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The Post-1950 Recession Period Performance of Prices in Canada: A Data Exposition

by P. Ferley, B. O'Reilly
and A. Dunnigan

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1 Introduction and Summary

The focus of this paper is on the post-1950 behaviour of prices in Canada with particular emphasis on the ex post response of absolute price inflation to slack demand. The objective is an initial examination of various data on prices as part of a larger research project on the cyclical responsiveness of prices and profit margins. There is no attempt in this paper to impute causality nor to draw any policy conclusions (structural or otherwise) reflecting the fact that no model is specified. This paper is best viewed as an ex post descriptive exercise.

Post-1950 classical business cycles in Canada, as determined by Statistics Canada, are presented in the next section of the paper with an attempt, admittedly judgemental, to rank them in order of relative severity. The third section looks more closely at recession period developments and the question of whether some of the weighted price series, including some aggregations of existing series done by us as an analytical aid, consistently respond differently from others to cyclical downturns of the general economy. The measure used to gauge recession period sensitivity is defined as the annualized rate of change in the recession period less that in the previous expansion period. This measure was first introduced using U.S. data by Cagan [3] and later modified by Sachs [11]; the modification was to set the annualized inflation rate during the recession against that in the last year of the previous expansion. Both the original and the modified measures were calculated for this present study using Canadian data. The results indicate some mixed evidence of a trend towards increased recession period sensitivity for both the Consumer Price Index (CPI) and the Industry Selling Price Index (ISPI) over the last two recessions relative to the 1974-75 recession. However, the results were sensitive to which measure was used. When a Sachs-type measure was used this evidence disappeared for both the CPI and the ISPI.

The analysis on sub-aggregates of the major series indicated that the prices of products whose markets are relatively open to international

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competition are consistently more sensitive to recessions. This can be seen in the industry selling price series for export-oriented industries and also in the implicit deflator for Gross National Expenditure when it is compared with a measure excluding exports (for the post-1970 recessions). From a comparison of the CPI, the CPI excluding food, and the CPI excluding food and energy it becomes obvious that food prices play a sizeable role in the apparent recession period sensitivity of the total CPI. For the most recent recession, energy prices increased the apparent recession period response of the total CPI. Regulated prices other than energy seem to be less sensitive to recession periods than non-regulated CPI prices.

Two objections that can be raised with the analysis described above are addressed in the paper. The first criticism is that the phase shift may obscure the results as inflation cycle peaks and troughs may not coincide with those in the output business cycle. For example, the effect of a recession (expansion) on inflation may go beyond the business cycle trough (peak). The second criticism is that for a Cagan-type measure, and to a lesser extent for a Sachs-type measure, the length of this phase shift will change from observation to observation as annualized inflation rates are derived for periods of varying duration. Measures of the recession period sensitivity of inflation are calculated for the major weighted price series and a number of their re-aggregations to take into account these two objections. First, the annualized rate of change between the two months prior to and two months following each of the peak and trough months is calculated. (Quarterly data are used for the implicit price deflators.) Then the difference in these annualized rates of change is used as a measure of recession period response. Filtering the data in this manner tended to result in lower rates of inflation for both the expansion and recession periods but did not result in a measure whose trend was noticeably different from that derived from unfiltered data. Then, measures of recession period sensitivity are calculated using the inflation cycle to define peaks and troughs. A major caveat to using the latter cycle is that the selection of peaks and troughs can be somewhat arbitrary. Reservations aside, using the inflation cycle did result in a measure that consistently showed a lower absolute inflation in recession periods. As well, there was a tendency for the trough of the inflation cycle, as defined by a number of the CPI series, to lag the business cycle trough. This tendency was not as apparent using ISPI or Wholesale Price Index (WPI) series.

We now discuss these points more fully starting with the dating of the post-1950s Canadian business cycles.

2 Post-1950 Canadian Business Cycles: Dating and Relative Severity

The dates shown for the business cycles in Table 1 were established by Statistics Canada [6] on the basis of aggregate production data and a diffusion index. In general terms, Statistics Canada began by establishing quarterly reference points based on a consensus of the two measures of total output: real Gross National Product adjusted for international transactions in investment income, and constant dollar industry Gross Domestic Product (RDP). The rough guidelines required at least one quarterly decline as a sufficient condition. In the final analysis though, each potential recessionary period was looked at separately to ensure that the causal factors behind the contraction of aggregate output were actual cyclical imbalances rather than such transitory factors as strikes. With a quarterly reference date established, Statistics Canada derived the monthly turning point using the monthly behaviour of RDP (the index of industrial production prior to 1961). Beginning with the recession period, June 1951-December 1951, seven distinct recessions were identified up to and including the one that troughed in December 1982.

In addition to the classical cycles identified by Statistics Canada there were two periods of slowdown in economic growth, 1966-67 and 1970. In 1967 real output decreased only marginally for one quarter while for the year the most notable sources of weakness were a decline in business investment and a slowing in the growth of government expenditures. Excluding the effects of the auto strike in September the slowdown in 1970 occurred during the first half of the year.

The dating of the seven business cycles and the two periods of economic slowdown are shown in Table 1. In terms of both duration and amplitude, the latest recession period was the most severe followed by the June 1953-June 1954 recession. However, if the focus is on output growth (cumulative and at annual rates) and the widening of the output gap, then the severity of recessions ranked from the most to least severe are: July 1981-December 1982, June 1953-June 1954, April 1960-January 1961, November 1979-June 1980, June 1951-December 1951, February 1957-January 1958, and June 1974-March 1975.[1] It is clear from the table that the rankings could be different if more emphasis were placed on a particular measure of slack.

For comparative purposes dates for the peaks and troughs of the manufacturing production cycles are shown in Table 2 and as may be seen these do not differ to any great extent from the cycles in aggregate

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1. Stuber [13] found the declines in output less for the nonfarm sector than for the total on a real GDP basis in 1953-54, 1957-58, and 1960-61.

Table 1

Dates of Peaks and Troughs of Canadian Post-1950 Classical Business Cycles and Relative Severity of Post-1950 Recessions in Canada

Canadian post-1950 classical[1] business cycle dates				Peak-to-trough change in real GNE (quarterly)		Ratio of actual to trend real output (quarterly)[2]			Unemployment rate gap (quarterly)[3]		Duration of recession -- first period after the peak to the trough	
Monthly:		Quarterly:						Δ Gap			Monthly	Quarterly
Peak	Trough	Peak	Trough	Total	Annual rate	Peak	Trough	x 100	Peak	Trough		
1951:May	1951:Dec.	1951Q1	1951Q4	-0.7	-0.9	n.a.	n.a.	n.a.	n.a.	n.a.	7	3
1953:May	1954:June	1953Q2	1954Q2	-2.6	-2.6	1.01	0.94	-6.6	-2.1	-0.4	13	4
1957:Jan.	1958:Jan.	1956Q4	1957Q4	-0.3	-0.3	1.05	1.01	-4.6	-1.7	0.9	12	4
1960:Mar.	1961:Jan.	1960Q1	1961Q1	-1.1	-1.1	1.01	0.96	-5.0	1.2	2.3	10	4
n.a.	n.a.	1966Q1	1968Q1[4]	7.1	3.5	1.04	1.00	-3.9	-1.1	0.0	n.a.	8
n.a.	n.a.	1969Q4	1970Q4[4]	0.9	0.9	1.01	0.96	-4.3	-0.6	1.0	n.a.	4
1974:May	1975:Mar.	1974Q1	1975Q1	-0.4	-0.4	1.03	0.98	-4.7	-1.7	-0.1	10	4
1979:Oct.	1980:June	1979Q4	1980Q2	-0.5	-1.0	1.01	0.98	-2.7	0.9	1.5	8	2
1981:June	1982:Dec.	1981Q2	1982Q4	-6.5	-4.4	1.01	0.90	-11.0	1.0	6.5	18	6

1. Source: Cross, Philip, "The Business Cycle in Canada: 1950-1981", Current Economic Analysis, March 1982, Statistics Canada, 13-004.

2. Source: Aubry, J.-P. and Lecavalier, D. "L'évolution du taux de chômage: une approche démographique et sectorielle", Bank of Canada Mimeograph, May 1983.

3. The actual unemployment rate minus the unemployment rate at trend output from the September 1983 version of the Bank of Canada's RDXF model. Prior to 1962Q1 a rate of 4.5 per cent was used for the trend unemployment rate.

4. Peak and trough are identified on the basis of the maximum deviation, positive and negative, from the trend output measure before subsequent change of direction. Ibid footnote 2 for source of trend output measure.

