INDEXES OF EFFECTIVE EXCHANGE RATES FOR WESTERN CANADA

Edward J. Chambers
Professor of Marketing and Economic Analysis and
Director of the Western Centre for Economic Research
University of Alberta

INTRODUCTION

This bulletin describes the methods used to develop an exchange rate index for western Canada. The work is part of a larger program of research into the region's exports to the international economy, with special attention to the strategic options facing producers in the coming decade following from the Free Trade Agreement, Europe 1992, and possible expanded trading arrangements with the Pacific rim.

No economic and financial indicator creates more controversy in western Canada than the foreign exchange value of the Canadian dollar. This is to be expected for the region's exports are highly concentrated in a relatively few resource based commodities, whose product attributes are not easily differentiated from those of foreign competitors. Western producers export highly price sensitive products at internationally determined prices over which they are unable to exert any significant influence.

In 1989 exports from the four western provinces amounted to some $39 billion, or about 30% of the country's merchandise exports. A significant fraction consisted of either raw or commodity grade processed materials. Based on the four years from 1986 to 1989 six commodities - crude oil, natural gas, sawn coniferous lumber, woodpulp, wheat

and coal - accounted for more than one half of the region's international exports. If another eight commodities are added including canola, copper ores and concentrates, newsprint, potash, sulphur, fish, and barley then these 14 commodities accounted for almost two of every three dollars in export values. Further, geographic markets for regional exports differ markedly from the Canadian average. About 55% of western exports went to the U.S. compared with a national share of approximately 75%, and the more than 20% going to the Pacific rim accounted for virtually all of the country's exports to that area.

INDEXES OF EFFECTIVE EXCHANGE RATES

Movements in the exchange rate affect interpretation of business, economic and labor market relationships. Further, Canadian monetary policy affects the economy not through interest rate changes alone, but also through the exchange rate. Exchange rate variability then has a reinforcing effect on business gross operating margins with significant consequence for the western Canadian economy. In the post-1973 years following adoption of the regime of floating, albeit heavily managed exchange rates, indexes of exchange rate values measuring the behavior of one currency in terms of others became widely prevalent. The question is whether existing and generally used measures of exchange rate behavior including the US/Canadian dollar rate, and the Bank of Canada's G-10 index serve well in evaluations of western Canada's international competitive position.

Common parlance refers to the "exchange rate". But the question is: "what rate?" The exchange rate between the Canadian dollar and any other single currency, even the US dollar, cannot for the country let alone for the region, necessarily serve as a perfectly suitable exchange rate measure. It is therefore usual to combine a number of exchange rates into an 'effective' index which is then used to interpret exchange rate impacts. The term 'effective' means that each of the foreign currency values making up the index is assigned an importance based upon the size of that country in the given country's external economic relations. There are some similarities - and some differences - between an index of prices like the Consumer Price Index (CPI) and an effective exchange rate index. The exchange rate index resembles a price index in the bundling together of a number of foreign currency values. It differs from the CPI because it is a measure of relative prices, ie. the price of number of other currencies in terms of Canadian currency, whereas a price index groups together a sample of individual goods and service prices to obtain a measure of the price level.

APPLICATION OF EFFECTIVE EXCHANGE RATE INDEXES TO WESTERN CANADA

The purposes to be served by effective exchange rate indexes have been stated by Elmer Koch:

"Exchange rate movements have a direct effect on the prices of traded goods and may thus have consequences for international trade flows as well as domestic price developments. Accordingly different EER (effective exchange rate) indices may be constructed, depending on whether greater emphasis is placed on the analysis of relationships between the exchange rate and the trade balance on the one hand or inflation on the other. For example, in the latter case the weight structure of the exchange rate index would be determined primarily by the geographical distribution of imports, whereas questions relating to trade and international competitiveness would be more appropriately examined with the help of a weighted EER index which takes into account bilateral and third market export flows. Indeed a number of central banks - for instance, the National Bank of the Belgium, the Netherlands Bank, and the National Bank of Denmark - regularly monitor differently weighted EER indices for these purposes."[Koch 1984, p. 2]

The purpose of the effective exchange index reported here is to assess the impact of exchange rate movements on the competitive position of the region's exports.

EXPORT PRODUCTS CONTAINED IN THE EXCHANGE RATE INDEX

As indicated above exports are highly concentrated in a relatively few resource based, low value added commodities. It is these exports that identify western Canada's position in the international economy. These new indexes identify trends in the export competitiveness of a bundle of key export commodities including crude oil, natural gas, woodpulp, sawn lumber, newsprint, wheat, canola, barley, coal, sulphur, potash, copper and zinc ores and concentrates. The total of these items represent well over three fifths of the region's commodity exports to the rest of the world.

