y$ where
u = the level of utility,
p = price of goods purchased,
q = quantity of goods purchased, and
y = total expenditure,

in order to determine the corresponding (Marshallian) consumer demand functions,

$$(2)\quad q = q\ (y,p)\,.$$

The second step is to substitute the demand functions (2), which represent that combination of purchases which maximizes utility subject to the budget constraint, back into the original utility function (1). This yields the indirect utility function

$$(3)\quad v = v\ (y,p)\,,$$

which indicates the maximum utility attainable at the given prices and income. Next, by taking advantage of the dual properties of the indirect utility and cost functions, we can simply invert the direct utility function (3) and arrive at the corresponding function,

$$(4)\quad c = c\ (v,p)\,,$$

which indicates the minimum cost at which a given utility can be obtained at the given prices.

Now, recalling the definition of the COL index, we can express it as follows:

$$(5)\quad \text{COL index} = \frac{c(v^{\circ},p^{t})}{c(v^{\circ},p^{\circ})}\,,$$

where v° is the preference indifference curve or 'standard of living,' p° is the price in the reference period, and p^{t} is the price in a later period. The COL index indicates the percentage increase in income required to maintain the consumers' standard of living under the new set of prices in period t.

As noted in the body of the paper, the underlying utility function used in this study is known as the Stone-Geary utility function and is of the form

$$(6)\quad u = \prod_{i=1}^{n} (q_i - \alpha_i)^{\beta_i} \text{ with } \Sigma\beta_i = 1,\ 0<\beta_i<1,\ q_i > \alpha_i$$

where q_i = the quantity of the i^{th} good consumed and α_i and β_i are parameters which are unique to the function (and whose economic interpretations are discussed below).

The corresponding demand functions are of the form,

$$(7)\quad q_i = \alpha_i + \frac{\beta_i}{p_i}(y - \Sigma p_i\alpha_i) \qquad i = 1,.....,n$$

Multiplying (7) by p_i puts the demand functions in expenditure form and makes the system linear in income and prices, thus yielding,

$$(7')\quad p_iq_i = p_i\alpha_i + \beta_i(y - \Sigma p_i\alpha_i) \qquad i = 1,.....,n$$

The fact that (7') is linear in the variables simplifies the estimation of the system of equations. All that are required are observations on prices (p_i) and expenditures (p_iq_i), then α_i and β_i can be estimated.

A household whose demand equations are of the form presented in expression (7') can be described as first expending to purchase "necessary" or "subsistence" quantities (α's) of each good i. It then divides the remaining "discretionary" or "supernumerary" income ($y - \Sigma p_i\alpha_i$) among the goods in fixed proportions (β's). The β_i can be interpreted as marginal budget shares because they give the proportions in which incremental income is allocated (it is for this reason that the sum of the β_i is restricted to one).

Now, by substituting the demand functions (7) back in the original utility function (6) we obtain the indirect utility function

$$(8)\quad v(y,p) = (y - \Sigma p_i\alpha_i) \prod_{i=1}^{n} \left(\frac{\beta_i}{p_i}\right)^{\beta_i}$$

which, as noted previously, indicates the maximum utility attainable at the given prices and income. Because the indirect utility and cost functions are inverses we can rearrange (8) and arrive at the cost function

$$(9)\quad c(v,p) = \Sigma p_i\alpha_i + u \prod_{i=1}^{n} \left(\frac{p_i}{\beta_i}\right)^{\beta_i}$$

Recalling the definition for the COL index given in expression (5), we can write the Stone-Geary utility function's unique COL index as follows:

$$(10)\quad \frac{c(v^\circ,p^t)}{c(v^\circ,p^\circ)} = \left(\frac{\Sigma p_i^\circ\alpha_i}{\Sigma p_i^\circ q_i^\circ}\right)\frac{\Sigma p_i^t\alpha_i}{\Sigma p_i^\circ\alpha_i} + \left(\frac{\Sigma p_i^\circ q_i^\circ - \Sigma p_i^\circ\alpha_i}{\Sigma p_i^\circ q_i^\circ}\right)\prod\left(\frac{p_i^t}{p_i^\circ}\right)^{\beta_i}$$

Letting $a^t = \Sigma p_i^t \alpha_i$, $Y^\circ = \Sigma p_i^\circ q_i^\circ$ and $b^t = \Pi \left(\frac{p_i^t}{\beta_i} \right)^{\beta_i}$

(10) becomes,

$$(10') \quad \frac{c(v^\circ, p^t)}{c(v^\circ, p^\circ)} = \left(\frac{a^\circ}{y^\circ} \right) \frac{a^t}{a^\circ} + \left(1 - \frac{a^\circ}{y^\circ} \right) \frac{b^t}{b^\circ}$$

APPENDIX B

EXPENDITURE DATA[1]

The expenditure data used in the estimation of the system of demand equations are Statistics Canada's household data from the 1969, 1972, 1974, 1976 and 1978 Family Expenditure Surveys.

In these surveys, a family unit is defined as a group of persons dependent on a common or pooled income for the major items of expense and living in the same dwelling, or one financially independent individual living alone.

Observations were used only for the following eight cities: St. John's, Halifax, Montreal, Ottawa, Toronto, Winnipeg, Edmonton, and Vancouver. It may be noted, however, that the coverage of the original surveys varied: urban and rural in 1969 and 1978, 14 cities in 1974, eight cities in 1972 and 1976.

The expenditures used are only those on current consumption; expenditures on personal taxes, security, and gifts and contributions are not included. Expenditures on current consumption include expenses incurred during the survey year for food, housing, fuel, light and water, household operations, clothing, automobile purchase and operation, other transportation, medical care, personal care, reading, recreation, education, smoking and alcoholic beverages, and a miscellaneous group of items. Consumer durables such as automobiles and household equipment are considered to be consumption items. Changes in equity, such as purchases and sales of a house, are considered to be change in assets and liabilities. Family expenditure for items used partially for business, such as a house or cars, are adjusted to exclude the amount chargeable to business use. Sales, excise, automobile, and real estate taxes are included as part of consumption expenditure for the commodity or service to which these taxes applied.

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[1] The breakdown of current consumption expenditures and the differences in the expenditure groupings between the various surveys are taken directly from the Statistics Canada publication, Family Expenditure in Canada, Volume 1, Preliminary Estimates: Eight Cities, 1978.

There are some changes in the 1978 survey from the earlier surveys in the grouping of items in the main expenditure categories. They are as follows:

1. Calculators and typewriters. For 1978, these items are included in "other household furnishings and equipment." For the earlier surveys, they are included in "household operation."

2. Other pet expenses, purchase, etc. For 1978, these are included with "pet food" in "household operation." For the earlier surveys, they are included in "recreation."

3. Fixed carpeting and built-in appliances. For 1978, these items are included in "owned living quarters" or in "net change in assets and liabilities," depending on whether the purchases were made to maintain or restore the condition of a property, or add to its value. For the earlier surveys, fixed carpeting is included in "other household furnishings and equipment," and built-in appliances are included in "household appliances."

4. Personal care appliances. For 1978, these are included in "personal care." For the earlier surveys, they are included in "household appliances." Personal care appliances include electric razors, hair styling equipment, etc.

5. Other vehicle purchases, operation, and rentals. For 1978, these are included in "recreation." For the earlier surveys, they are included in "transportation." "Other vehicles" refer to vehicles other than cars and trucks and include motorcycles, snowmobiles, tents and travel trailers, boats, aircraft, etc.

6. Bicycles. For 1978, these are included in "recreation." For the earlier surveys, they are included in "transportation."

The 1978 data are not adjusted to have the same commodity composition as in earlier years, and the 1974 data do include the screened sample.

In the estimation, the data are assumed to be taken from a normally distributed sample when in fact they were gathered in a stratified clustered systematic sample. This implies that the standard errors of the estimated coefficient are likely to be underestimates of the true standard errors.

Tariff Protection and Industrial Development in Canada

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2.1 INTRODUCTION

A clear difference in views concerning the impact of tariff protection on industrial development has emerged in the debate over tariff policy in Canada. The traditional view, espoused by defenders of the highly protective tariffs of the National Policy, is that domestic producers progressively gain competitive strength operating in a protected market. This view has been challenged recently by those who argue that protection is responsible for the low productivity of Canadian manufacturing.

Critics of protection explain the low productivity of Canadian manufacturing using the notion of excessive entry of producers into the domestic market. I examine this notion in Section 1, and find serious flaws in both the logic and evidence on which it rests. The basic difficulty is that excessive entry is expected only when established firms ignore opportunities for entry-preventing behaviour.

Entry-preventing behaviour results in a complicated relationship between protection and the competitive strength of domestic producers. Aggressive marketing and product development act as barriers to entry by strengthening the competitive position of established firms relative to new entrants, and also act to strengthen the competitive position of domestic producers both at home and abroad. The interaction between this positive impact on competitive position and the negative effect of high prices in the protected domestic market is analyzed in Section 2. A clearly negative impact of protection on competitive position is indicated only when economies of scale are an effective deterrent to the entry of new producers.

Current proposals for trade liberalization dismiss the argument that protection enhances industry development. Our analysis suggests that a blanket dismissal of the argument is invalid because there are types of industries in which protection can have a positive impact on development. Section 3 contains a discussion of industry characteristics which increase the likelihood that protection has a positive impact on development.