Table 2

Manufacturing Cycles (OECD dates)

Cycle dates: Peak(P)	Trough(T)		Manufacturing production: Total change	At annual rates	Duration (months)
1951:Apr.	1951:Dec.	→ T	-4.9	-7.3	8
(n.a.)	(n.a.)				
1953:May	1954:July	T→ P	14.9	10.3	17
(n.a.)	(n.a.)	P→ T	-5.5	-4.7	13
1956:Dec.	1957:Dec.	T→ P	23.0	8.9	29
(same)	(same)	P→ T	-9.7	-9.7	12
1960:Jan.	1961:Jan.	T→ P	15.3	7.1	25
(same)	(1961:Mar.)	P→ T	-5.4	-5.4	12
1974:Feb.	1975:Mar.	T→ P	141.0	7.0	157
(same)	(same)	P→ T	-8.7	-8.1	13
1979:May	1980:July	T→ P	23.0	5.1	50
(same)	(same)	P→ T	-6.0	-5.2	14
1981:June	1982:Nov.	T→ P	8.4	9.2	11
(1981:Jan.)	(n.a.)	P→ T	-19.9	-14.5	17

output. The first two recessions were identified by looking at manufacturing production statistics. Subsequently, dates from the Encaoua study[2] were taken as the starting point but then reconsidered by us on the basis of production, strike and capacity utilization data. As may be seen from Table 2 the major difference occurs in 1981 where we date the peak as June 1981 and Encaoua chose January. The actual Index of Industrial Production (IIP) data show some sluggishness in the fourth quarter of 1980 with a month-to-month decline from December 1980 to January 1981 but subsequently IIP exhibited constant monthly growth until June 1981 (inclusive).

3 Relative Recession Period Performance of Selected Series: Stylized Facts

This section of the paper considers the performance of a number of weighted price indices, as well as a number of re-aggregations of these indices, over the seven most recent business cycles. The dating of the business cycles is based on the information provided in Section 2. The measure that is used to gauge performance is the difference between the annualized rate of inflation during the recession and expansion phases of

2. Encaoua, D. et al. [7]. The dates have been judgementally modified on the basis of Statistics Canada's data on manufacturing production and dates for general cycles.

each business cycle. One of the more problematic aspects of the analysis is the selection of the appropriate measure of absolute inflation during both peaks and troughs since the results, in terms of both magnitude and relative performance, can be altered depending upon how the absolute rate of inflation is defined. The present analysis does not control for the severity of individual business cycles,[3] for the factors affecting the downturn nor for the initial conditions.

Only seven business cycles are considered because of limitations in the availability of the data. The sample is small compared to studies done for the United States where, for example, a study by Sachs [11] considered 17 U.S. business cycles from 1892 to 1975 and a study by Cagan [3] considered 19 U.S. business cycles from 1892 to 1970. Unfortunately, for this present study data are only available from 1949 and therefore we are not able to make any comparisons between prewar and postwar periods. One difference between the Cagan and Sachs studies was how they determined absolute inflation during the expansion. Sachs used the annualized rate of change of prices between the peak and one year prior to the peak, henceforth referred to as Inflation Measure 2 (IM2), whereas Cagan used the peak and the previous trough as his points of reference (IM1). (Absolute inflation at the trough for both studies was the annualized rate of change of prices between the trough and the previous peak.) The intent of the U.S. studies was to determine whether prices had become more or less sensitive over time to downturns in the economy. Prices were considered more sensitive if the fall in inflation during the recession relative to inflation during the expansion increased between cycles. Both studies concluded that there had been a decline in responsiveness during the postwar period.

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3. Sachs addressed the question as to why this measure was chosen by expressing the price and wage equation in the following manner.

$$Dp_t = a(y_t^d - y_t^s) + Dp_t^e$$

where $Dx = \frac{1}{x}\frac{dx}{dt}$, y_t is aggregate output, and

Dp_t^e is expected inflation.

Then, if Dp_t^e can be assumed to be the same in the time periods being compared, the difference between the rate of inflation at the trough and peak is

$$Dp_t^T - Dp_t^P = a(y_t^d - y_t^s)^T - a(y_t^d - y_t^s)^P$$

i.e., the difference is related to the change in the gap.

The present study duplicates these studies with Canadian data. The results indicate some evidence of a shift towards increased sensitivity over the most recent recessions. However, the results can be altered if the method for determining the absolute rate of inflation is changed. This difference can be seen by considering Tables 3a and 3b. Table 3a shows the results using IM1 calculated by taking a three-month moving average of the price level for the CPI, ISPI and WPI centred on the business cycle peak and trough months. The annualized rate of change in prices was calculated between these two points. The results show that over the last two business cycles prices have become increasingly cyclically sensitive relative to the May 1974-March 1975 recession for the CPI and ISPI. Prices were markedly less sensitive during the May 1974-March 1975 recession which occurred in the wake of the 1972-73 commodity price boom. This may help explain the sharp run-up in prices that occurred during a recessionary period; the trend inflation of the prior expansion does not seem to reflect the 1972-73 commodity price boom because it is based on the average annual rate of price increase from January 1961. These results can be compared with those in Table 3b where the inflation rate during the expansion is calculated using IM2 which takes the percentage change between the peak and one year prior to the peak. The results using this method show no obvious trend with respect to the cyclical sensitivity for either the CPI or the ISPI. As well, method IM1, summarized in Table 3a does indicate a slight trend towards increased responsiveness in the 1950s and early 1960s for the CPI but this trend also disappears when IM2 is used. The data in Table 3b do indicate that the largest declines in inflation occurred in the first and last business recessions. The price performance in the February 1949-May 1951 expansion may have been affected by the inflationary impact of the Korean War. The May 1953-June 1954 recession seems to have had the least downward effect on prices.

The use of IM1 has been criticized as being deficient when considering very long expansionary periods because it tends to minimize the impact of events that occur very close in time to the business cycle peak. As was pointed out above this methodology tended to minimize the effect of the 1972-73 commodity price boom in the January 1961-May 1974 expansion. As a result, we have used only IM2 for the comparable calculations on the disaggregations of the major price series shown in Tables 4 to 10.[4]

The performance of various implicit deflators is shown in Table 4. The measure calculated for the implicit GNE deflator indicates that the largest decline in inflation occurred in the 1956Q4-1957Q4 recession. As

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4. Using IM2 is not without its own problems. Just as IM1 may understate events like the 1972-73 commodity price boom, IM2 may have a tendency to overstate their impact. However, the latter problem was felt to be smaller than the former.

Table 3a

Annual Rate of Change of Prices in Postwar Business Cycles (Annualized rates of change)

Reference cycles:			Consumer Price Index(UA)			Industry Selling Price Index(UA)			Wholesale Price Index(UA)		
Trough	Peak	Trough	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+5.6	+8.2	+2.6	n.a.	n.a.	n.a.	+8.7	-3.2	-11.9
1951:Dec.	1953:May	1954:June	-2.0	+1.0	+3.0	n.a.	n.a.	n.a.	-5.3	-1.1	+4.2
1954:June	1957:Jan.	1958:Jan.	+1.5	+2.4	+0.9	n.a.	+0.4	n.a.	+1.9	-0.7	-2.6
1958:Jan.	1960:Mar.	1961:Jan.	+1.5	+1.9	+0.4	+0.5	+0.1	-0.4	+0.7	+0.5	-0.2
1961:Jan.	1974:May	1975:Mar.	+4.0	+10.7	+6.7	+4.1	+13.5	+9.4	+5.5	+7.3	+1.8
1961Q1	1966Q1	1968Q1	+1.9	+3.7	+1.8	+1.4	+2.1	+0.7	+2.2	+1.8	-0.4
1968Q1	1969Q4	1970Q4	+4.4	+2.2	-2.2	+2.9	+1.3	-1.6	+3.5	+0.0	-3.5
1970Q4	1974Q1	1975Q1	+6.4	+11.6	+5.2	+8.9	+16.0	+7.1	+14.2	+10.2	-4.0
1975:Mar.	1979:Oct.	1980:June	+8.7	+10.5	+1.8	+9.4	+12.0	+2.6	n.a.	n.a.	n.a.
1980:June	1981:June	1982:Dec.	+12.7	+9.6	-3.1	+11.5	+4.8	-6.7	n.a.	n.a.	n.a.

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and the previous trough.

UA = Unadjusted

Table 3b

Annual Rate of Change of Prices in Postwar Business Cycles

Reference cycles:			Consumer Price Index(UA)			Industry Selling Price Index(UA)			Wholesale Price Index (UA)		
Trough	Peak	Trough	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+11.3	+8.2	-3.1	n.a.	n.a.	n.a.	18.0	-3.2	-21.2
1951:Dec.	1953:May	1954:June	-1.4	+1.0	+2.4	n.a.	n.a.	n.a.	-1.8	-1.1	+0.7
1954:June	1957:Jan.	1958:Jan.	+3.1	+2.4	-0.7	+2.9	+0.4	-2.5	3.0	-0.7	-3.7
1958:Jan.	1960:Mar.	1961:Jan.	+1.6	+1.9	+0.3	0.0	+0.1	+0.1	-0.2	+0.5	+0.7
1961:Jan.	1974:May	1975:Mar.	+10.6	+10.7	+0.1	+19.0	+13.5	-5.5	+25.6	+7.3	-18.3
1961Q1	1966Q1	1968Q1	+3.6	+3.7	+0.1	+3.3	+2.1	-1.2	+4.6	+1.8	-2.8
1968Q1	1969Q4	1970Q4	+4.5	+2.2	-2.3	+3.9	+1.3	-2.6	+4.1	+0.0	-4.1
1970Q4	1974Q1	1975Q1	+9.7	+11.6	+1.9	+17.5	+16.0	-1.5	+27.0	+10.2	-16.8
1975:Mar.	1979:Oct.	1980:June	+9.5	+10.5	+1.0	+15.0	+12.0	-3.0	n.a.	n.a.	n.a.
1980:June	1981:June	1982:Dec.	+12.7	+9.6	-3.1	+11.5	+4.8	-6.7	n.a.	n.a.	n.a.