COUNTRIES INCLUDED IN THE EXCHANGE RATE INDEX

To develop an exchange rate index reflecting the competitiveness of the above set of commodities requires identification of a set of countries for inclusion. Movements in the index follow from the countries included. The country basket used was determined pragmatically by first applying the criterion of a country's importance as a market for the designated group of commodity exports. The total of nineteen countries represented in the basket make it considerably broader than the Bank of Canada's G-10 index. For example, Australia, Finland, Sweden, Spain, and Portugal are included though they are of minimal importance as direct export markets. They enter the index because they are active international competitors in third country markets in one or more of the designated commodities.

A further problem in country selection arises because western Canada exports significant amounts, particularly of agricultural commodities, into the markets of countries with nonconvertible currencies, or to countries whose price problems border on hyperinflation. Evidence from the construction of other exchange rate indexes suggest that the

inclusion of these currencies introduces a greater degree of distortion into an index than does their exclusion. This is especially true when countries with high rates of inflation are introduced [Dutton and Grennes 1985]. How should these currencies be accounted for in the index, if at all? There are two possible approaches: the first is to exclude them from the basket and assume that any changes in international competitiveness are adequately reflected in the index average; the second is to assume that changes related to these countries should be tied to a specific currency such as the US dollar, the yen or the DM. The Western Centre indexes reported here adopt the first approach.

THE CHOICE OF WEIGHTING SYSTEM

As Koch emphasizes, the purposes to be served by an exchange rate index determine choice of the weighting system. Since the purpose of the index reported here is to measure export competitiveness for a defined group of commodities it must account not only for exports to countries in the currency basket but also competition in third country markets. To illustrate this point consider as a contrast the weighting system employed in construction of the Bank of Canada's G-10 index. It is weighted by *direct* trade, both exports and imports, involving Canada and 10 major industrialized countries: Belgium-Luxembourg, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the U.K., and the U.S. These are bilateral weights (the relative importance of Canada's two way trade with each of these countries). Bilateral weighting yields an index which incompletely describes Canada's international competitive position since by omitting rivalry in third markets, it cannot properly measure changes in international competitiveness. For example, Australia is not included in the G-10 index at all, yet western Canadian competition with Australia in numerous geographic markets in a number of the designated commodities, both agricultural and nonagricultural, is quite intense. Though Sweden is included in the G-10 index it is assigned a weight based upon direct trade thereby ignoring competition with Sweden as a major exporter of pulp, paper and lumber products to third country markets. Third country effects must be taken into account in assessing exchange rate impacts on international competitiveness. When this occurs a set of multilateral replaces a set of bilateral weights.

WEIGHTING METHOD

To calculate the western Canada effective exchange rate index sets of multilateral weights must be employed. For each commodity there is a double weighting with weights for commodity i estimated as follows:

(a) Identify currency basket as states A to N.

(b) Construct a vector of country export share ratios for western Canada's exports of commodity i to the countries in the currency basket. Effectively this is a row vector of export share ratios (x) which for an N country currency basket A, B, C,...N is

$x = [x_a, x_b, x_c,....,x_n]$.

(c) Construct for each commodity a matrix, M, of market share coefficients in home supplies and total imports (excluding imports from Canada) to the domestic market for each of the currency basket states. For a currency basket containing countries A, B, C,....N the market share coefficient matrix for a given commodity will be:

State	A	B	C	----	N
A	m_{aa}	m_{ab}	m_{ac}	----	m_{an}
B	m_{ba}	m_{bb}	m_{bc}	----	m_{bn}
C	m_{ca}	m_{cb}	m_{cc}	----	m_{cn}
----	----	----	----	----	----
N	m_{na}	m_{nb}	m_{nc}	----	m_{nn}

Each column of the matrix for each commodity contains the set of market share coefficients, m, for each state. On the diagonal is the proportion of each country's market provided from domestic sources.

(d) Premultiply the commodity matrix of market shares, M, by the vector for each commodity of western Canadian export country share ratios, x. The product will be a 1 by N vector showing the weight for commodity i assigned to each member of the currency basket.

(e) The exchange rate for each country in the currency basket is defined as foreign currency units per Canadian dollar. These rates were converted to indexes with average levels for 1981 set as the base (1981=100). The index of exchange rates for each country multiplied by the country weights yields an effective exchange rate index for each of the twelve commodities.

(f) To obtain for the entire set of commodities the effective nominal exchange rate index for western Canada, the effective exchange rate index for each commodity obtained in (e) is weighted by that commodity's relative share in total exports (export values in domestic currency of the designated set of commodities).

The country weight estimated from annual average export trade and market share data covering the years 1986 and 1987 are reported in Appendix 1. The appendix also contains the country weights in the Bank of Canada G-10 index.