2.2 THE EXCESS-ENTRY HYPOTHESIS

The seminal contribution to the argument that protection leads to low productivity is by Eastman and Stykolt (1967). Eastman and Stykolt show that the impact of tariffs on pricing behaviour can be expected to depend on whether domestic producers act competitively or collusively. In particular, prices are shown to be more likely to rise with the level of tariffs when domestic producers act collusively.

Bloch (1974) and Hazledine (1980) provide empirical studies of pricing in Canadian manufacturing with market concentration used as a proxy for the tendency to act collusively. Both studies find that concentration has a positive and statistically significant impact on the relationship between tariffs and the price level of Canadian producers. Thus, the studies provide empirical support to the static pricing analysis of Eastman and Stykolt.

Eastman and Stykolt also analyze the dynamic impact of protection. They argue that the high prices set by domestic producers behind a tariff wall provide an inducement for additional producers to enter protected industries. With entry, the output of each producer is reduced and unit cost is increased to the extent that the producers are operating below the output necessary for the achievement of minimum unit cost of production. The inefficient operation at small scale is reflected in low labour and capital productivity.

An extreme form of the excess-entry hypothesis is applied by Harris (1983) in estimating the impact of proposed trade liberalization on Canadian manufacturing. The notion applied is that entry continues until all domestic producers are earning zero economic profit. Any price increase due to protection then leads to an equal cost increase, so that productivity in Canadian manufacturing relative to foreign competitors becomes inversely proportional to the domestic price increase arising from protection.

Direct observation of the process of excessive entry predicted by Eastman and Stykolt is not possible. The pattern of protective tariffs has been working on entry behaviour for the last century, but extensive data entry are available only in the last two decades. This has led empirical researchers to focus on consequences of excessive entry, particularly the failure of domestic producers to achieve efficient levels of output.

Eastman and Stykolt report a positive and statistically significant relationship between the achievement of efficient scale and market size for Canadian manufacturing industries. They argue that because protection isolates the domestic market from the larger world market, protection reduces scale efficiency. However, Muller (1982) notes that none of the empirical studies which have investigated the determinants of the achievement of scale efficiency in Canadian manufacturing have found a statistically significant negative relationship between scale efficiency and measures of the level of tariff protection. Instead, the studies rely upon the link between market size and scale efficiency. Muller suggests that this leaves empirical support for the excess-entry hypothesis on shaky ground.

Muller also criticizes the logic of the excess-entry hypothesis by pointing out that the dynamic analysis of Eastman and Stykolt has never been adequately formalized. The theory of entry-preventing pricing suggests that small market size acts as a barrier to entry, which allows established producers to raise

prices above minimum unit production cost without attracting entry. A reduction in scale efficiency is expected with smaller market size only if established firms raise prices by more than the rise in the entry-preventing price. Eastman and Stykolt argue that small market size leads to an increase in domestic price in a protected market, but they do not argue that the price increase exceeds the increase in the entry-preventing price.

Recent developments in the theory of entry-preventing behaviour are especially damaging to the logic of the excess-entry hypothesis. Spence (1977) argues that the acquisition of excess capacity can be an effective deterrent to entry, while Eaton and Lipsey (1981) extend the argument to all forms of product-specific investment including advertising and R & D all lead to reduced entry into Canadian manufacturing industries is provided by Orr (1974). If established firms effectively prevent entry through the use of non-price strategies, there is no logical connection between the static pricing analysis of Eastman and Stykolt and their dynamic analysis of excessive entry.

2.3 THE IMPACT OF TARIFFS ON THE COMPETITIVE POSITION OF DOMESTIC PRODUCERS

The Eastman and Stykolt analysis of pricing treats the prices of goods in the world market as unaffected by demand from a relatively small economy such as Canada. With the imposition of a Canadian tariff, the price of imported goods in Canada rises in proportion to the tariff rate. This improves the competitive position of Canadian producers in the home market if they hold their prices constant. However, Eastman and Stykolt argue that when domestic producers engage in collusive pricing they will raise their prices to match the rise in the price of imported goods. Thus, collusive pricing wipes out the favourable impact of protection on the competitive position of domestic producers in the home market. Furthermore, the prices of Canadian goods in foreign markets rise with the price in the home market, so that the competitive position of Canadian goods in foreign markets deteriorates.

When we allow for the possible range of pricing responses of domestic producers, the effect of protection on the competitive position of domestic producers ranges from positive to neutral in the home market and from neutral to negative in foreign markets. In each case, the effect is more negative, the greater is the approach to collusive pricing by the domestic producers. Market concentration serves as a proxy for the degree of collusion, so we expect the pricing response to protection from producers in concentrated industries to be more damaging to their competitive position both at home and abroad.

The full consequences of protection on competitive position include the effects of excessive entry or entry-preventing behaviour on the part of established firms. Even the extreme form of the excess-entry hypothesis utilized by Harris (1983) opens a role for protection in improving the competitive position of domestic output in both foreign and domestic markets. Excessive entry in differentiated product markets increases the number of product varieties offered by domestic producers. This has the effect of raising the total demand for domestic output both at home and abroad to the extent that the additional product varieties attract purchasers away from foreign products.

Established producers in a

protected domestic market can attempt to deter entry by increasing the number of product varieties they offer to buyers. The increased number of varieties lowers the potential demand for any additional variety produced by a new entrant, thereby lowering the expected profit from entry. Baldwin and Gorecki (1983) find that Canadian plants produce a more diversified set of products than is produced by their U.S. counterparts, and that diversification increases in industries with both high concentration and high tariffs. We expect the threat of domestic entry associated with collusive pricing in a protected market to be greatest in industries with both high concentration and high tariffs, so the Baldwin and Gorecki study provides evidence that Canadian producers respond to the threat of excessive entry by the entry-preventing strategy of proliferation of product varieties.

The consequences of an increase in product varieties for the total demand for domestic output are likely to be more positive when the increase is due to entry-preventing behaviour by established firms than when it is due to excessive entry. An established firm has an incentive to introduce varieties which are the least competitive with its pre-existing varieties, while a new entrant has an incentive to offer a variety which is most competitive with pre-existing varieties. When additional varieties are more competitive with pre-existing varieties in the domestic market, there is less likelihood of a shift of demand from foreign produced varieties to domestic varieties.

Other forms of non-price competition, such as aggressive marketing and product development, also act as barriers to entry by reducing the potential demand for the product of a new entrant. The success of these forms of competition as barriers to entry requires a positive response by domestic buyers, which implies an improvement in the competitive position of domestic goods in at least the domestic market where the entry-preventing behaviour is focused. Thus, entry-preventing behaviour can be expected to improve the competitive position of domestic producers in the domestic market and possibly in foreign markets, whether the behaviour is in the form of increased product varieties or more intensive use of other forms of non-price competition.

Another entry-preventing strategy identified in Section 1 is the acquisition of excess capacity. Excess capacity has no direct effect on the attractiveness of domestic output to either foreign or domestic buyers. However, the presence of excess capacity increases the incentive to engage in dumping of domestic output in foreign markets. This enhances the competitive position of domestic producers in foreign markets relative to the position when prices are identical for domestic sales and exports.

Improvements in the competitive position of domestic producers, either at home or abroad which follow from excessive entry or entry-preventing behaviour, work against the impact of collusive pricing with protection. This leaves the net effect of protection and its relation to market concentration in doubt. However, neither excessive entry nor entry-preventing behaviour is expected when there are scale-economy barriers to entry in place in an industry. In this case, tariffs are expected to have an impact on competitive position, which becomes more negative as market concentration increases. Therefore, we have a clear prediction that concentration leads to deterioration in the impact of protection on competitive

position only when an industry is characterized by high scale-economy barriers.

The importance of scale-economy barriers in determining the impact of protection on the competitive position of Canadian producers is demonstrated in a comparison of empirical studies of Canadian trade in manufactured goods. Studies by Baumann (1976) and Caves, et al. (1980) show a negative relationship between tariff rates and net exports across samples of Canadian manufacturing industries. This suggests that the overall competitive position of Canadian producers, in foreign and domestic markets combined, is negatively affected by protection. However, neither study allows for an interaction in the effects of tariffs, concentration and scale-economy barriers. When this interaction is included in a study by Bloch (1983), the impact of protection on net exports is positive when a measure of the barrier to entry arising from scale economies is zero, but becomes increasingly negative with higher values of this barrier measure. The interaction between tariffs and concentration does not have a statistically significant impact on trade in the Bloch study.

2.4 TRADE POLICY FOR INDUSTRIAL DEVELOPMENT

My examination of the logic and evidence supporting the excess-entry hypothesis suggests that the hypothesis is unsubstantiated. Instead, we find support for the hypothesis that collusive pricing in the protected Canadian market leads to entry-preventing behaviour on the part of established producers. This entry-preventing behaviour tends to improve the competitive position of Canadian output in both domestic and foreign markets, thereby working to offset the deterioration in competitive position due to collusive pricing. Only when economies of scale provide a natural barrier to entry of new plants is there a clear deterioration in competitive position associated with a collusive pricing response to protection.

Defenders of the National Policy argue that highly protective tariffs lead domestic producers to progressively gain competitive strength. My analysis suggests that this argument has current validity when applied to the right industries. In the modern context, competitive strength is associated with superior products and marketing. Aggressive marketing and product development are linked with efforts by established producers to deter entry while engaging in collusive pricing in a protected domestic market. There is evidence that collusive pricing occurs with high market concentration, and argue that entry-preventing strategy is used only in the absence of a barrier to entry due to economies of scale. Thus, the argument of the defenders of the National Policy is applicable to industries with high concentration and low economies of scale.