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

UA = Unadjusted

Table 4

Annual Rate of Change of Prices in Postwar Recession Periods

Reference cycles:			Implicit GNE deflator			Implicit private GNE deflator			Final domestic demand: Total			Final domestic demand: Excluding imports			Implicit GNE deflator excluding exports			Implicit deflator for exports			Implicit deflator for imports		
Trough	Peak	Trough	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.	Expansion[1]	Recession	Rec. minus Exp.
1949Q1	1951Q1	1951Q4	9.9	7.1	-2.8	10.3	8.9	-1.4	9.4	7.3	-2.1	7.4	10.9	3.5	9.9	5.7	-4.2	8.8	8.1	-0.7	11.6	0.1	-11.5
1951Q4	1953Q2	1954Q2	-0.9	1.6	2.5	-1.7	1.1	2.8	0.9	2.9	2.0	0.9	3.7	2.8	-0.3	2.4	2.7	-2.6	-0.4	2.2	-0.2	1.0	1.2
1954Q2	1956Q4	1957Q4	4.9	1.0	-3.9	4.0	0.6	-3.4	4.5	2.2	-2.3	5.2	2.2	-3.0	5.7	1.7	-4.0	1.8	-1.2	-3.0	1.4	3.6	2.2
1957Q4	1960Q1	1961Q1	1.7	0.4	-1.3	1.2	0.6	-0.6	1.3	1.6	0.3	1.7	1.4	-0.3	1.8	0.4	-1.4	0.4	0.4	0.0	-0.8	2.6	3.4
1961Q1	1974Q1	1975Q1	13.6	13.0	-0.6	14.3	11.6	-2.7	11.0	13.7	2.7	9.5	10.7	1.2	9.2	12.1	2.9	28.1	16.9	-11.2	15.5	22.6	7.1
1961Q1	1966Q1	1968Q1	4.4	3.9	-0.5	3.3	3.8	0.5	4.3	3.8	-0.5	4.9	4.1	-0.8	4.6	4.1	-0.5	2.0	2.6	0.6	1.7	2.2	0.5
1968Q1	1969Q4	1970Q4	4.8	4.9	0.1	3.6	5.0	1.4	5.0	4.2	-0.8	5.6	5.1	-0.5	5.3	5.4	0.1	2.6	3.4	0.8	2.9	1.3	-1.6
1970Q4	1974Q1	1975Q1	13.6	13.0	-0.6	14.3	11.7	-2.6	11.0	13.8	2.8	9.5	10.7	1.2	9.2	12.2	3.0	28.1	16.9	-11.2	15.5	22.6	7.1
1975Q1	1979Q4	1980Q2	12.0	10.8	-1.2	12.9	9.4	-3.5	9.5	11.3	1.8	7.5	9.4	1.9	8.4	10.1	1.7	22.1	12.3	-9.8	14.3	16.4	2.1
1980Q2	1981Q2	1982Q4	10.1	9.8	-0.3	9.2	8.9	-0.3	12.2	9.8	-2.4	12.4	13.3	0.9	11.0	12.5	1.5	7.2	3.8	-3.4	11.4	3.1	-8.3

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

well the 1953Q2-1954Q2 recession seemed to have the least downward effect on prices. The implicit GNE deflator shows a much smaller decline in the 1981Q2-1982Q4 recession than the CPI and ISPI. Only the implicit deflator for imports shows an equally large decline in inflation in the last recession relative to the first. There is no obvious trend with respect to the cyclical sensitivity of the aggregate implicit deflator though there is some indication that externally determined prices (or exchange rate movements) are more important in the post-1970 recession behaviour of prices than in the previous recession periods (compare the implicit GNE deflator and that excluding exports). Another interesting result is that the implicit private GNE deflator seems more flexible downward than the aggregate deflator in the post-1970 recession periods compared to recessions prior to 1970.

In Tables 5, 6 and 7 some disaggregations on the CPI are presented.[5] Since most of the price series we have constructed ourselves are unadjusted, the question of the effects of seasonality arises. If the results for the seasonally adjusted CPI in Table 5 are compared with those for the unadjusted CPI in Table 3b it does not seem that this complication should be of great concern. From Table 5 it can be seen that food prices played a sizeable role; they affected the apparent cyclical sensitivity of the aggregate CPI in both directions in almost all cycles, while in the most recent cycle energy prices were prominent in increasing the apparent cyclical response. When the food and energy components are removed from the CPI, the last recession does not appear as successful in lowering trend inflation as previous recessions. The results in Table 6 support earlier work ([15]) in that the regulated prices, particularly with energy prices removed, are less sensitive cyclically than non-regulated prices. (The earlier work found that the response of regulated prices lagged that of non-regulated prices, probably because of institutional factors, but was not necessarily different over a complete cycle.) Table 7 shows that commodities with a high import content (CPIM) tend to increase the responsiveness of prices in both directions. This is similar to the behaviour of CPI food and not that surprising given the large share of food items in CPIM.

Tables 8, 9 and 10 contain some disaggregations of the ISPI.[5] Except for the 1960 recession food prices do not seem to have been as important for the ISPI as for the CPI, perhaps reflecting the larger weight of fresh food in the latter. Energy prices were important in increasing the apparent cyclical sensitivity of industry selling prices in the most recent recession as was the case for the CPI. Highly

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5. For a definition of these sub-aggregates and the method by which they were constructed see Appendices 2 and 3.

Table 5

Annual Rate of Change of Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	CPI (SA) Expansion[1]	CPI (SA) Recession	CPI (SA) Rec. minus Exp.	CPI ex. food (SA) Expansion[1]	CPI ex. food (SA) Recession	CPI ex. food (SA) Rec. minus Exp.	CPI ex. food and energy (SA) Expansion[1]	CPI ex. food and energy (SA) Recession	CPI ex. food and energy (SA) Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+10.8	+7.5	-3.3	+9.1	+6.6	-2.5	n.a.	n.a.	n.a.
1951:Dec.	1953:May	1954:June	-1.4	+1.0	+2.4	+0.3	+1.2	+0.9	0.0	+1.5	+1.5
1954:June	1957:Jan.	1958:Jan.	+3.1	+2.4	-0.7	+1.9	+2.9	+1.0	+2.5	+3.1	+0.6
1958:Jan.	1960:Mar.	1961:Jan.	+1.3	+1.5	+0.2	+1.8	+0.7	-1.1	+2.0	+1.0	-1.0
1961:Jan.	1974:May	1975:Mar.	+10.9	+10.7	-0.2	+8.5	+10.0	+1.5	+7.5	+10.4	+2.9
1961Q1	1966Q1	1968Q1	+3.4	+3.8	+0.4	+2.4	+4.3	+1.9	+2.4	+4.4	+2.0
1968Q1	1969Q4	1970Q4	+4.5	+2.1	-2.4	+4.6	+3.5	-1.1	+4.9	+3.5	-1.4
1970Q4	1974Q1	1975Q1	+9.9	+11.7	+1.8	+6.8	+10.8	+4.0	+6.1	+10.4	+4.3
1975:Mar.	1979:Oct.	1980:June	+9.5	+9.9	+0.4	+8.5	+10.3	+1.8	+8.3	+9.9	+1.6
1980:June	1981:June	1982:Dec.	+12.8	+9.9	-2.9	+12.7	+11.5	-1.2	+10.4	+10.6	-0.2

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

SA = Seasonally adjusted

Table 6

Annual Rate of Change of Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	Consumer Price Index: Regulated (UA) Expansion[1]	Regulated (UA) Recession	Regulated (UA) Rec. minus Exp.	Non-Regulated (UA) Expansion[1]	Non-Regulated (UA) Recession	Non-Regulated (UA) Rec. minus Exp.	Regulated ex. energy (UA) Expansion[1]	Regulated ex. energy (UA) Recession	Regulated ex. energy (UA) Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+7.4	+7.6	+0.2	+11.8	+8.4	-3.4	+7.8	+8.0	+0.2
1951:Dec.	1953:May	1954:June	-0.9	+1.0	+1.9	-1.5	+1.0	+2.5	-1.4	+1.1	+2.5
1954:June	1957:Jan.	1958:Jan.	+1.8	+2.3	+0.5	+3.5	+2.4	-1.1	+2.2	+2.4	+0.2
1958:Jan.	1960:Mar.	1961:Jan.	+2.8	+1.5	-1.3	+1.1	+2.0	+0.9	+3.0	+1.6	-1.4
1961:Jan.	1974:May	1975:Mar.	+9.4	+10.9	+1.5	+11.3	+10.5	-0.8	+6.1	+11.7	+5.6
1961Q1	1966Q1	1968Q1	+2.1	+5.0	+2.9	+3.7	+3.5	-0.2	+2.5	+5.0	+2.5
1968Q1	1969Q4	1970Q4	+6.9	+2.8	-4.1	+4.1	+2.0	-2.1	+7.6	+2.0	-5.6
1970Q4	1974Q1	1975Q1	+6.5	+12.0	+5.5	+10.6	+11.5	+0.9	+3.7	+12.0	+8.3
1975:Mar.	1979:Oct.	1980:June	+8.8	+11.7	+2.9	+9.6	+10.2	+0.6	+7.8	+10.7	+2.9
1980:June	1981:June	1982:Dec.	+17.5	+12.9	-4.6	+11.2	+7.9	-3.3	+10.9	+13.6	+2.7