NOMINAL EFFECTIVE EXCHANGE RATE INDEX FOR WESTERN CANADA

With "high inflation" countries excluded from the currency basket, the indexes are not particularly sensitive to whether they are in arithmetic or geometric form. Fig. 1 compares the Western Centre nominal effective index with two other measures of the external value of the currency: the US/Canadian dollar index (which implicitly assumes that all other currencies have a weight of zero), and the G-10 index of the Bank of Canada. All are on a base of 1981=100. A rise in the index represents an appreciation in the value of the Canadian dollar, and a fall is a depreciation. Most apparent is the dispersion in the time profiles of the three indexes in their post 1981 behavior through early 1984 and circled in the figure. During those quarters the Western Centre index shows measurable appreciation in the external value of the dollar, while the G-10 index shows stability, and the US/Canadian dollar rate shows a slight depreciation. Thus, at a time of weakened commodity prices and distressed economic conditions in western Canada, the effective exchange rate was appreciating and aggravating difficulties in the regional economy. The figure also highlights the 1976-79 period when a depreciation in the external value of the Can$ served to intensify boom conditions. Only in the 1987-89 period did appreciation of the exchange rate compensate for increased commodity prices. The conclusion must be that the actual course of effective exchange rates has been largely procyclical in the past fifteen years.

Figure 1. US$, G-10 and Western Centre Nominal Effective Exchange Rates
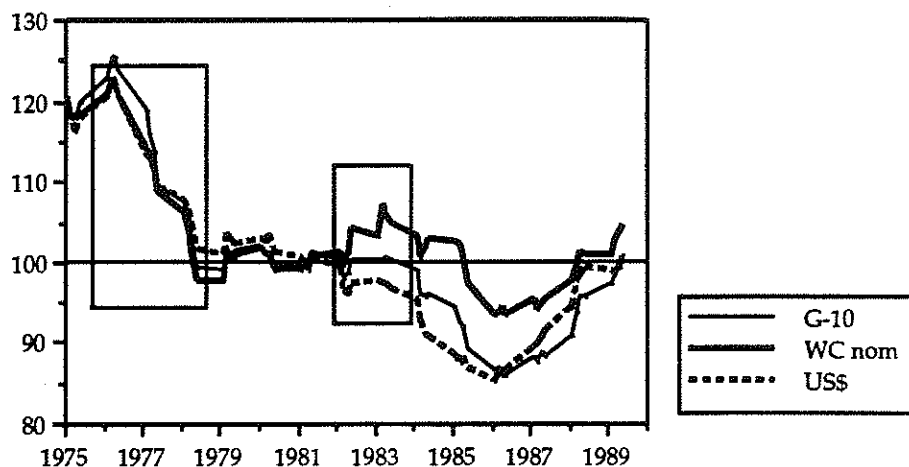
Source: Bank of Canada Review and the Western Centre
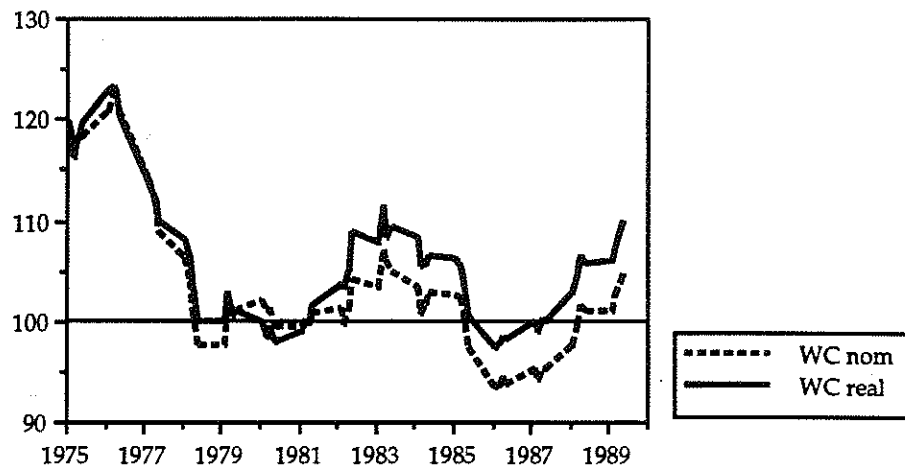
A REAL EFFECTIVE EXCHANGE RATE INDEX

Though there are no high inflation countries in the currency basket used by the Western Centre in constructing the exchange rate index, inter-country differences in inflation can reduce the reliability of nominal effective rates as indicators of competitiveness. More appropriate may be indexes derived from cost adjusted rates of exchange, ie. how have exchange rates moved relative to movements in the ratio of costs in one country to that in others. In the case of products used to derive the index the problem can be summarized as follows. Generally these commodities are quoted in US dollars. If the US dollar appreciates by say 20% against the Canadian dollar, then under the assumption of no independent price action by Canadian producers they will receive Can$120 for each Can$100 previously received. However, the most important question is whether the competitive position of western producers has changed. The answer depends not simply on the change in the external value of the dollar, but also on the changes in Canadian costs relative to changes in costs in other countries.