The combination of high concentration and low economies of scale is uncommon among well-established industries. Caves, et al. (1980) report a positive and statistically significant relationship between concentration and economies of scale in their study of the determinants of concentration in Canadian manufacturing. However, there is a useful distinction between the type of capital-intensive, standardized products which have dominated manufacturing activity in the past and the skill-intensive, high-technology industries which are likely to dominate in the future. Concentration and economies of scale are logically related for industries producing the

first type of product, but not for industries with products of the second type. Thus, a positive case for protection to enhance industrial development is plausible in just the type of industry which is currently the focus of government development efforts in Canada.

Economic theory has only recently begun to examine the role of non-price strategies in the dynamics of industry development. A comprehensive framework in which to examine the consequences of tariff protection is not yet available. Furthermore, empirical studies of the impact of tariffs in Canadian manufacturing have been obsessively focused on demonstrating the negative consequences of protection, often neglecting the opposite implications of the statistical results. Current proposals for trade liberalization in Canada are based on this combination of incomplete theorizing and biased empirical studies. Our construction of a positive case for protection to enhance industrial development in selected industries is based on a critical re-examination of this same body of theory and evidence. Two conclusions follow: first, current proposals for trade liberalization are only applicable to those industries in which there is no plausible basis for expecting industrial development. Second, there is a pressing need for research to identify the precise conditions for a positive impact of tariffs on industrial development, so that we can refine and expand the crude indicators of high concentration and low economies of scale.

NOTE

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BIBLIOGRAPHY

Baldwin, John R. and Paul K. Gorecki, "Trade, Tariffs, Product Diversity and Length of Production Run in Canadian Manufacturing Industries: 1970-1979," Economic Council of Canada, Discussion Paper No. 247, 1983.

Baumann, Harry, "Structural Characteristics of Canada's Pattern of Trade," Canadian Journal of Economics 9, 1976, pp. 408-424.

Bloch, Harry, "Prices, Costs, and Profits in Canadian Manufacturing: The Influence of Tariffs and Concentration," Canadian Journal of Economics 7, 1974, pp. 594-610.

Bloch, Harry, "Domestic Market Structure, Tariffs, and the Pattern of Canada's Trade in Manufactured Goods," unpublished, Department of Economics, University of Denver, 1983.

Caves, Richard E., Michael E. Porter, and A. Michael Spence, with John T. Scott, Competition in the Open Economy: A Model Applied Canada, Harvard University Press, Cambridge, MA., 1980.

Eastman, Harry C. and Stephen Stykolt, The Tariff and Competition in Canada, McMillan, Toronto, 1967.

Eaton, B. Curtis and Richard G. Lipsey, "Capital Commitment, and Entry Equilibrium," Bell Journal of Economics 12, 1981, pp. 594-604.

Harris, Richard, "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition," Institute for Economic Research at Queen's University, Discussion Paper No. 524, 1983.

Hazledine, Tim, "Testing Two Models of Pricing and Protection with Canada/United States Data," Journal of Industrial Economics 29, 1980, pp. 145-154.

Muller, R. Andrew, "The Eastman-Stykolt Hypothesis Reconsidered," Canadian Journal of Economics 15, 1982, pp. 757-765.

Orr, Dale, "Determinants of Entry: A Study of the Canadian Manufacturing Industries," Review of Economics and Statistics 56, 1974, pp. 58-66.

Spence, A. Michael, "Entry, Capacity, Investment and Oligopolistic Pricing," Bell Journal of Economics 8, 1977, pp. 534-544.

A 1985 Forecast of Seeded Area in the Prairie Provinces

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Total area utilized to produce cereal grains and oilseeds in the prairie provinces equalled 75.7 million acres in 1984. The total area has grown very slowly with the only additional land coming from land formerly producing forages. Total area seeded has, however, grown substantially. The growth in seeded area has been at the expense of summerfallow. For the years 1982, 1983 and 1984, summerfallow area equalled 22.1, 21.3 and 20.9 million acres respectively. Since 1981, summerfallow has dropped by 2.9 million acres. The result of less and less summerfallow is that more and more crops are seeded on stubble. In 1982, 29.6 million acres or 56 percent of the seeded land was on stubble. By 1984, 33.5 million acres or 61 percent of the area was seeded on land cropped in the preceding year. Besides being the major source of cropland growth, the increased area seeded on stubble is important because the decision of which crop to plant on stubble differs from crops grown on fallow land. Before forecasting the area of each crop seeded on stubble and fallow, it is worthwhile to review the forecasts for total seeded area.

Table 1 shows the predicted area seeded exceeded the actual area in 1982 by 0.6 million acres (one percent); equaled the actual area in 1983; and underestimated the 1984 seeded area by 1.1 million acres (two percent). In 1984, the major source of error was an additional .4 million acres added from forage crops and .4 million more acres of crop seeded on stubble than was forecast. For 1985, two forecasts of seeded area are presented. One assumes the same amount of land will be seeded in 1985 as in 1984. In order to equal the total area seeded last year, the crop seeded on stubble must increase by 2 million acres in 1985. This occurs primarily because the amount of fallow land available for seeding in 1985 has fallen from 21.6 million acres in 1984 to 20.1 million acres in 1985. In 1984, 1.6 million more acres were seeded on stubble than in 1983 and in 1983, .8 million more acres were seeded on stubble than in 1982. To just maintain the seeded area in 1985, only .4 million acres of 2.4 million acres added to the seeded area base in the last two years can be summerfallowed in 1985. Therefore, for every six acres added to the seeded area since 1982, only one acre can be summerfallowed in 1985 without seeded area falling. On average, for every three acres seeded

to cereal grains and oilseeds, one acre is summerfallowed in the prairies. The other forecasted level of seeded area reflects past trends in the expanding area seeded on stubble and indicates the increase will not be sufficient in 1985 to prevent the total seeded area from declining. The area seeded on stubble in 1985 is expected to increase to 34.7 million acres. This represents a 1.2 million acre increase but it is not sufficient to offset a known 1.5 million acre decrease in the fallow land available for seeding in 1985. Therefore, summerfallow is forecast to increase in 1985 to 20.8 million acres. This level is an increase of .7 million acres above 1984. Area summerfallowed is forecasted to decline by .1 million acres in Manitoba and .2 million acres in Alberta. But this drop is more than offset with a forecasted increase in Saskatchewan of one million acres. Therefore, the key to a growth in seeded area rests with Saskatchewan farmers. Given the fall soil moisture in the northern half of the grain producing area in Saskatchewan was generally normal and the stocks of grain are projected to be at minimal levels, the conditions suggest further reductions in fallow are likely. Because of this possibility, the two forecasts of seeded area are used to predict individual crops.

Prairie seeded acreages to oats, barley, canola and flax for 1985 are forecasted to be similar to 1983 seeded acreages. This means a decline in acreages of these crops from their 1984 levels, particularly with respect to canola and flax. Given the seeded area remains unchanged or falls slightly, the upshot is that wheat acreages can be expected to be an historical high.

The area seeded to wheat in 1985 is predicted to be 0.8 million acres above the previous record set in 1983. This substantial increase from 1984 can be attributed to the current low levels of farm wheat stocks. A comparison of expected prices between the spring of 1984 and 1985 shows that with the current initial payment and most recent final payment, expected revenues per acre from wheat have increased relative to the other crops.

Land summerfallowed in 1984 was at an historic low level for the prairies. This means the available fallow seedbed for 1985 is at an all-time low. Prairie wheat acreages on a fallow seedbed are forecasted to decline from 1984, which means that the expected wheat acreage increase is due to the forecasted increase of wheat seeded on a stubble seedbed. This is the first time that the seeded acreage of wheat on stubble is expected to exceed the wheat seeded on fallow for all of western Canada. (However, in Saskatchewan, acreage of wheat on fallow is still predicted to be greater than the area seeded on stubble.)

Barley area for the prairies is forecasted to decrease 5 percent from its 1984 level, returning to its 1983 figure of 9.5 million acres. An increase in barley acreage is expected in Manitoba and Alberta, but a large decrease in Saskatchewan's barley acreage on stubble is expected to offset this.

Barley prices utilized to determine its relative profitability were based upon the cash market in Thunder Bay. Because of the current local barley shortages within the prairies, the street prices of barley may not accurately reflect prices at Thunder Bay and the expected relative profitability would be underestimated in the forecasts. In this case, the forecasted area would be too low. Therefore, the area seeded to barley may equal last year's area, but is unlikely to exceed it without a substantial de-

TABLE 1

Actual and Predicted Cropland Usage in the Prairies
(Million Acres)

	1982		1983		1984		1985	
Land Use	Actual	Predicted	Actual	Predicted	Actual	Predicted	Predicted	
Seeded on Fallow	23.2	23.0	22.6	22.1	21.6	21.3	20.1[1]	20.1[2]
Seeded on Stubble	29.6	30.7	31.2	31.9	33.5	33.1	35.5	34.7
New Land	0.3	0	.1	0	.4	0	0	0
TOTAL CROPLAND	53.1	53.7	53.9	54.0	55.5	54.4	55.6	54.8
Summer-fallow	22.1	21.8	21.3	21.2	20.1	20.9	20.0	20.8
TOTAL LAND	75.2	75.5	75.2	75.2	75.6	75.3	75.6	75.6

[1] Assumes the same area seeded in 1985 as was seeded in 1984.
[2] Forecasted area seeded in 1985.

decrease in summerfallow.