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

UA = Unadjusted

Table 7

Annual Rate of Change of Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	CPI (UA) Expansion[1]	CPI (UA) Recession	CPI (UA) Rec. minus Exp.	CPI (UA): Components with high import content (CPIM) Expansion[1]	CPIM Recession	CPIM Rec. minus Exp.	CPI (UA): Excluding components with a high import content Expansion[1]	Excluding Recession	Excluding Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+11.3	+8.2	-3.1	+6.7	+9.3	+2.6	+11.7	+8.3	-3.4
1951:Dec.	1953:May	1954:June	-1.4	+1.0	+2.4	-9.7	+1.9	+11.6	-0.3	+0.9	+1.2
1954:June	1957:Jan.	1958:Jan.	+3.1	+2.4	-0.7	+7.8	+2.7	-5.1	+2.7	+2.4	-0.3
1958:Jan.	1960:Mar.	1961:Jan.	+1.6	+1.9	+0.3	+6.7	-1.1	-7.8	+0.8	+2.4	+1.6
1961:Jan.	1974:May	1975:Mar.	+10.6	+10.7	+0.1	+10.6	+6.3	-4.3	+10.8	+11.2	+0.4
1961Q1	1966Q1	1968Q1	+3.6	+3.7	+0.1	-	-	-	-	-	-
1968Q1	1969Q4	1970Q4	+4.5	+2.2	-2.3	-	-	-	-	-	-
1970Q4	1974Q1	1975Q1	+9.7	+11.6	+1.9	-	-	-	-	-	-
1975:Mar.	1979:Oct.	1980:June	+9.5	+10.5	+1.0	+10.8	+17.7	+6.9	+9.2	+9.6	+0.4
1980:June	1981:June	1982:Dec.	+12.7	+9.6	-3.1	+10.5	+4.5	-6.0	+13.0	+10.3	-2.7

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and the previous trough.

UA = Unadjusted

Table 8

Annual Rate of Change in Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	Industry Selling Price Index (UA): ISPI Expansion[1]	ISPI Recession	ISPI Rec. minus Exp.	ISPI ex. food Expansion[1]	ISPI ex. food Recession	ISPI ex. food Rec. minus Exp.	ISPI ex. food and energy Expansion[1]	ISPI ex. food and energy Recession	ISPI ex. food and energy Rec. minus Exp.
1958:Jan.	1960:Mar.	1961:Jan.	+0.0	+0.1	+0.1	+0.8	-1.2	-2.0	+0.8	-1.0	-1.8
1961:Jan.	1974:May	1975:Mar.	+19.0	+13.5	-5.5	+19.5	+13.4	-6.1	+18.3	+13.2	-5.1
1961Q1	1966Q1	1968Q1	+3.3	+2.1	-1.2	+2.3	+2.5	+0.2	+2.3	+2.6	+0.3
1968Q1	1969Q4	1970Q4	+3.9	+1.3	-2.6	+3.9	+1.2	-2.7	+3.9	+1.1	-2.8
1970Q4	1974Q1	1975Q1	+17.5	+16.0	-1.5	+16.0	+16.6	+0.6	+15.3	+16.2	+0.9
1975:Mar.	1979:Oct.	1980:June	+15.0	+12.0	-3.0	+16.0	+12.9	-3.1	+15.7	+12.2	-3.5
1980:June	1981:June	1982:Dec.	+11.5	+4.8	-6.7	+11.5	+5.0	-6.2	+8.6	+4.1	-4.5

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

UA = Unadjusted

Table 9

Annual Rate of Change in Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	Industry Selling Price Index by Level of Concentration (UA): High Expansion[1]	High Recession	High Rec. minus Exp.	Medium Expansion[1]	Medium Recession	Medium Rec. minus Exp.	Low Expansion[1]	Low Recession	Low Rec. minus Exp.
1961:Jan.	1974:May	1975:Mar.	+29.4	+8.5	-20.9	+17.9	+16.9	-1.0	+9.1	+4.7	-4.4
1961Q1	1966Q1	1968Q1	+4.8	+3.1	-1.7	+3.1	+1.5	-1.6	+2.3	+4.4	+2.1
1968Q1	1969Q4	1970Q4	+9.7	-0.5	-10.2	+3.5	+1.9	-1.6	-1.3	+0.1	+1.4
1970Q4	1974Q1	1975Q1	+24.7	+15.1	-9.6	+17.7	+18.2	+0.5	+9.3	+5.9	-3.4
1975:Mar.	1979:Oct.	1980:June	+22.0	+15.2	-6.8	+13.6	+13.0	-0.6	+11.9	+0.5	-11.4
1980:June	1981:June	1982:Dec.	+17.7	+5.6	-12.1	+10.3	+4.7	-5.6	+8.9	+3.6	-5.3

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

UA = Unadjusted

concentrated industries, for the very few observations we have, seem to exhibit the apparently anomalous behaviour of having relatively sensitive prices. However, this seems to be attributable to the fact that this category of industries contains petroleum and coal refining and primary metal industries. A reclassification of industry selling prices according to whether the industry was open, closed, export-oriented, import-competing or energy-producing is shown in Table 10. Again interpretation is clouded by a paucity of observations, but the unequivocal conclusion appears to be that prices in export-oriented industries are the most cyclically sensitive.

The results derived using filtered data (as described on page 2) are shown in Tables 11 and 12. The use of filtered data and the peaks and troughs as defined by the business cycle does result in lower rates of inflation for both the expansion and recession periods. The change in inflation between the expansion and recession period does not appear to show more downward response in each recession relative to the previous one and thus does not provide any clearer interpretation for the trend in the sensitivity of prices over time. Measures were then recalculated using the filtered data and peaks and troughs as defined by the inflation cycle. These results are also shown in Tables 11 and 12. Using the inflation cycle to define peaks and troughs results in the recession always managing to lower absolute inflation. As well, if we eliminate the first and sixth recessions the remaining measures suggest that prices have become increasingly cyclically sensitive. It should be noted that the selection of peaks and troughs for the inflation cycle was much more arbitrary than it was for the business cycle. Table 13 shows the lags and leads of the peaks and troughs of a number of filtered price series relative to the peaks and troughs of the business cycle. This table shows that the trough of the inflation cycle as defined by the CPI series tends to lag the business cycle trough. This tendency was not as apparent from the ISPI or WPI series.

Table 10

Annual Rate of Change in Prices in Postwar Recession Periods

Reference cycles: Trough	Peak	Trough	Industry Selling Price Index (UA): Open Expansion[1]	Open Recession	Open Rec. minus Exp.	Closed Expansion[1]	Closed Recession	Closed Rec. minus Exp.	Export-Oriented Expansion[1]	Export-Oriented Recession	Export-Oriented Rec. minus Exp.	Import-Competing Expansion[1]	Import-Competing Recession	Import-Competing Rec. minus Exp.	Energy Expansion[1]	Energy Recession	Energy Rec. minus Exp.
1961:Jan.	1974:May	1975:Mar.	+13.3	+18.2	+4.9	+17.2	+14.5	-2.7	+22.5	+9.6	-12.9	+18.1	+10.1	-8.0	+39.6	+14.8	-24.8
1961Q1	1966Q1	1968Q1	+0.2	+1.4	+1.2	+5.2	+1.6	-3.6	+3.5	+3.6	+0.1	+2.1	+1.9	-0.2	+1.9	+1.0	-0.9
1968Q1	1969Q4	1970Q4	+1.3	+2.5	+1.2	+4.4	+2.1	-2.3	+5.7	-0.9	-6.6	+3.0	+0.9	-2.1	+3.0	+2.8	-0.2
1970Q4	1974Q1	1975Q1	+9.5	+19.2	+9.7	+18.9	+15.0	-3.9	+21.1	+14.4	-6.7	+15.3	+13.5	-1.8	+28.4	+23.7	-4.7
1975:Mar.	1979:Oct.	1980:June	+12.8	+16.0	+3.2	+11.3	+11.8	+0.5	+19.9	+7.8	-12.1	+17.1	+15.8	-1.3	+19.4	+20.0	+0.6
1980:June	1981:June	1982:Dec.	+12.4	+6.4	-6.0	+11.2	+5.7	-5.5	+6.0	-0.6	-6.6	+6.6	+4.8	-1.8	+41.0	+12.0	-29.0

1. The inflation rate during the expansion was calculated as the annualized rate of change between the peak and one year before the peak.