In other words to what extent have production costs been increasing faster (or slower) for foreign producers than for Canadian producers.

To summarize, a real effective exchange rate index uses the same weights as the nominal index but adjusts the latter by the ratio of foreign to domestic input costs. If changes in the nominal exchange rate exactly reflect changes in the ratio of foreign to domestic production costs, then changes in the nominal will be equal to changes in the real rate. The real rate incorporates explicit allowance for respective country input cost behavior. The nominal exchange rate index (foreign currency per unit of domestic currency) is divided by the ratio of a foreign input cost index to a domestic input cost index. This may be expressed for any period as

$$E\beta r = \sum_{i=1}^{n} w_i \{[(\beta_{it})(P_t/P_{it})] / (\beta_{ib})(P_b/P_{ib})]\}$$

Figure 2. Western Centre Real and Nominal Effective Exchange Rates

Source: Western Centre for Economic Research

where Eβr = the real effective exchange rate index

β = the nominal effective exchange rate index for country i

Pt = the domestic input cost index in period t

Pb = the domestic input cost index in the base period

Pit = the input cost index of country i in period t

Pib = the input cost index of country i in the base period

wi = country i's weight in the currency basket.

The most directly applicable measure of input costs would be an index specific to each country for every one of the twelve commodities entering the exchange rate calculation. Inputs into agricultural production differ not simply in relative importance but also in absolute composition from those in the production of sawn lumber, and these in their turn differ from those in the production of copper ores and concentrates, and so on across each commodity.

Regrettably industry specific indexes of input costs are not available in Canada, let alone for all countries in the currency basket. In the circumstances it can be argued that proxies for input costs must be selected from overall measure of inflation, such as the CPI, the Gross Domestic Product price index, or the equivalent of the Industrial Products Price Index (IPPI). None of these surrogates is entirely satisfactory because though they may be highly correlated with input costs in the longer run, their rates of change in the shorter run display some disparity.

In Fig. 2 we report a real effective exchange rate index obtained by deflating the nominal index for each country by the ratio of foreign CPIs to that for western Canada. In general the time profiles of the nominal and real indexes are quite similar. If anything the real index more strongly indicates the procyclical behaviour of the exchange rate in the 1975-84 years.

CONCLUSION

An exchange rate index properly should reflect its purpose. The purpose of the effective exchange rate indexes presented is measurement of the export competitiveness of a group of western Canadian natural resource products. The countries included in the indexes include a select set of nineteen high and medium income countries which are either significant markets for our produce, or important export competitors of western Canada. As an index employing multilateral not bilateral weights, the importance assigned each country currency recognizes competition (in the designated set of commodities) between western Canada and that country not simply in the latter's own market but in the domestic markets of the other countries. An index based on multilateral trade flows results in country currency weights quite different from those in the Bank of Canada G-10 index. In particular, the U.S. weight is less and the weights of Japan, Australia, and the Scandanavian countries are of measurable importance.

An important finding of the research is that the time path traced by the Western Centre indexes present a different picture of economic impact than either the US$ rate or the G-10 index of the Bank of Canada. The indication is that one of the strongest arguments for a flexible exchange rate, namely its role in ameliorating the effects of fluctuations in commodity prices, was not applicable to western Canada in the decade following 1975. In the years through 1981 exchange rate depreciation exacerbated the boom in the region, while appreciation worsened the subsequent economic collapse from 1982 through 1984. Only in the 1987-89 period did a rising exchange rate moderate the expansionary effects in the region of sharply rising commodity prices.

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APPENDIX 1

Country weights in the WCER effective exchange rate index compared with those in the Bank of Canada G-10 index

Country	Weight in WCER index	Weight in G-10 index
U. S.	.6209	.8180
Australia	.0955	.0000
Japan	.0830	.0600
U. K.	.0487	.0420
Sweden	.0245	.0050
France	.0233	.0140
Germany	.0189	.0240
Italy	.0154	.0120
South Korea	.0104	.0000
Finland	.0094	.0000
Norway	.0080	.0000
New Zealand	.0076	.0000
Portugal	.0075	.0000
Spain	.0074	.0000
Belgium-Luxembourg	.0058	.0090
Netherlands	.0050	.0110
Switzerland	.0030	.0050
Austria	.0029	.0000
Denmark	.0028	.0000

Weights in the G-10 index are averages of total bilateral merchandise trade (including exports and imports) for the period 1972-1986. Weights in the WCER index are 1986-87 averages as explained in the text.