A 24 percent decrease from 1984 is expected for prairie canola acreages in 1985. This decline is expected to occur in Manitoba and Saskatchewan on both fallow and stubble seedbeds, and in Alberta on a stubble seedbed. Canola on fallow in Alberta is forecasted to show a modest increase in 1985. This net decrease in predicted canola acreages is due to its lower expected revenues. The model indicates that expected revenues from canola are not only lower than they were in 1984, but low relative to other crops.

Last year, the forecasted area of canola was 6.5 million acres, while the seeded area equalled 7.1 million acres. Table 2 shows the major source of error was the canola seeded on stubble land. The area predicted on stubble was 3.3 million acres while the actual area was 3.8 million acres. The forecast error is due to underestimating stubble seeded cropland and underpredicting the share of the stubble land seeded to canola. The expected prices utilized in the model were from the months October, November and December. In the spring of 1984 (April -

June), canola prices increased 40 percent above the levels used to forecast 1984 seeded area. The apparent effect of the higher canola prices at the time of seeding was to increase the area seeded on stubble. Unless similar market events occur in 1985, the area of land seeded to canola is forecasted to decline by 1.7 million acres.

Prairie seeded acreages for flaxseed in 1985 are forecasted to decrease 33 percent from last year (a decrease of .5 million acres). The decline is expected in all three provinces and on both seedbeds. The reasoning behind this is the presence of relatively higher on-farm stocks of flax across the prairies.

Oat acreages for the prairies are also expected to decline in 1985 (about 8 percent below 1984 figures), particularly on stubble seedbeds. This can be attributed to the relatively low expected revenue from oats.

In conclusion, the 1985 forecasts suggest that prairie farmers will seed more land to wheat than ever before. The increase occurs in all provinces. The only factor which may reduce the switch to more wheat would be an announcement of lower initial payments for the 1985/86 crop year. Given the low stocks of all grains and the lower forecasted area for barley, oats, canola and flax, the expected supplies of these crops will just be sufficient to meet historical requirements in 1985/86.

TABLE 2

Prairie Provinces
Actual and Forecasted Seeded Area
(Million Acres)

Crop	Seedbed	1984 Actual	1984 Forecast	1985 Forecast	
Wheat	Fallow	16.0	15.9	15.1[1]	15.1[2]
	Stubble	15.7	15.7	19.3	18.7
	Total	31.7	31.6	34.4	33.8
Oats[3]	Fallow	.5	.5	.6	.6
	Stubble	2.1	1.7	1.7	1.7
	Total	2.6	2.2	2.3	2.3
Barley	Fallow	1.4	1.4	1.1	1.1
	Stubble	8.7	8.8	8.5	8.4
	Total	10.1	10.2	9.6	9.5
Canola	Fallow	3.3	3.2	3.0	3.0
	Stubble	3.8	3.3	2.5	2.4
	Total	7.1	6.5	5.5	5.4
Flaxseed	Fallow	.4	.3	.2	.2
	Stubble	1.1	1.1	.8	.8
	Total	1.5	1.4	1.0	1.0
Other[4]	Total	2.5	2.5	2.7	2.7
TOTAL		55.5	54.4	55.5	54.8

[1] Assumes the total area seeded in 1985 equals 1984.
[2] Forecasted area seeded 1984.
[3] Oats seeded for grain only.
[4] Mixed grain, sunflowers, mustard, peas, lentils, buckwheat, rye and corn.

The System of Transfers to and from Households in Canada

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The federal government has recently initiated a public debate on the future of benefits programs for children and the elderly in Canada. The government's own position has been set out in a consultation paper (Canada, 1985) to which all interested parties have been invited to respond. As part of this consultative process I want to draw attention to some fundamental issues which have been overlooked. In brief, I shall propose that the effect of government transfer programs must be considered within the context of a broader system of intergenerational transfers to and from households. Any attempt to set national priorities for income distribution should take this broad transfer system into account.

In modern society the transfers received by households include both government transfers and private transfers received from other households (see Lampman and Smeeding, 1983). Although private support systems may have declined in importance as government support systems have expanded, they are not insignificant (Shanas, 1979). The supports provided by individuals include personal services of various kinds, and transfers of money and goods, often in the form of gifts. Gift transactions are important features of kinship networks. Osborn and Williams (1976) have shown that in London, Ontario, exchanges of gifts between kin are considerably more frequent than exchanges of household tasks, discussion of daily problems, child care, or financial assistance.

The continued existence of private transfer systems in modern society is no longer questioned, and in recent years attention has shifted to the nature of their effects. It has become clear that we know very little about the relationships between household transfers and government transfer programs (Moon, 1983). Until more is known about the nature of these relationships we will not be able to arrive at any realistic assessment of the effectiveness of public policies concerning income redistribution. Nevertheless, it is possible to make some preliminary observations which may serve to indicate the kinds of issues which need to be addressed in public debate and in social scientific research.

Transfer programs intended to benefit children and the elderly evidently have an age criterion as one of their conditions. The specific age categories identified cannot be

considered in isolation, however, since in reality they are merely segments of the life cycle. The federal government's consultation paper on Child and Elderly Benefits recognizes this fact when it notes that one of the constraints upon changing the level of elderly benefits is the need to allow for adjustments in patterns of savings in earlier years (Canada, 1985, p. 8). The accumulation of savings is not the only economic consideration which must be viewed from a life cycle perspective. It is also necessary to take into account patterns of savings and income disbursements, including inter-family transfers.

Recent analyses of expenditure surveys in Canada (Cheal, 1983) and the United States (Chen and Chu, 1982; McConnel and Deljavan, 1983) have shown that gifts and contributions account for relatively large proportions of the disbursements by elderly families. The elderly do, of course, receive benefits from others as well as giving to them, but their gift transactions do not balance. The elderly give more than they receive, and their 'altruistic deficit' is larger than that for any other age group (Cheal, 1983; 1985).

Deficits in private transfers experienced by some households arise because other households have net surpluses in their transactions. In Canada, the greatest net per capita benefits are received by unattached individuals under 45 years of age, and by families with one or more children age four or younger in which the husband is under 45 years of age (Cheal, 1984).

It is instructive to compare the net effects of transactions between households with the net effects of transactions between households and government agencies. This comparison is particularly interesting for what it has to tell us about the relationships between the values of everyday life and the principles of official policy.

Since the end of the Second World War, federal and provincial governments in Canada have attempted to redistribute incomes in favour of sections of the population considered to be in need. Among those groups the elderly have been identified as a prime target for public policy. Government intervention has taken a variety of forms, and although the social benefits of some programs appear to be minor, government transfers to the elderly have clearly brought about a redistribution of income (Ross, 1980, pp. 63-65). Government transfer payments now make up a significant proportion of the incomes of older Canadians (Stone and MacLean, 1979, p. 23). At the same time, the elderly have benefited from the progressive nature of the Canadian income tax system. Since their average incomes are low, the burden of direct taxation falls mainly on the members of younger age groups. As a result, elderly Canadians are substantial net beneficiaries in their transactions with the state.

The comparative effects of private and public transactions for households at different stages of the family life cycle can be illustrated from Statistics Canada's 1978 Family Expenditure Survey (Statistics Canada, 1982).

FAMILY LIFE CYCLE STAGES

a. Unattached individuals, under 45 years of age.
b. Married couples with no children under sixteen years old, in which the husband is under 45 years of age.
c. Married couples with one or more children age four or younger, in which the husband is under 45 years of age.
d. Married couples with one or more

children under sixteen years old, none of whom are four years old or younger, in which the husband is under 45 years of age.

e. Married couples with children under sixteen years old, in which the husband is age 45 to 64.
f. Married couples with no children under sixteen years old, in which the husband is age 45 to 64.
g. Married couples, in which the husband is 65 years of age or older.
h. Unattached individuals, age 65 or older.

The figures presented in Table 1 show that the system of household transactions in Canada consists of two types of intergenerational transfers that flow in opposite directions. The net effect of transactions between households and governments is to transfer income from the young and the middle-aged to the elderly. On the other hand, the net effect of transactions between households is to transfer income from the middle-aged and the elderly to the young. It is important to note that the magnitudes of these effects are unequal. Nevertheless, the system of private transfers is too substantial to be ignored. The net deficit in private transactions incurred by elderly households is equivalent to between six percent and nine percent of the net benefit that they gain from their transactions with governments.

4.1 DISCUSSION

Recent discussions of income benefits have tended to focus upon the various means by which established income redistribution policies might be implemented (e.g., Hum, 1984). As a result, there has been little serious reflection upon the ends which these programs should serve. It is appropriate at this time to ask ourselves what the relationship should be between government programs and Canadian social life.

In the consultation paper on Child and Elderly Benefits, the federal government has explicitly not proposed reducing the level of elderly benefits (Canada, 1985, p. 11), but has instead advanced a model for the reform of child benefits. The proposed reform would increase the tax burden for most families with children, and thus make their average deficit in transactions with governments even larger (Canada, 1985, p. 12). This combination of policy recommendations might be desirable if there was an evident commitment among Canadians to reduce the economic circumstances of families with children while leaving the economic benefits of the elderly intact. Yet the opposite seems to be the case. If we look at what Canadians actually do in their everyday private transactions, it appears that younger families are prepared to withhold economic benefits from the elderly, while the elderly themselves seek to maintain a high level of expenditure on others. The reasons for these practices, if they could be clearly established, might tell us a great deal about the ways in which Canadians adjust to economic and social pressures. In particular, it seems likely that much more attention will need to be paid in the future to the "life cycle squeezes" experienced by pre-retirement age groups (see esp. Oppenheimer, 1974; 1982; Schultz, 1974).