UA = Unadjusted

Comparison Using the Business Cycle and the Inflation Cycle

Table 11

Reference cycles:			Implicit GNE deflator (PGNE)			Filtered[1] PGNE using business cycle dates for the peak and trough			Inflation cycles (+ lag) (- lead)		Filtered[1] PGNE using inflation cycle dates for the peak and trough		
Trough	Peak	Trough	Expansion	Recession	Rec. minus Exp.	Expansion	Recession	Rec. minus Exp.	Peak	Trough	Expansion	Recession	Rec. minus Exp.
1949Q1	1951Q1	1951Q4	+9.9	+7.1	-2.8	+11.9	+4.5	-7.4	1950Q4(-1)	1952Q4(+4)	+14.1	-0.9	-15.0
1951Q4	1953Q2	1954Q2	-0.9	+1.6	+2.5	+1.4	+1.1	-0.3	1953Q3(+1)	1954Q4(+2)	+2.1	+0.3	-1.8
1954Q2	1956Q4	1957Q4	+4.9	+1.0	-3.9	+2.8	+2.2	-0.6	1956Q2(-2)	1958Q1(+1)	+4.9	+0.9	-4.0
1957Q4	1960Q1	1961Q1	+1.7	+0.4	-1.3	+0.8	+0.6	-0.2	N.A.	1960Q4(-1)	-	+0.3	-
1961Q1	1974Q1	1975Q1	+13.6	+13.0	-0.6	+16.9	+9.7	-7.2	1974Q1(0)	1975Q1(0)	+16.9	+9.7	-7.2
1975Q1	1979Q4	1980Q2	+12.0	+10.8	-1.2	+11.2	+10.4	-0.8	1979Q3(-1)	1980Q4(+2)	+12.3	+10.1	-2.2
1980Q2	1981Q2	1982Q4	+10.1	+9.8	-0.3	+11.0	+6.5	-4.5	1981Q2(0)	N.A.	+11.0	-	-

Table 12

Business cycles:			CPI (SA)			Filtered[1] CPI(SA) using business cycle dates for the peak and trough			Inflation cycles (+ lag) (- lead)		Filtered[1] CPI(SA) using inflation cycle dates for the peak and trough		
Trough	Peak	Trough	Expansion	Recession	Rec. minus Exp.	Expansion	Recession	Rec. minus Exp.	Peak	Trough	Expansion	Recession	Rec. minus Exp.
1949:Feb.	1951:May	1951:Dec.	+10.8	+7.5	-3.3	+10.0	+2.6	-7.4	1951:Feb.(-3)	1952:Mar.(+3)	+16.5	-4.2	-20.7
1951:Dec.	1953:May	1954:June	-1.4	+1.0	+2.4	+0.6	+2.1	+1.5	1953:Aug.(+3)	1954:Oct.(+4)	+3.0	-1.4	-4.4
1954:June	1957:Jan.	1958:Jan.	+3.1	+2.4	-0.7	+2.8	+4.9	+2.1	1956:Nov.(-2)	1958:June(+5)	+4.7	-0.4	-5.1
1958:Jan.	1960:Mar.	1961:Jan.	+1.3	+1.5	+0.2	+0.5	+0.9	+0.4	1959:Aug.(-7)	1961:May(+4)	+5.9	-1.0	-6.9
1961:Jan.	1974:May	1975:Mar.	+10.9	+10.7	-0.2	+12.2	+7.7	-4.5	1974:Apr.(-1)	1975:Feb.(-1)	+14.3	+7.2	-7.1
1975:Mar.	1979:Oct.	1980:June	+9.5	+9.9	+0.4	+11.9	+11.1	-0.8	1979:Oct.(0)	1980:Feb.(-4)	+11.9	+9.2	-2.7
1980:June	1981:June	1982:Dec.	+12.8	+9.9	-2.9	+11.5	+3.5	-8.0	1981:July(+1)	1983:Feb.(+2)	+13.1	+2.9	-10.2

1. The data are filtered by taking the annualized rate of change between the two months prior to and two months following each of the peak and trough months (quarters).

N.A. indicates that a peak or trough could not be identified.
S.A. = Seasonally adjusted

Table 13

Months By Which the Inflation Cycle for the Specified Filtered Price Series Lags (+) or Leads (-) the Business Cycle

Business cycles:		Implicit price deflator:		CPI:		CPI ex. food:		CPI ex. food and energy:		ISPI:		ISPI ex. food:		ISPI ex. food and energy:		WPI:	
Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
1951:May	1951:Dec.	-1	+4	-3	+3	-1	+6	-	-	-	-	-	-	-	-	-4	+3
1953:May	1954:June	+1	+2	+3	+4	+1	+3	+2	+5	-	-	-	-	-	-	+1	+1
1957:Jan.	1958:Jan.	-2	+1	-2	+5	+2	+5	+4	+5	-4	-4	-1	+1	-3	+1	-9	-4
1960:Mar.	1961:Jan.	N.A.	-1	-7	+4	-10	+5	-10	+5	+2	+2	-1	-1	-1	-1	+1	-4
1974:May	1975:Mar.	0	0	-1	-1	-1	0	+2	-1	0	-2	0	+1	-3	+1	-3	-2
1979:Oct.	1980:June	-1	+2	0	-4	-1	+1	-1	+3	+1	-2	+1	-3	+1	-3	-	-
1981:June	1982:Dec.	0	N.A.	+1	+2	-2	+3	+4	+4	-1	-1	-2	-1	-2	-3	-	-

N.A. indicates that a peak or trough could not be identified.

APPENDIX 1

Data Sources for the Price Series

(i) CPI

- selected series from Matrix 300 of the Cansim Mini Base
- selected series from Bank of Canada Tape entitled DATCON*PRICES

(ii) Implicit Deflators

- selected series from Matrix 526, Matrix 527, Matrix 1011 and Matrix 1012 of the Cansim Mini Base

(iii) Industry Selling Price Index

- selected series from Matrix 655-674 of the Cansim Mini Base
- selected series from Bank of Canada Tape entitled DATCON*PRICES

(iv) Wholesale Price Index

- selected series from Matrix 293 of the Cansim Main Base which also appear on the Bank of Canada Tape entitled DATCON*HISTPERM
- selected seasonally adjusted series from DATCON*HISTPERM

APPENDIX 2

Series Comprising the Reclassifications

(i) Consumer Price Index

A) CPI with high import content (CPIM):

fish (FIS), fresh fruit (FUT), fresh vegetables (VEG), sugar (SUG), household textiles and related plastics (HOS), piece goods and notions (NOT), automobile and truck purchase (AUT), automobile batteries (BAT), bicycle purchase and operation (BIC), reading (REA), liquor purchase from stores (LIC), vacuum cleaners (VAC)

B) Regulated CPI (CPIR):

public transportation (PUBTR), communications (COMM), dairy products and eggs (DEGGS), turkey (TURK), vehicle registration fees and drivers licenses (VEREG), water (WATER), property taxes and special charges (PROTAX), electricity (ELEC), fuel oil and other liquid fuel (FUELO), gasoline (GASO), piped and bottled gas (GAS), oil and oil change (MOIL), chicken (CHICK), tobacco and alcohol (TOBAL) (sub-groups may differ prior to October 1978)

(ii) Industry Selling Price Index

A) Degree of openness

Import-competing (ISPIM):
leather (LEA), textiles (TEX), knitting mills (NIT), electrical products (ELE), rubber and plastic products (RUB), miscellaneous manufacturing (MIS)

Export-oriented (ISPEX):
primary metal industries (PRI), wood industries (WOO), paper and allied product (PAP)

Open (ISPOP):
machinery industries (MAC), transportation equipment industries (TRA), chemical and chemical products industries (CHE)

Closed (ISPCO):
clothing (CLO), food and beverages (FAB), tobacco products (TOB), furniture and fixtures (FAF), metal fabricating (MET), non-metallic mineral products (NOM)

Energy (ISPE): petroleum and coal refining (PET)

B) Concentration

High concentration (ISPHI):
tobacco products, primary metal industries, petroleum and coal products, textile industries
(excludes textile industries prior to 1971)

Medium concentration (ISPME):
rubber and plastic products, paper and allied, non-metallic mineral products, electrical products, chemical and chemical products, food and beverages, leather, miscellaneous manufacturing, metal fabricating, transportation equipment (includes textile industries and machinery industries prior to 1971)

Low concentration (ISPLO):
knitting mills, furniture and fixtures, clothing, wood, machinery industries (excludes machinery industries prior to 1971)

APPENDIX 3

Methodology for Choice of Series in Reclassifications
Construction of new sub-aggregates of the Consumer Price Index

The Consumer Price Index (CPI) is constructed as a chain-linked Laspeyres fixed weight index as explained in Statistics Canada, 62-546 "The Consumer Price Index Reference Paper". The weights are determined by expenditure surveys and are held fixed until changes are warranted as determined by subsequent surveys. When the CPI was initially compiled in January 1949 it was weighted according to a 1947-48 expenditure pattern. Subsequent reweighting occurred in: February 1961 (a 1957 expenditure pattern); May 1973 (a 1967 expenditure pattern); October 1978 (a 1974 expenditure pattern); April 1982 (a 1978 expenditure pattern). At the point in time when new weights are introduced the index is 'chain linked' to the historical series. The construction of new sub-aggregates of the CPI requires that this methodology be maintained in order that they be compatible with the published CPI.