TABLE 1

The System of Household Transfers by Family Life Cycle: Canada 1978

	Family Life Cycle Stages								
	1	2	3	4	5	6	7	8	Total Sample
	$	$	$	$	$	$	$	$	
Transfers household/government									
Payments to governments									
Personal taxes	2,396	4,507	3,493	4,738	4,331	4,433	1,048	290	
Unemployment insurance	137	255	188	214	216	208	31	-	
Pension contributions‡1	140	271	204	234	243	238	38	4	
Total	2,673	5,033	3,885	5,186	4,790	4,879	1,117	294	
Receipts from governments									
Old age security, etc.	-	-	-	-	-	63	3,669	2,384	
Pensions	-	-	-	-	-	84	938	451	
Other transfer payments	411	788	1,324	1,317	1,739	819	490	226	
Total	411	788	1,324	1,317	1,739	966	5,097	3,061	
Net transfers household/ government	-2,262	-4,245	-2,561	-3,869	-3,051	-3,913	+3,980	+2,767	
Transfers household/household									
Gift expenditures									
Money gifts	142	173	106	87	129	275	305	220	180
Other gifts	137	194	153	137	144	208	197	70	158
Total	279	367	259	224	273	483	502	290	338
Gift receipts									
Money gifts	183	134	180	120	59	34	31	40	102
Other gifts	172	276	231	172	146	160	132	76	178
Total	355	410	411	292	205	194	163	116	280
Net transfers household/ household	+76	+43	+152	+68	-68	-289	-339	-174	-58
Net household transfers	-2,186	-4,202	-2,409	-3,801	-3,119	-4,202	+3,641	+2,593	
Income of household‡2	13,143	24,147	20,901	25,635	25,658	24,410	12,262	6,078	
Number in household	1.0	2.1	3.9	4.4	4.7	2.7	2.2	1.0	
Age of household head	28.3	29.1	30.9	37.4	50.4	55.7	71.5	74.1	

Source: Survey of Family Expenditure in Canada, 1978; Statistics Canada unpublished tabulations.
‡1 All pension entries refer to the Canada and Quebec pension plans.
‡2 Income before taxes.

BIBLIOGRAPHY

Canada, Minister of National Health and Welfare, Child and Elderly Benefits, Ottawa, Department of National Health and Welfare, January, 1985.

Cheal, David, "Intergenerational Family Transfers," Journal of Marriage and the Family, Vol. 45, No. 4, 1983, pp. 805-813.

Cheal, David, The Gift Economy, Report submitted to the Social Sciences and Humanities Research Council of Canada, December, 1984.

Cheal, David, "Moral Economy: Gift Giving in an Urban Society," Winnipeg Area Study Report, No. 5, Institute for Social and Economic Research, University of Manitoba, 1985.

Chen, Yung-Ping and Kwang-Wen Chu, "Household Expenditure Patterns," Journal of Family Issues, Vol. 3, No. 2, 1982, pp. 233-250.

Hum, Derek, "Universality and Restraint in Income Security," Western Economic Review, Vol. 3, No. 3, 1984, pp. 15-29.

Lampman, Robert and Timothy Smeeding, "Interfamily Transfers as Alternatives to Government Transfers to Persons," Review of Income and Wealth, Series 29, No. 1, 1983, pp. 45-66.

McConnel, Charles and Firooz Deljavan, "Consumption Patterns of the Retired Household," Journal of Gerontology, Vol. 38, No. 4, 1983, pp. 480-490.

Moon, Marilyn, "The Role of the Family in the Economic Well-Being of the Elderly," The Gerontologist, Vol. 23, No. 1, 1983, pp. 45-50.

Oppenheimer, Valerie Kincade, "The Life-Cycle Squeeze: The Interaction of Men's Occupational and Family Life Cycles," Demography, Vol. 11, No. 2, 1974, pp. 227-245.

Oppenheimer, Valerie Kincade, Work and the Family, New York, Academic Press, 1982.

Osborn, Richard and J. Ivan Williams, "Determining Patterns of Exchanges and Expanded Family Relationships," International Journal of Sociology of the Family, Vol. 6, No. 2, 1976, pp. 197-209.

Ross, David, The Canadian Fact Book on Income Distribution, Ottawa, Canadian Council on Social Development, 1980.

Schultz, Theodore, "Fertility and Economic Values," pp. 3-22 in Theodore Schultz (ed.), Economics of the Family, Chicago, University of Chicago Press, 1974.

Shanas, Ethel, "The Family as a Social Support System in Old Age," The Gerontologist, Vol. 19, No. 2, 1979, pp. 169-174.

Statistics Canada, Family Expenditure in Canada, Vol. 3, (Catalogue No. 62-551), Ottawa, Statistics Canada, 1982.

Stone, Leroy and Michael MacLean, Future Income Prospects for Canada's Senior Citizens, Montreal, Institute for Research on Public Policy, 1979.

ANALYSTS' NOTEBOOK

Coping With Collinearity

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5.1 INTRODUCTION

Collinearity (multicollinearity) is widely accepted as the most important and intractable disturbance to linear regression models. A standard diagnosis such as examining the simple correlation nature is often inadequate, as is dropping variables/observations and judging the resultant variability of coefficients and associated statistics. This note reviews recent developments in diagnosing the presence of harmful collinearity and suggests some remedies. By necessity, the discussion is summary in form, with general rules of thumb replacing detailed proof. For this the reader is referred to the bibliography.

One caveat is important. The presentation here rests on the work of Belsley, Kuh, and Welsch (1980), and the reader should be cautioned that the entire area is under active research and debate. This note merely summarizes the present state of the art; it may well change tomorrow.

5.2 WHAT IS COLLINEARITY?

Collinearity is basically not a statistical problem. That is, according to the approach of BKW (1980), inferring the presence of "harmful" collinearity is not assisted by any statistical test such as is used to reject a null hypothesis in the classical research situation.

Rather, collinearity is diagnosed using indications which have been developed using simulation and other trial and error processes. This is simply because collinearity is not due to some flaw in sampling or other failure in the ordinary least squares assumptions.

Intuitively, collinearity exists among two or more independent variables which are highly correlated. The effect of this is to produce regression estimates with inflated variances. In other words, the individual t values are unreliable, and it becomes difficult to test hypotheses on the regression parameters. A formal definition is supplied by Gunst (1984):

> A collinearity is said to exist among the columns of $X = (x_1, x_2, \ldots x_p)$ if for a suitably

predetermined $e_n > 0$ there exists constants $c_1, c_2, \ldots c_p$ not all zero, such that

$c_1x_1 + c_2x_2 + \ldots c_px_p =$

S with $||S|| < e_n \cdot ||c||$

A simple analogy is provided by Hocking and Pendleton (1983). A picket fence (where each picket represents an independent variable), has even spaces between the pickets. Collinearity exists when pickets overlap. The collinearity becomes more severe as individual pickets widen and overlap other pickets, effectively hiding them from view. In other words, collinearity obscures the role of individual pickets (variables), and makes some pickets (variables) redundant.

5.3 DIAGNOSING COLLINEARITY

Conventional indications of collinearity are:

a. parameter instability when one or more variables are withdrawn from the regression;
b. instability in the estimates of standard error of the regression coefficients, when variables and/or observations are withdrawn;
c. large subsets of regressors (independent variables) statistically indistinguishable from zero, but high overall goodness of fit (R^2);
d. statistically significant pairwise correlations between independent variables.

The first indication that multicollinearity may be a problem in any specification occurs as variables are dropped/added to the equation. Previously significant (statistically) variables become insignificant, and may change sign. In simple cases, the pairwise correlations may provide straightforward indications of the offending variables. However, as a general rule, experimenting with specifications and examining the correlation matrix are limited as collinearity diagnostics. A simple procedure or indicator is usually insufficient to detect collinearity. This is a crucial point. Collinearity is frequently specific to model specification (what variables are included, and the algebraic form of the regression), and definition of the variables. Several points are important to detecting collinearity.

First, the regression model is ill-suited for exploratory analysis. In fitting a regression, the analyst ought to have developed a clear structural model, for which the regression serves as a step in confirming the hypotheses underlying the research. Exploratory analysis, comprising bivariate plots, summary statistics, and various graphical approaches (stem-leaf plots, etc.) ought to be undertaken prior to the specification of a confirmatory model.

Second, each variable must be clearly understood in terms of its construction and definition. Aside from aiding in the interpretation of the regression parameters, the variable definition is essential to unraveling measures which may "overlap."

5.4 SPECIFIC DIAGNOSTICS IN DETECTING MULTICOLLINEARITY

5.4.1 Condition Index

The condition index, developed by Belsley, Kuh and Welsch (1980), measures the degree to which regression parameters are influenced by small perturbations in the data matrix. As this index rises toward 10 to 15, the sensitivity of regression

parameters increases. In general, BKW indicate that a condition index in excess of 20 is a clear indication of harmful collinearity. As the condition index rises, the 'R^2' on the underlying linear relationship (among the subset of offending independent variable) will rise.

5.4.2 Variance-Decomposition Proportions

The condition index signals that a subset of the independent variable are collinear. The variance decomposition matrix signals which variables are involved. This is a p X p matrix (where p is the number of independent variables). Reading across each row, any set of two entries or more which have values in excess of .5 signals a variable which is likely to contribute to harmful collinearity. Note that aside from the first row (corresponding to the intercept term), one entry will often be relatively high (.6 or greater). It is also likely that for any high index, several variables will be involved, and the variance decomposition will be distributed across the row. Therefore, if the condition index is high (20 or more), look for several "high" entries. With only two variables (i.e., pairwise correlation), the values will be relatively high, around .7, but as the number of variables involved increases, the typical value will fall and be spread across a number of (but not all) entries.

5.4.3 Variance Inflation Factors

Variance inflation factors (VIF) provide a simple measure of the susceptibility of a variable to collinearity from other terms included in the regression. Generally, values in excess of 10 indicate that the variable is redundant. However, there is no real basis for such a rule of thumb. Also, the set of VIFs does not reveal near dependencies; that is, subsets of independent variables which are weakly collinear, and which can degrade statistical evaluation of a regression. VIFs are easy to understand, and do provide a quick way to initially evaluate a regression. Also, the square root of the largest VIF is the lower bound for the highest condition index.

5.5 EXAMPLE

Consider the following regression run on the MINCOME Baseline data. This data set has 2173 observations, and is cross-sectional. While collinearity is pervasive for time series data, cross-sectional data can also exhibit this problem. The object of this regression is to estimate the determinants of household total net worth as a function of

a. household income, F35
b. family size (number of persons), F8
c. family size index, F11
d. number of children under 6, F10
e. net worth (less house value), NTWRTH1
f. age of male head, F6
g. age of female head, F7
h. number of years in work force - male head, F56
i. income in 1974, INCOME74
j. income in 1973, INCOME73

Clearly, certain subsets of these variables, namely (a,i,j), (f,g,h), and (b,c,d) are likely to be collinear. (Note this regression is run solely to illustrate the diagnostics.) The results (using SAS) are as follows (the dependent variable is total household net worth).

TABLE 1a

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|	VARIANCE INFLATION	VARIABLE LABEL
INTERCEP	1	-18005.641	3524.547	-5.109	0.0001	0.000000	INTERCEPT
F35	1	0.081665	0.283382	0.288	0.7733	10.582473	TOTAL 1974 ADJUSTED INCOME
F8	1	-1962.852	698.706	-2.809	0.0052	12.232990	FAMILY SIZE
F11	1	142.650	51.441487	2.773	0.0058	15.627763	FAMILY SIZE INDEX
F10	1	201.775	480.488	0.420	0.6747	1.588469	NUMBER OF CHILDREN UNDER 6
NTWRTH1	1	1.320939	0.062885	21.006	0.0001	1.140160	
F6	1	334.466	49.511406	6.755	0.0001	2.275003	AGE, MALE HEAD
F56	1	8.692264	50.822164	0.171	0.8643	2.293864	NUMBER OF YEARS WORKED FULLTIME-MALE
INCOME74	1	0.024698	0.329496	0.075	0.9403	13.026178	
INCOME73	1	0.413441	0.168180	2.458	0.0143	2.329838	

As expected, several variables give indications of collinearity, in particular F8 and F11, and possibly INCOME74; however, we have no idea of how these may be linearly related. The condition index and variance decompositions proportion matrix provides useful clues.

TABLE 1b

COLLINEARITY DIAGNOSTICS			VARIANCE PROPORTIONS									
NUMBER	EIGENVALUE	CONDITION INDEX	PORTION INTERCEP	PORTION F35	PORTION F8	PORTION F11	PORTION F10	PORTION NTWRTH1	PORTION F6	PORTION F56	PORTION INCOME74	PORTION INCOME73
1	7.829	1.000	0.0001	0.0003	0.0002	0.0001	0.0026	0.0032	0.0006	0.0023	0.0002	0.0011
2	0.840270	3.052	0.0001	0.0000	0.0003	0.0000	0.0850	0.5953	0.0000	0.0077	0.0000	0.0001
3	0.543326	3.796	0.0000	0.0002	0.0001	0.0000	0.2604	0.2923	0.0024	0.1083	0.0000	0.0007
4	0.396420	4.444	0.0002	0.0165	0.0017	0.0001	0.1061	0.0533	0.0013	0.1219	0.0044	0.0075
5	0.198023	6.288	0.0065	0.0056	0.0034	0.0019	0.1753	0.0155	0.0296	0.3127	0.0047	0.0086
6	0.100551	8.824	0.0086	0.0210	0.0226	0.0011	0.0420	0.0006	0.0672	0.0945	0.0019	0.2387
7	0.058572	11.561	0.0106	0.0114	0.0473	0.0019	0.0443	0.0111	0.0245	0.0003	0.0286	0.5809
8	0.022902	18.489	0.1237	0.0267	0.0012	0.0067	0.1046	0.0104	0.7584	0.3392	0.0749	0.0116
9	0.008746	29.919	0.0827	0.5366	0.2594	0.0379	0.0039	0.0043	0.1054	0.0082	0.5419	0.1395
10	0.002314	58.171	0.7674	0.3818	0.6640	0.9503	0.1757	0.0141	0.0107	0.0048	0.3433	0.0113

The condition index rises to 32, indicating the possible presence of collinearity. Further reading across row 11 reveals large proportions associated with F8 and F11. In row 10, with a condition index of 17.57, there are large proportions associated with F35 and INCOME74.

None of this is surprising. The definition of the variables is such that F8 and F11 are very close, as is F35 and INCOME74. Also, these are pairwise relationships, which are revealed in the correlation matrix (see Appendix), but if more than two variables are involved, the correlation matrix is not helpful. Revising the specification produces the results in Tables 2a and 2b.

Note that despite the condition index rising to only 8.7, a number of near linearities are signaled. Ideally, only one entry in the row ever should be relatively large and stand out. This regression still has plenty of problems, not the least of which is a severe simultaneous equation bias because net worth type of variables appear on both sides of the regression equation.

TABLE 2a

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|	VARIANCE INFLATION	VARIABLE LABEL
INTERCEP	1	-12370.523	1884.510	-6.564	0.0001	0.000000	INTERCEPT
F35	1	0.043674	0.110014	0.397	0.6915	1.572953	TOTAL 1974 ADJUSTED INCOME
F8	1	-50.242142	252.026	-0.199	0.8421	1.569681	FAMILY SIZE
NTWRTH1	1	1.347282	0.062762	21.467	0.0001	1.120055	
F6	1	361.755	46.145319	7.839	0.0001	1.948971	AGE, MALE HEAD
F56	1	19.602245	50.991896	0.384	0.7008	2.277415	NUMBER OF YEARS WORKED FULLTIME-MALE
INCOME73	1	0.537219	0.149776	3.587	0.0004	1.822373	

TABLE 2b

COLLINEARITY DIAGNOSTICS			VARIANCE PROPORTIONS						
NUMBER	EIGENVALUE	CONDITION INDEX	PORTION INTERCEP	PORTION F35	PORTION F8	PORTION NTWRTH1	PORTION F6	PORTION F56	PORTION INCOME73
1	5.501	1.000	0.0010	0.0034	0.0027	0.0074	0.0014	0.0050	0.0028
2	0.740899	2.725	0.0010	0.0004	0.0042	0.9012	0.0008	0.0001	0.0004
3	0.399270	3.712	0.0050	0.0845	0.0023	0.0016	0.0010	0.3369	0.0047
4	0.185178	5.450	0.0157	0.2105	0.1125	0.0601	0.0272	0.1981	0.0398
5	0.100740	7.390	0.0238	0.0819	0.1908	0.0010	0.0986	0.0386	0.3874
6	0.052667	10.220	0.0124	0.4119	0.6011	0.0194	0.1214	0.0404	0.5562
7	0.020325	16.451	0.9411	0.2073	0.0863	0.0092	0.7497	0.3810	0.0087

5.6 SUMMARY AND DIAGNOSIS

Collinearity reduces the hypothesis-testing power of linear regression by inflating the variance on parameter estimates. In diagnosing collinearity, the analyst must proceed slowly. Recommended are:

a. careful exploratory analysis on all variables and key bivariate relationships;
b. analysis of the simple correlation matrix;
c. careful development of the structural model, and definition of variables;
d. collinearity should be suspected if - VIF is greater than 10
   - condition index is greater than 15; and
   - variance proportions are relatively high on more than one variable.

   These are likely to be the offending terms, but note that others could be involved.

5.7 REMEDIES: A PARTING WORD

The corrective action taken in "fixing" the model used to be to drop the offending variable. Unless some silly mistake has been made (as in the example above), care should be taken not to drop variables which have a theoretical role in one's statistical analysis.

Another common remedy is to transform the data. Standardized regression, centering, logarithms, first differences (on times series data) are transformations which frequently eliminate collinearity. They can also trigger collinearity just as frequently. Also, unless these transformations are indicated by the theory, it is ill-advised to undertake them as a cure of collinearity. Also, polynomial

regressions often have collinearity in certain ranges of the data.

Specialized techniques such as mixed Bayesian and ridge regression can be used, but require extra (prior) information beyond the scope of most research. Also, these are quite sophisticated procedures, and are not recommended for most social research.