There were essentially two new aggregates of the CPI compiled for this study: a CPI for regulated commodities (CPIR) and a CPI for commodities with a high import content (CPIM). [1] The formation of the CPIR was based on the work done by Karen Wilson at Statistics Canada and later adapted by Paul Fenton and Anne Dunnigan at the Bank. These two studies compiled the index back to April 1973. This starting point was chosen because: a number of the indices for regulated commodities only began in 1971, federal marketing boards for dairy, eggs and poultry generally came into existence about this time, and crude oil and natural gas prices began to be regulated around 1973-74. For this study it was desirable to push back the starting point to January 1949. The problems that this caused included: the CPI component for water was not available prior to April 1973, the total weight of regulated goods over the period January 1949 to March 1973 was very small (14%) compared to the period April 1973 to present (25%), and the appropriate implicit weights were not available for the initial period. [2] This latter problem required the use of expenditure weights though this is the same procedure used by Statistics Canada. The construction of CPIR requires that it first be

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1. The complements to these indices (i.e., the CPI for non-regulated goods) were derived as a weighted subtraction of the new sub-aggregate from the total CPI for each period and then appropriately chain-linked.

2. These problems are in addition to the ones earlier enumerated by Karen Wilson with respect to the index over the period April 1973 to present. The Wilson paper stressed that the constructed index should not be viewed as an official index of regulated prices because a number of items, principally rent and sales taxes, are excluded. These components were left out because the items regulated within each vary considerably from province to province. The index constructed for this study also does not include cablevision charges from September 1978 to the present because the information is secure. This latter component has a very small weight.

calculated over the period from January 1949 to January 1961 and then chain-linked to the other periods. The equations used to calculate the series are shown below.

Constructing a CPI for Regulated Goods (CPIR), January 1949=100

CPIR for the period t = January 1949 to January 1961

$$CPIR(t) = 100 \times \left[1.9 \frac{LOCOM(t)}{LOCOM(Jan\ 49)} + 0.9 \frac{INCIT(t)}{INCIT(Jan\ 49)} + 1.0 \frac{PHONE(t)}{PHONE(Jan\ 49)} + 0.3 \frac{POST(t)}{POST(Jan\ 49)} + 0.2 \frac{VEREG(t)}{VEREG(Jan\ 49)} + 1.2 \frac{ELEC(t)}{ELEC(Jan\ 49)} + 1.5 \frac{PROTAX(t)}{PROTAX\ (Jan\ 49)} + 7.1 \frac{TOBAL(t)}{TOBAL\ (Jan\ 49)} \right] \frac{1}{14.1}$$

$$CPINR(t) = \frac{1}{1-.141} \left[\frac{CPI(t)}{CPI(Jan\ 49)} - .141 \frac{CPIR(t)}{CPIR(Jan\ 49)} \right] \times 100$$

CPIR for the period t = January 1961 to April 1973

$$CPIR(t) = CPIR(Jan\ 61) \times \left[1.4600 \frac{LOCOM(t)}{LOCOM(Jan\ 61)} + 0.5400 \frac{INCIT(t)}{INCIT(Jan\ 61)} + 1.3894 \frac{PHONE(t)}{PHONE(Jan\ 61)} + 0.2099 \frac{POST(t)}{POST(Jan\ 61)} + 0.2682 \frac{VEREG(t)}{VEREG(Jan\ 61)} + 1.4837 \frac{ELEC(t)}{ELEC(Jan\ 61)} + 2.4285 \frac{PROTAX(t)}{PROTAX(Jan\ 61)} + 6.6000 \frac{TOBAL(t)}{TOBAL(Jan\ 61)} \right] \frac{1}{14.3797}$$

$$CPINR(t) = \frac{1}{1-.143797} \left[\frac{CPI(t)}{CPI(Jan\ 61)} - .143797 \frac{CPIR(t)}{CPIR(Jan\ 61)} \right] \times CPINR(Jan\ 61)$$

CPIR for the period t = April 1973 to September 1978

$$CPIR(t) = CPIR(Apr\ 73) \times \left[2.2926 \frac{PUBTR(t)}{PUBTR(Apr\ 73)} + 1.5162 \frac{COMM(t)}{COMM(Apr\ 73)} + 3.9888 \frac{DEGGS(t)}{DEGGS(Apr\ 73)} + 0.2539 \frac{TURK(t)}{TURK(Apr\ 73)} + 0.3897 \frac{VEREG(t)}{VEREG(Apr\ 73)} + 0.4547 \frac{WATER(t)}{WATER(Apr\ 73)} + 1.1650 \frac{FUELO(t)}{FUELO(Apr\ 73)} + 0.6737 \frac{GAS(t)}{GAS(Apr\ 73)} + 1.5461 \frac{ELEC(t)}{ELEC(Apr\ 73)} + 2.9999 \frac{PROTAX(t)}{PROTAX(Apr\ 73)} + 2.8841 \frac{GASO(t)}{GASO(Apr\ 73)} + 0.2615 \frac{MOIL(t)}{MOIL(Apr\ 73)} + 5.8539 \frac{TOBAL(t)}{TOBAL(Apr\ 73)} \right] \frac{1}{24.2801}$$

$$CPINR(t) = \frac{1}{1-.242801} \left[\frac{CPI(t)}{CPI(Apr\ 73)} - .242801 \frac{CPIR(t)}{CPIR(Apr\ 73)} \right] \times CPINR(Apr\ 73)$$

CPIR for the period t = September 1978 to March 1982

$$CPIR(t) = CPIR(\text{Sep 78}) \times \Big[2.09 \frac{PUBTR(t)}{PUBTR(\text{Sep 78})} + 1.44 \frac{COMM(t)}{COMM(\text{Sep 78})} + 3.02 \frac{DEGGS(t)}{DEGGS(\text{Sep 78})} + 0.52 \frac{CHICK(t)}{CHICK(\text{Sep 78})} + 0.19 \frac{TURK(t)}{TURK(\text{Sep 78})} + 0.27 \frac{VEREG(t)}{VEREG(\text{Sep 78})} + 0.38 \frac{WATER(t)}{WATER(\text{Sep 78})} + 1.21 \frac{FUELO(t)}{FUELO(\text{Sep 78})} + 1.00 \frac{GAS(t)}{GAS(\text{Sep 78})} + 1.55 \frac{ELEC(t)}{ELEC(\text{Sep 78})} + 2.77 \frac{PROTAX(t)}{PROTAX(\text{Sep 78})} + 3.37 \frac{GASO(t)}{GASO(\text{Sep 78})} + 0.23 \frac{MOIL(t)}{MOIL(\text{Sep 78})} + 6.33 \frac{TOBAL(t)}{TOBAL(\text{Sep 78})} \Big] \frac{1}{24.37}$$

$$CPINR(t) = \frac{1}{1-.2437} \Big[\frac{CPI(t)}{CPI(\text{Sep 78})} - .2437 \frac{CPIR(t)}{CPIR(\text{Sep 78})} \Big] \times CPINR(\text{Sep 78})$$

CPIR for the period t = March 1982 to present

$$CPIR(t) = CPIR(\text{Mar 82}) \times \Big[2.154 \frac{PUBTR(t)}{PUBTR(\text{Mar 82})} + 1.526 \frac{COMM(t)}{COMM(\text{Mar 82})} + 2.714 \frac{DEGGS(t)}{DEGGS(\text{Mar 82})} + 0.590 \frac{CHICK(t)}{CHICK(\text{Mar 82})} + 0.163 \frac{TURK(t)}{TURK(\text{Mar 82})} + 0.391 \frac{VEREG(t)}{VEREG(\text{Mar 82})} + 0.326 \frac{WATER(t)}{WATER(\text{Mar 82})} + 1.494 \frac{FUELO(t)}{FUELO(\text{Mar 82})} + 1.035 \frac{GAS(t)}{GAS(\text{Mar 82})} + 1.623 \frac{ELEC(t)}{ELEC(\text{Mar 82})} + 2.278 \frac{PROTAX(t)}{PROTAX(\text{Mar 82})} + 4.751 \frac{GASO(t)}{GASO(\text{Mar 82})} + 0.245 \frac{MOIL(t)}{MOIL(\text{Mar 82})} + 5.473 \frac{TOBAL(t)}{TOBAL(\text{Mar 82})} \Big] \frac{1}{24.763}$$

$$CPINR(t) = \frac{1}{(1-.24763)} \Big[\frac{CPI(t)}{CPI(\text{Mar 82})} - \frac{0.24763 \times CPIR(t)}{CPIR(\text{Mar 82})} \Big] \times CPINR(\text{Mar 82})$$

LOCOM = Local and commuter transportation services
INCIT = Inter-city transportation services
PHONE = Telephone service
POST = Postage
For the remaining mnemonics see Appendix 2.

In the construction of the CPI sub-aggregate for commodities with a high import content (CPIM), a methodology similar to that described for the CPIR was used. Selection of those commodities to include in CPIM did not benefit from previous work as was the case with CPIR. To make the selection of those commodities to include in this sub-aggregate, data from the Input-Output tables were used. Commodities were defined as having a high import content if the ratio of imports to total domestic commercial demand was greater than 25%.[3] A reconciliation of the I-O commodities

3. It would have been preferable to have the ratio of both imports and total domestic commercial demand at the retail level but this was not available.

and the 1974 Family Expenditure Survey (FES) commodity breakdown was made available by Statistics Canada. This allowed the matching of the selected I-O commodities with FES items which in turn could be readily paired with CPI components. There was slippage moving from the I-O to the FES commodities particularly with respect to clothing items. The I-O breakdown only distinguishes between "clothing" and "knitted wear" with the latter commodity having an import share greater than 25% while the former does not. The FES (and CPI) has a much finer breakdown of clothing items but does not distinguish between knitted and not knitted items. As a result the decision was taken not to include any clothing items in the CPIM. There was also some slippage with respect to a number of food items. The I-O data are not as finely disaggregated as would have been desirable for such foods as processed fruit and vegetables. As a result, the decision was made not to include these two components in the final construction of CPIM. A related problem with the food items was the appropriate weights. Prior to April 1973 a number of food components had weights that were allowed to vary through the course of the year rather than held constant. Because of this Statistics Canada could not provide the required implicit or expenditure weights for a number of food components. The decision was taken to use the average of the monthly seasonal weights.