Finally, regression models are part of many advanced procedures in the social sciences. LISREL, ANCOVA, and other approaches all may contain collinear relationships which are hard to detect, especially if the researcher simply lets the machine do the analysis. In my view, this is a major weakness of these new procedures.

In the final analysis, the focus must be on the relation between theory and estimation. Collinearity seems to occur so frequently, simply because performing regression analysis is trivial using modern software. Coping with collinearity is primarily accomplished through care in the specification of the model. It makes no sense to correct for collinearity if the underlying model has silly mistakes in specification (as the example above), or because the variables are poorly understood.

NOTE

This is a revised version of a TECHNOTE published January 16, 1985.

REFERENCES

Belsley, D. A., E. Kuh, and R. E. Welsch, Regression Diagnostics, New York, John Wiley, 1980.

Gunst, R. F., "Toward a Balanced Assessment of Collinearity Diagnostics," American Statistician Volume 38, May, 1984, pp. 79-82.

Hocking, R. R., and O. J. Pendleton, "The Regression Dilemma," Communication in Statistics A12, 1983, pp. 497-527.

APPENDIX

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / NUMBER OF OBSERVATIONS

	NTWRTH	F35	F8	F11	F10	NTWRTH1	F6	F7	F56	INCOME74
NTWRTH NETWORTH	1.00000 0.0000 535	0.12506 0.0038 535	0.15983 0.0002 535	0.27446 0.0001 535	-0.20674 0.0001 535	0.70363 0.0001 535	0.42320 0.0001 532	0.43528 0.0001 531	0.39427 0.0001 529	0.29675 0.0001 535
F35 TOTAL 1974 ADJUSTED INCOME	0.12506 0.0038 535	1.00000 0.0000 794	-0.18312 0.0001 794	-0.16485 0.0001 794	-0.08914 0.0120 794	0.17760 0.0001 535	-0.13130 0.0002 791	-0.13399 0.0002 789	0.07413 0.0380 784	0.79407 0.0001 794
F8 FAMILY SIZE	0.15983 0.0002 535	-0.18312 0.0001 794	1.00000 0.0000 794	0.92668 0.0001 794	0.16068 0.0001 794	0.00053 0.9903 535	0.39600 0.0001 791	0.35942 0.0001 789	0.43096 0.0001 784	0.29222 0.0001 794
F11 FAMILY SIZE INDEX	0.27446 0.0001 535	-0.16485 0.0001 794	0.92668 0.0001 794	1.00000 0.0000 794	-0.01866 0.5996 794	0.07895 0.0680 535	0.49839 0.0001 791	0.48298 0.0001 789	0.49306 0.0001 784	0.36243 0.0001 794
F10 NUMBER OF CHILDREN UNDER 6	-0.20674 0.0001 535	-0.08914 0.0120 794	0.16068 0.0001 794	-0.01866 0.5996 794	1.00000 0.0000 794	-0.12717 0.0032 535	-0.35925 0.0001 791	-0.40183 0.0001 789	-0.21150 0.0001 784	-0.10277 0.0037 794
NTWRTH1	0.70363 0.0001 535	0.17760 0.0001 535	0.00053 0.9903 535	0.07895 0.0680 535	-0.12717 0.0032 535	1.00000 0.0000 535	0.16713 0.0001 532	0.16629 0.0001 531	0.19936 0.0001 529	0.23818 0.0001 535
F6 AGE, MALE HEAD	0.42320 0.0001 532	-0.13130 0.0002 791	0.39600 0.0001 791	0.49839 0.0001 791	-0.35925 0.0001 791	0.16713 0.0001 532	1.00000 0.0000 791	0.92093 0.0001 786	0.66473 0.0001 781	0.17064 0.0001 791
F7 AGE,FEMALE HEAD	0.43528 0.0001 531	-0.13399 0.0002 789	0.35942 0.0001 789	0.48298 0.0001 789	-0.40183 0.0001 789	0.16629 0.0001 531	0.92093 0.0001 786	1.00000 0.0000 789	0.60951 0.0001 780	0.16580 0.0001 789
F56 NUMBER OF YEARS WORKED FULLTIME-MALE	0.39427 0.0001 529	0.07413 0.0380 784	0.43096 0.0001 784	0.49306 0.0001 784	-0.21150 0.0001 784	0.19936 0.0001 529	0.66473 0.0001 781	0.60951 0.0001 780	1.00000 0.0000 784	0.37107 0.0001 784
INCOME74	0.29675 0.0001 535	0.79407 0.0001 794	0.29222 0.0001 794	0.36243 0.0001 794	-0.10277 0.0037 794	0.23818 0.0001 535	0.17064 0.0001 791	0.16580 0.0001 789	0.37107 0.0001 784	1.00000 0.0000 794
INCOME73	0.33833 0.0001 535	0.48174 0.0001 794	0.32025 0.0001 794	0.40586 0.0001 794	-0.12973 0.0002 794	0.24581 0.0001 535	0.20679 0.0001 791	0.20005 0.0001 789	0.41862 0.0001 784	0.74088 0.0001 794

	INCOME73
NTWRTH NETWORTH	0.33833 0.0001 535
F35 TOTAL 1974 ADJUSTED INCOME	0.48174 0.0001 794
F8 FAMILY SIZE	0.32025 0.0001 794
F11 FAMILY SIZE INDEX	0.40586 0.0001 794
F10 NUMBER OF CHILDREN UNDER 6	-0.12973 0.0002 794
NTWRTH1	0.24581 0.0001 535
F6 AGE, MALE HEAD	0.20679 0.0001 791
F7 AGE,FEMALE HEAD	0.20005 0.0001 789
F56 NUMBER OF YEARS WORKED FULLTIME-MALE	0.41862 0.0001 784
INCOME74	0.74088 0.0001 794
INCOME73	1.00000 0.0000 794

OTHER TECHNOTES

Technical bulletins provide a short discussion of current interest to the research community. One copy of each bulletin (or set of bulletins) is distributed to interested individuals free of charge. Subsequent copies are $2.50 each. Quantity orders (more than 10) will be $2.00 each.

TB-1 RESPONSE RATES ON MAILOUT SURVEYS.
A brief review of the techniques for attaining acceptable response rates on a mailout survey.

TB-2 ESTIMATION OF LORENZ CURVE (AND GINI COEFFICIENT) FROM GROUPED INCOME DISTRIBUTIONS.
Lorenz curve and GINI coefficient are basic measures of inequality. This technical note presents a simple way of computing this measure, and a SAS (Statistical Analysis System) program for implementing this procedure.

TB-3 WHY IS 1000 ENOUGH? WHEN IS 1000 NOT ENOUGH?
It is puzzling that a sample of 1000 provides sufficient accuracy for survey research. This note reviews (at an intuitive level) why this is so, and also, under what conditions a larger sample is needed.

TB-4 REPRESENTATIVENESS AND RANDOMNESS IN SURVEY RESEARCH.
All survey research produces samples which are not completely representative of the population. This note reviews the idea of representative sample, and presents one way in which samples are weighted.

TB-5 A PRIMER ON POLLS.
Survey research is very common, but from published reports it appears that few have the information needed to evaluate the quality of a poll.

TB-6 A CONCISE VIEW OF MULTIVARIATE METHODS: FACTOR ANALYSIS AND PRINCIPAL COMPONENTS.
(Forthcoming in 1985) This note reviews the essentials and application of these two widely employed data reduction techniques.

TB-7 ECONOMIC FORECASTS: WILL THEY EVER GET IT RIGHT?
(Forthcoming in 1985) Economists are criticized for failing to forecast the future. In fact, given the difficulties, the record of performance has been reasonably good. This paper reviews the recent record for the forecasting industry and outlines why economists cannot be expected to do better.

TB-8 COPING WITH COLLINEARITY.
Multicollinearity is one of the most perplexing problems in regression. This note reviews the state of the art in the area, and presents the most common diagnostics.

TB-9 TO BE OR NOT TO BE - THE LOGISTIC CHOICE.
Dichotomous models are a convenient method for analyzing data which describes behaviour involving choice. This note outlines the use of the models and diagnostics associated with standard computer programs.

Book Reviews

Parliament vs. People: An Essay on Democracy and Canadian Political Culture, by Philip Resnick, Vancouver, New Star Books, 1984. (120 pp.)

This is a provocative little book designed to stir up controversy. It sets out to attack many of the cherished beliefs Canadians hold about their system of government and outlines an alternative approach to the organization of Canadian political and economic life. This is a tall order in a book of only 120 pages. However, Professor Resnick provides a general and speculative essay, not a detailed analysis, and it would be unfair to fault the book for glossing over certain issues. The aim is to arouse Canadians from their habit of living in a mental fog, and in this it succeeds.

The people who operate government in Canada and those of us who study it full-time have tended to assume the superiority of existing political arrangements, especially if some modest institutional reforms could be accomplished. Only very recently have Canadians in general questioned the assumption that representative, cabinet-parliamentary government is the most effective, responsive, adaptable, yet stable, political system ever invented. There are still devout proponents of the system around who cling firmly to this belief, but Professor Resnick is not among them. Representative government is too elitist and not sufficiently democratic in his view. It reflects and reinforces unwarranted disparities in economic power within Canadian society. Resnick sketches a more participatory political structure, involving the retention of familiar representative institutions but supplementing them with new forms of direct democracy. As an alternative to corporate domination and state capitalism, or a centrally-planned economy, he proposes a form of market socialism with workers in control of major enterprises.