Once the CPI items with a high import content were identified they were included in the CPIM only if the data were not secure and were available back to January 1949. As a result the sub-aggregate only accounts for about 12% of the total CPI. The actual equations used to construct the series are presented below.

Constructing a CPI for Goods with a High Import Content (CPIM), January 1949=100

CPIM for the period t = January 1949 to January 1961

$$\begin{aligned} CPIM(t) = 100 \times \Big[& 0.4 \frac{FIS(t)}{FIS(Jan\ 49)} + 2.0 \frac{FUT(t)}{FUT(Jan\ 49)} + 2.0 \frac{VEG(t)}{VEG(Jan\ 49)} + 0.7 \frac{SUG(t)}{SUG(Jan\ 49)} \\ & + 0.9 \frac{HOS(t)}{HOS(Jan\ 49)} + 0.5 \frac{NOT(t)}{NOT(Jan\ 49)} + 1.5 \frac{AUT(t)}{AUT(Jan\ 49)} + 0.1 \frac{BAT(t)}{BAT(Jan\ 49)} \\ & + 0.4 \frac{BIC(t)}{BIC(Jan\ 49)} + 1.0 \frac{REA(t)}{REA(Jan\ 49)} + 1.2 \frac{LIC(t)}{LIC(Jan\ 49)} \Big] \frac{1}{10.7} \end{aligned}$$

$$CPIXM(t) = \frac{1}{1-.107} \left[\frac{CPI(t)}{CPI(Jan\ 49)} - .107 \frac{CPIM(t)}{CPIM(Jan\ 49)} \right] \times 100$$

CPIM for the period t = January 1961 to April 1973

$$CPIM(t) = CPIM\ (Jan\ 61)\ X\ \Big[\ 0.6\ \frac{FIS(t)}{FIS(Jan\ 61)} + 0.9\ \frac{FUT(t)}{FUT(Jan\ 61)} + 1.4\ \frac{VEG(t)}{VEG(Jan\ 61)} + 0.0\ \frac{SUG(t)}{SUG(Jan\ 61)} + 0.63\ \frac{HOS(t)}{HOS(Jan\ 61)} + 0.34\ \frac{NOT(t)}{NOT(Jan\ 61)} + 5.0936\ \frac{AUT(t)}{AUT(Jan\ 61)} + 0.0629\ \frac{BAT(t)}{BAT(Jan\ 61)} + .2005\ \frac{BIC(t)}{BIC(Jan\ 61)} + 1.1\ \frac{REA(t)}{REA(Jan\ 61)} + 1.3\ \frac{LIC(t)}{LIC(Jan\ 61)} + 0.3\ \frac{VAC(t)}{VAC(Jan\ 61)}\ \Big]\ \frac{1}{11.927}$$

$$CPIXM(t) = \frac{1}{1-.11927}\ \Big[\ \frac{CPI(t)}{CPI(Jan\ 61)} - .11927\ \frac{CPIM(t)}{CPIM(Jan\ 61)}\ \Big]\ X\ CPIXM(Jan\ 61)$$

CPIM for the period t = April 1973 to September 1978

$$CPIM(t) = CPIM(Apr\ 73)\ X\ \Big[\ .4848\ \frac{FIS(t)}{FIS(Apr\ 73)} + 1.1361\ \frac{FUT(t)}{FUT(Apr\ 73)} + 1.2598\ \frac{VEG(t)}{VEG(Apr\ 73)} + 0.2\ \frac{SUG(t)}{SUG(Apr\ 73)} + 0.5134\ \frac{HOS(t)}{HOS(Apr\ 73)} + 0.3812\ \frac{NOT(t)}{NOT(Apr\ 73)} + 5.2329\ \frac{AUT(t)}{AUT(Apr\ 73)} + 0.0662\ \frac{BAT(t)}{BAT(Apr\ 73)} + 0.0598\ \frac{BIC(t)}{BIC(Apr\ 73)} + 0.9722\ \frac{REA(t)}{REA(Apr\ 73)} + 0.9609\ \frac{LIC(t)}{LIC(Apr\ 73)} + 0.1\ \frac{VAC(t)}{VAC(Apr\ 73)}\ \Big]\ \frac{1}{11.3673}$$

$$CPIXM(t) = \frac{1}{1-.113673}\ \Big[\ \frac{CPI(t)}{CPI(Apr\ 73)} - .113673\ X\ \frac{CPIM(t)}{CPIM(Apr\ 73)}\ \Big]\ X\ CPIXM(Apr\ 73)$$

CPIM for the period t = September 1978 to March 1982

$$CPIM(t) = CPIM(Sep\ 78)\ X\ \Big[\ 0.4327\ \frac{FIS(t)}{FIS(Sep\ 78)} + 1.0932\ \frac{FUT(t)}{FUT(Sep\ 78)} + 0.8113\ \frac{VEG(t)}{VEG(Sep\ 78)} + 0.14\ \frac{SUG(t)}{SUG(Sep\ 78)} + 0.6369\ \frac{HOS(t)}{HOS(Sep\ 78)} + .2823\ \frac{NOT(t)}{NOT(Sep\ 78)} + 5.9653\ \frac{AUT(t)}{AUT(Sep\ 78)} + 0.0537\ \frac{BAT(t)}{BAT(Sep\ 78)} + 0.1353\ \frac{BIC(t)}{BIC(Sep\ 78)} + .84\ \frac{REA(t)}{REA(Sep\ 78)} + 1.2398\ \frac{LIC(t)}{LIC(Sep\ 78)} + 0.14\ \frac{VAC(t)}{VAC(Sep\ 78)}\ \Big]\ \frac{1}{11.7705}$$

$$CPIXM(t) = \frac{1}{1-.117705}\ \Big[\ \frac{CPI(t)}{CPI(Sep\ 78)} - .117705\ \frac{CPIM(t)}{CPIM(Sep\ 78)}\ \Big]\ X\ CPIXM(Sep\ 78)$$

CPIM for the period March 1982 to present

$$CPIM(t) = CPIM(Mar\ 82) \times \left[0.5949 \frac{FIS(t)}{FIS(Mar\ 82)} + 0.9850 \frac{FUT(t)}{FUT(Mar\ 82)} + .9469 \frac{VEG(t)}{VEG(Mar\ 82)} \right.$$

$$+ .12 \frac{SUG(t)}{SUG(Mar\ 82)} + 0.6150 \frac{HOS(t)}{HOS(Mar\ 82)} + 0.2758 \frac{NOT(t)}{NOT(Mar\ 82)}$$

$$+ 6.2461 \frac{AUT(t)}{AUT(Mar\ 82)} + 0.0590 \frac{BAT(t)}{BAT(Mar\ 82)} + 0.1220 \frac{BIC(t)}{BIC(Mar\ 12)}$$

$$\left. + 0.8540 \frac{REA(t)}{REA(Mar\ 82)} + 0.9943 \frac{LIC(t)}{LIC(Mar\ 82)} + 0.16 \frac{VAC(t)}{VAC(Mar\ 82)} \right] \frac{1}{11.9730}$$

$$CPIXM(t) = \frac{1}{1-.119730} \left[\frac{CPI(t)}{CPI(Mar\ 82)} - .119730 \frac{CPIM(t)}{CPIM(Mar\ 82)} \right] \times CPIXM(Mar\ 82)$$

Construction of the new sub-aggregates of the Industry Selling Price Index

The Industry Selling Price Index (ISPI) was first compiled in January 1956. It was weighted on the basis of 1953 gross shipments classified by manufacturing industries according to the 1948 Standard Industrial Classification (SIC). Reweightings subsequently occurred in: January 1961 (1961 gross shipments of manufacturing industries and the 1960 SIC); and January 1971 (1971 gross shipments of manufacturing industries and the 1970 SIC). The ISPI is constructed as a chain-linked Laspeyres fixed weight index as explained in Statistics Canada, 62-543 "Industry Selling Price Indexes: Manufacturing". The construction of new sub-aggregates requires that they also be chain-linked to be compatible with the published ISPI.

There were two sets of sub-aggregates of the ISPI formed for the purposes of this study. Industries were grouped according to their international competitiveness and their degree of concentration. The first re-aggregation employed a classification system developed by Clinton and Hannah [5] in which industries are characterized as being either export-oriented (ISPEX), open (ISPOP), import-competing (ISPIM), closed (ISPCO) or energy-producing (ISPE). The classification system was based on a measure for each two-digit industry of both export-orientation (the value of exports divided by total shipments) and import penetration (imports divided by the Canadian market for that industry).[4] Those industries with the export measure greater than 20% but with import penetration less than this were considered export-oriented. Those industries with import penetration greater than 20% but with an export measure less than 20% were considered import-competing. An industry was considered open if both measures were greater than 20%, closed if both measures were less than 20%. The measures were calculated over the period

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4. The original source of the data was "Manufacturing Trade and Measures", 1966-1979, Department of Industry, Trade and Commerce.