Resnick begins with the familiar observation that Canadians lack a revolutionary and populist tradition. Our society is the product of a counter-revolution; its national motto is "peace, order and good government," not "life, liberty and the pursuit of happiness." In politics our traditions have been elitist. Canadians have been taught deference and obedience. The political order complemented and reinforced the emerging economic system, according to Resnick:

> With our second-hand parliamentary institutions from England, we inherited a good deal more: an unelected upper house, aristocratic pretensions and parliamentary rituals, royal prerogative and, finally, property rights written into the fabric of political culture.

Resnick concedes that in comparative terms Canadians are a remarkably free people and that in terms of civil liberties progress has been realized within the framework of the parliamentary system.

If one accepts Resnick's assumption that democracy must involve direct, popular control over decisions, one is led inevitably to his conclusions. Canadians have shown themselves in critical situations, like the War Measures crisis of 1970, to be too deferential towards governmental elites. Yet, there has been a growing dissatisfaction with important features of the political system. Even the recent constitutional reform exercise, which Resnick claims was proclaimed as a striking accomplishment of a mature democracy, was in fact criticized by many knowledgeable observers as being flawed in the procedures followed and the final results. In short, Canadians are not yet aggressive enough in their political participation, but they are less passive and subject to manipulation than Resnick implies, and governments have been forced to cope with a new insistence that people be heard before decisions affecting them are taken. While this is not direct democracy, it represents progress.

To implement the theory of direct democracy, Resnick proposes something called "the base-unit" level where democratic norms would be learned through the practice of debating and approving policy initiatives, to be transmitted to committees at the municipal and provincial or national level, or by reacting to proposals from governments at those levels. Seventeen thousand base units, with approximately 1,000 members each spread across the country, would be granted some decision-making powers. Most decisions will still be made by elected governments, he concedes. In other words, Resnick is forced to acknowledge the practical need for representative government, but it is unclear whether representation is antithetical to direct democracy in his theoretical outlook. There is not the space here to debate the matter, but I believe that Professor Resnick ignores, or at least underestimates, the positive civic virtues of representative institutions.

In the economic sphere, Resnick rejects a laissez-faire market economy or a centrally-planned socialist economy. As the first step towards market socialism, firms with assets in excess of $5 million would be nationalized (with compensation to the former owners paid on a sliding scale up to an arbitrary maximum) and immediately turned over to their employees. Resnick acknowledges that such a dramatic step would involve numerous problems, some of which he anticipates and handles with some persuasion. There is still a large leap of faith involved in accepting his plan, however, even if one accepts his philosophical goals.

Most readers will dismiss this book as utopian and impractical. Judged in terms of the immediate political feasibility of the ideas advanced, they would be right. However, this mistakes the purpose of the book, which is intended to raise broader philosophical issues. At a time when Canadians should be

looking for new ideas, Professor Resnick has provided a stimulating personal definition of new directions.

Paul G. Thomas, St. John's College, University of Manitoba.

The Global Competitive Struggle: Challenges to the United States and Canada, by Peter Morici, C.D. Howe Institute, Toronto, and National Planning Association, Washington, D.C., 1984. (124 pp.)

The study is organized in two parts and in eight chapters. Part I (chapters 1-5) outlines the nature of the global competition facing the Advanced Industrial Countries (AICs). Part II (chapters 6-8) describes the responses of the United States and Canada, and examines the implications of these responses for the U.S.-Canada relations. The study leads to the conclusion that neither country can realistically meet the challenges of global competition by relying primarily on exports of its traditional strength, namely, high technology product (U.S.) and natural resource product (Canada).

Two features of the post-war world economy are emphasized. First, the dismantling of exchange controls and the reduction of traditional tariff barriers under the auspices of the IMF and the GATT have led to the emergence of a truly international market place. Secondly, the ascending competitiveness of the Newly Industrializing Countries (NICs) have enabled them to make inroads into the world market place initially in labour-intensive and then in capital-intensive products. They are now being followed up by a second generation NICs.

The AICs were able to adapt remarkably well, and this was thought to be a key element in their successful growth in the 1950s and 1960s. In recent years, this adaptability appears to have declined, threatening the growth prospects of all countries. The lack of adaptability arises from the fact international shifts in comparative advantage that involve the contractions of some of the AICs' manufacturing industries, and these are being resisted in the AICs by defensive policy measures[1]. The author argues that the AICs are forced into a defensive posture because of a growing conflict in their international economic and domestic social policy courses. Policy measures such as orderly marketing agreements (OMAs), voluntary export restraints (VERs), domestic subsidies, export credit financing and setting performance criteria for foreign subsidiaries are discussed at great length. However, the discussion misses the point that these measures share a common characteristic. That is, when adopted by a single country, they could provide a needed degree of relief; however, when other countries respond in self-defence and follow the same practices, relief obtained by each is substantially reduced. It has been shown elsewhere that all countries might be left worse off as a result of international policy competition[2].

One question the study addresses is the extent to which changes in

the AICs' comparative advantage could be explained by changes in their factor endowments. Each of the AICs' factor endowments are expressed as a percentage of the world total for two bench mark years: 1963 and 1980. In 1963, the U.S. was seen to be relatively well-endowed with R & D scientists, physical capital and skilled labour. In later years, the U.S. relative position weakened in all categories except semi-skilled labour. The share of R & D scientists improved for Japan, Germany and the U.K. Between 1963 and 1980, Japan doubled its capital stock; France increased its share of physical capital while the share of Germany and the U.K. declined. Of the six countries studied, factor endowments changed the least for Canada. On the basis of changes in factor endowments, one would expect Japan, Germany and the U.K. to improve their competitiveness in technology-intensive products and they did. Canada's competitiveness showed little change. Somewhat surprising is the finding that Japan did not do as well as could be expected in capital-intensive products and France did better in technology-intensive products. These departures from expected patterns are explained by government policy initiatives in respect of technology-intensive industries in both Japan and France.

Three comments on this part of the study are warranted. First, the author computes a country's comparative advantage by its export-import ratio, and mentions the fact that the results would not have been different if net exports to total trade ratio was used. However, both these measures are biased because import data used in calculations incorporate the effects of restrictions which may vary from one country to another. A measure that is free of this bias is the Revealed Comparative Advantage (RCA) index, and information on the RCA index of most manufactured products for major countries is available in a UN study[3]. Secondly, changes in factor endowments are compared for years: 1963 and 1980; whereas those in comparative advantage for years: 1969, 1973 and 1979. The rationale for using different sets of years for comparison is nowhere explained. Finally, the author points out that since 1973, the U.S. and Canada experienced only minor changes in their export performance and did better than the European economies as a whole. Other studies corroborate this finding[4]. No explanation is offered for the differential performance of North America and Europe.

As the U.S. and Canada adjust to the challenges of the global competition, their interests at times converge and at others diverge. The two countries share a common interest in opening up foreign markets for their service industries and agricultural products. Conflicts arise from Canada's asymmetrical trade and investment relations with the U.S. Further, as the U.S. resorts to defensive measures, Canada may be affected in more ways than one. First, to the extent these measures succeed, they serve to deflect potential competition to Canada. Secondly, any action taken by the U.S. is, under the MFN clause, applied nondiscriminatingly to all countries. Thus, Canada may be hurt from measures designed to tackle problems to which Canada has not contributed.

One way of avoiding the spillover of policy measures is to enlarge the scope of bilateral free trade between the two nations. The subject is currently under study in both countries. A preferred way of avoiding policy competition is to bring the policy measures under

multilateral surveillance by enlarging the scope of the GATT.

In discussing the approaches of the two nations on multilateral agreements, the author attributes to the U.S. a doctrinaire position - concerned with a strict observance of the GATT principles and favouring an increase in the authority of the GATT. Canada is represented as taking a pragmatic approach - less critical of government discretion in matters of policy incentives and favouring flexibility in the application of international rules of conduct. Although historically correct, this description ignores recent developments which point to a reversal of the two countries' traditional positions. At present, it is the small and middle countries such as Canada that are showing a strong interest in revitalizing multilateral organizations. Recent and current U.S. positions on the replenishment of IDA, the appropriate size and character of World Bank and IMF activities, et cetera, show a cooling of the U.S. initiatives towards multilateral institutions[5].

With the possible exception of the analysis involving changes in AIC's comparative advantages, the study contains little that is original. Its main usefulness lies in the summary and the synthesis of numerous other detailed but not easily accessible studies on the subject, including several of the author's own.

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NOTES

[1] See UNIDO, page 3.

[2] See Cooper, pp. 168-173.

[3] See UNIDO, listed in the Bibliography.

[4] See Alam, pp. 20-25.

[5] See Helleiner, page 64.

BIBLIOGRAPHY

Alam, S.N., "Canada's Exports to Developing Nations 1971-82," Department of Economics, University of Calgary discussion paper, Series No. 88, December, 1984.

Cooper, R.N., The Economics of Interdependence, McGraw Hill, New York, 1968.

Helleiner, G.K., "Underutilized Potential: Canada's Economic Relations With Developing Countries," Behind the North/South Dialogue. A Conference sponsored by the Shastri Indo-Canadian Institute, Calgary, May, 1984.

UNIDO, Changing Patterns of Trade in World Industry: An Empirical Study on Revealed Comparative Advantage, United Nations, New York, 1982.

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