1976-80 with the results assumed constant back to 1961. These series were extended back only to January 1961 because of incompatibility between the 1948 and the 1960 SIC. The actual equations used to calculate the series follow below.

Constructing ISPI Sub-Aggregates by Degree of International Competition, January 1961=100

Constructing the indices for the period t = January 1961 to December 1970

$$ISPCO(t) = 100 \times \left[.032 \frac{CLO(t)}{CLO(Jan\ 61)} + .220 \frac{FAB(t)}{FAB(Jan\ 61)} + .013 \frac{TOB(t)}{TOB(Jan\ 61)} + .015 \frac{FAF(t)}{FAF(Jan\ 61)} + .066 \frac{MET(t)}{MET(Jan\ 61)} + .029 \frac{NOM(t)}{NOM(Jan\ 61)} \right] \frac{1}{.375}$$

$$ISPE(t) = 100 \times \left[\frac{PET(t)}{PET(Jan\ 61)} \right]$$

$$ISPEX(t) = 100 \times \left[.101 \frac{PRI(t)}{PRI(Jan\ 61)} + .045 \frac{WOO(t)}{WOO(Jan\ 61)} + .090 \frac{PAP(t)}{PAP(Jan\ 61)} \right] \frac{1}{.236}$$

$$ISPIM(t) = 100 \times \left[.012 \frac{LEA(t)}{LEA(Jan\ 61)} + .036 \frac{TEX(t)}{TEX(Jan\ 61)} + .009 \frac{NIT(t)}{NIT(Jan\ 61)} + .055 \frac{ELE(t)}{ELE(Jan\ 61)} + .015 \frac{RUB(t)}{RUB(Jan\ 61)} + .027 \frac{MIS(t)}{MIS(Jan\ 61)} \right] \frac{1}{.154}$$

$$ISPOP(t) = 100 \times \left[.032 \frac{MAC(t)}{MAC(Jan\ 61)} + .089 \frac{TRA(t)}{TRA(Jan\ 61)} + .064 \frac{CHE(t)}{CHE(Jan\ 61)} \right] \frac{1}{.185}$$

Constructing the indices for the period t = December 1970 to present

$$ISPCO(t) = ISPCO(Dec\ 70) \times \left[.030 \frac{CLO(t)}{CLO(Dec\ 70)} + .199 \frac{FAB(t)}{FAB(Dec\ 70)} + .011 \frac{TOB(t)}{TOB(Dec\ 70)} + .016 \frac{FAF(t)}{FAF(Dec\ 70)} + .075 \frac{MET(t)}{MET(Dec\ 70)} + .032 \frac{NOM(t)}{NOM(Dec\ 70)} \right] \frac{1}{0.363}$$

$$ISPE(t) = ISPE(Dec\ 70) \times \left[\frac{PET(t)}{PET(Dec\ 70)} \right]$$

$$ISPEX(t) = ISPEX(Dec\ 70) \times \left[.084 \frac{PRI(t)}{PRI(Dec\ 70)} + .047 \frac{WOO(t)}{WOO(Dec\ 70)} + .082 \frac{PAP(t)}{PAP(Dec\ 70)} \right] \frac{1}{.213}$$

$$ISPIM(t) = ISPIM(Dec\ 70) \times \left[.025 \frac{RUB(t)}{RUB(Dec\ 70)} + .009 \frac{LEA(t)}{LEA(Dec\ 70)} + .035 \frac{TEX(t)}{TEX(Dec\ 70)} + .009 \frac{NIT(t)}{NIT(Dec\ 70)} + .068 \frac{ELE(t)}{ELE(Dec\ 70)} + .026 \frac{MIS(t)}{MIS(Dec\ 70)} \right] \frac{1}{.172}$$

$$ISPOP(t) = ISPOP(Dec\ 70) \times \left[.044 \frac{MAC(t)}{MAC(Dec\ 70)} + .099 \frac{TRA(t)}{TRA(Dec\ 70)} + .066 \frac{CHE(t)}{CHE(Dec\ 70)} \right] \frac{1}{.209}$$

The second re-aggregation of the ISPI was based on concentration ratios (derived from shipments) of the leading eight enterprises for each two-digit industry.[5] The data are available from Statistics Canada's Industrial Organization and Concentration in Manufacturing, Mining and Logging industries, Cat. 31-402. An industry was considered to have: high concentration (ISPHI) if the ratio was 60% or greater, medium concentration (ISPME) if the ratio was less than 60% but greater than 30% and low concentration (ISPLO) if the ratio was 30% or less. Concentration ratios were calculated for eight years between 1965 and 1980 inclusive. The grouping of industries into one of the three categories was allowed to change between the period 1961-70 and 1971-present if changes in the concentration ratio warranted. For example the textile industry was considered to have medium concentration through the period 1961-70 on the basis of an average concentration ratio of 58.8% over the years 1965, 1968 and 1970. The industry was considered to be of high concentration over the period 1971-present on the basis of an average concentration ratio of 62.5% over the years 1972, 1974, 1976, 1978 and 1980. Similar to the other ISPI re-aggregation, these series were only extended back to January 1961 because of incompatibility between the 1948 and the 1960 SIC. The actual equations used to calculate the series are given below.

Constructing ISPI Sub-Aggregates by Degree of Concentration, January 1961=100

Constructing the indices for the period t = January 1961 to December 1970

$$ISPHI(t) = 100 \times \left[.013 \frac{TOB(t)}{TOB(Jan\ 61)} + .050 \frac{PET(t)}{PET(Jan\ 61)} + .101 \frac{PRI(t)}{PRI(Jan\ 61)} \right] \frac{1}{0.164}$$

$$\begin{aligned} ISPME(t) = 100 \times \Big[& .015 \frac{RUB(t)}{RUB(Jan\ 61)} + .090 \frac{PAP(t)}{PAP(Jan\ 61)} + .029 \frac{NOM(t)}{NOM(Jan\ 61)} \\ & + .055 \frac{ELE(t)}{ELE(Jan\ 61)} + .064 \frac{CHE(t)}{CHE(Jan\ 61)} + .220 \frac{FAB(t)}{FAB(Jan\ 61)} \\ & + .012 \frac{LEA(t)}{LEA(Jan\ 61)} + .027 \frac{MIS(t)}{MIS(Jan\ 61)} + .066 \frac{MET(t)}{MET(Jan\ 61)} \\ & + .089 \frac{TRA(t)}{TRA(Jan\ 61)} + .036 \frac{TEX(t)}{TEX(Jan\ 61)} + .032 \frac{MAC(t)}{MAC(Jan\ 61)} \Big] \frac{1}{.735} \end{aligned}$$

$$\begin{aligned} ISPLO(t) = 100 \times \Big[& .009 \frac{NIT(t)}{NIT(Jan\ 61)} + .015 \frac{FAF(t)}{FAF(Jan\ 61)} + .032 \frac{CLO(t)}{CLO(Jan\ 61)} \\ & + .045 \frac{WOO(t)}{WOO(Jan\ 61)} \Big] \frac{1}{.101} \end{aligned}$$

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5. Gerald Stuber in a separate study [14] has considered the profit performance of industries by level of concentration over the business cycle. It should be noted that his concentration ratios were derived using the leading four firms rather than eight firms. This should not cause large differences because there is a high positive correlation between these two measures.

Constructing the indices for the period t = December 1970 to present

$$ISPHI(t) = ISPHI(Dec\ 70) \times \left[.011 \frac{TOB(t)}{TOB(Dec\ 70)} + .042 \frac{PET(t)}{PET(Dec\ 70)} + .084 \frac{PRI(t)}{PRI(Dec\ 70)} + .035 \frac{TEX(t)}{TEX(Dec\ 70)} \right] \frac{1}{.172}$$

$$ISPME(t) = ISPME(Dec\ 70) \times \left[.025 \frac{RUB(t)}{RUB(Dec\ 70)} + .082 \frac{PAP(t)}{PAP(Dec\ 70)} + .032 \frac{NOM(t)}{NOM(Dec\ 70)} + .068 \frac{ELE(t)}{ELE(Dec\ 70)} + .066 \frac{CHE(t)}{CHE(Dec\ 70)} + .199 \frac{FAB(t)}{FAB(Dec\ 70)} + .009 \frac{LEA(t)}{LEA(Dec\ 70)} + .026 \frac{MIS(t)}{MIS(Dec\ 70)} + .075 \frac{MET(t)}{MET(Dec\ 70)} + .099 \frac{TRA(t)}{TRA(Dec\ 70)} \right] \frac{1}{0.681}$$

$$ISPLO(t) = ISPLO(Dec\ 70) \times \left[.009 \frac{NIT(t)}{NIT(Dec\ 70)} + .016 \frac{FAF(t)}{FAF(Dec\ 70)} + .030 \frac{CLO(t)}{CLO(Dec\ 70)} + .047 \frac{WOO(t)}{WOO(Dec\ 70)} + .044 \frac{MAC(t)}{MAC(Dec\ 70)} \right] \frac{1}{.146}$$

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