EFFECTS OF USING VARIOUS MACRO-INDEX FORMULAE IN LONGITUDINAL PRICE AND VOLUME COMPARISONS

Empirical studies

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ABSTRACT

The paper is devoted to two longitudinal studies of price and volume indices, which have been carried out by the Prices Division, Statistics Canada. The first study is based on data for the Canadian Final Domestic Demand 1947-1989, the other one is based on data for the Canadian Manufacturing Industry 1961-1981. Both studies compare numerical results obtained using various macro-index formulae and various frequencies of their linking. The objectives of these comparisons, discussed in the first section of the paper, are: to help assessing biases of the aggregative index formulae and of their derivatives, and to suggest some practical solutions concerning choices that have to be made. The second section of the paper outlines the design of both studies and the algorithms used in them.

The third and forth section of the paper present comparative results of the Final Domestic Demand study and of the Manufacturing Industry study, respectively. In particular, price index numbers associated with different single-year and multi-year baskets are compared to each other. Furthermore, the comparisons include indices calculated in a direct mode and in a chain mode, the latter using various linking frequencies. The last section of the paper contains some concluding general observations.

Only a very limited selection of numerical results that have been gathered in the studies is shown in the paper. This is especially so with respect to volume indices. Those interested may obtain more information about the studies and additional results from the author of the paper: Bohdan Schultz, Prices Division, Statistics Canada, Ottawa, Canada, K1A 0T6.
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1. BACKGROUND

National statistical agencies generate most of the composite price indices using, at least at some stages of their production, the formulae that conceptually correspond to ratios of expenditures or revenues associated with a certain quantitative combination of goods and services (***basket of products***). Similarly, most of the composite volume indices, whether generated directly or derived indirectly, conceptually correspond to ratios of expenditures or revenues associated with a certain structure of prices (***price regime***). These formulae will be hereafter referred to as the ***aggregative formulae.***

Many theoreticians claim that aggregative formulae lack solid economic justification and provide biased index numbers because of their detachment from the theory of consumer or producer behaviour. Notwithstanding this criticism, the aggregative formulae continue to be used extensively in practice. The first obvious reason is the fact that statistical agencies are not able, and will never be able, to generate price and volume index series derived straight from the abstract concepts of constant utility or constant resources. There is no doubt, however, that the popularity of aggregative formulae is also due to other reasons. One noteworthy advantage is that their concept is accessible to the general public. Non-specialists are able to grasp the idea of a price index derived by comparing the amounts of money needed to acquire the same set of commodities, which is not the case with a price index based on the notion of constant utility or well being. The fact that the basket-defined price indices can be expressed as weighted means of sub-indices is another good feature, making it possible to analyse the contributions of specific classes of products to the composite price change. Similar observations apply, mutatis mutandis, to volume indices derived by means of aggregative formulae, which call for the estimation of expenditures or revenues expressed in a certain set of prices. These values, being additive across commodities and through time, can be used to analyse structural changes in the economy in real terms, a feature appreciated by national accountants.

Whatever doctrine they believe, index makers generally agree that the price or volume changes estimated using aggregative formulae could be biased. The biases result from the fact that a given basket of products (a given price regime), drawn from one reference time and often kept unchanged over long periods, is used to estimate price (volume) change between two or more time points. Consequently, statisticians try to eliminate or to minimise these biases by crossing different baskets (price regimes), by crossing the aggregative formulae associated with different baskets (price regimes), by crossing weights of the indices, or by linking index numbers in longer time series. This gave birth to countless secondary formulae, creating a problem on its own: how to choose the most useful formula from this abundant *indexarium*.

Various criteria have been suggested for this purpose, not all convincing or practical. Some theoreticians suggested that formula should be chosen according to the actual form of the utility function, for example, that the "ideal" Fisher formula should be used in the case of a quadratic utility function. Since the very existence of a collective utility function is questionable, the belief that its specific form could be identified reminds me of the joke "*It is not certain that Homer was a real person, but it is sure that he was blind* ". Criteria based on arithmetic properties of the formulae are more workable, however, no composite price or volume index formula can bear all desirable characteristics. Worse, crossing and linking aggregative formulae generally leads to a loss of some of their valuable properties, such as additivity, or the possibility of generating index numbers without delays. As a result, statisticians have to make compromises and to choose a formula bearing most of the positive characteristics that matter in the given case (or fewer negative features).

In this context, empirical comparisons of price and volume indices calculated using various formulae become instrumental. Although these empirical studies cannot tell which of the compared formulae is better in general, they are indicative of the degree of discrepancy between the results provided. Such knowledge helps to assess the biases of indices calculated in the past and facilitates the choice of formulae for the future calculations. Indeed, there is no need to consider formulae that can be generated in practice only with great difficulties or with delays, if very similar numerical results are obtainable by means of some other formula that is simpler or otherwise superior.

The Prices Division of Statistics Canada carried out several of these studies. In two of them, by P. Généreux[1] and C.Bérubé[2], the official Consumer Price Index (CPI) has been compared to the corresponding series of Fisher indices and to the series with higher linking frequencies than in the official CPI series. Since the consumer expenditure data were available, in general, only every four years, it was impossible to use them for examining the behaviour of index series with many formulae (for example, those that use annual links). The two other comparative studies, carried out by the author of this paper, were more thorough. They relate to the Final Domestic Demand Price and Volume Index series and to the Manufacturing Industry Price Index series, for which longer data have been available. Their methodology and results are shown hereafter.

[1] **"Impact of the choice of formulae on the Canadian Consumer Price Index", in *Price Level Measurement: Proceedings from a conference sponsored by Statistics Canada*,** Ottawa, December 1983, pp 489-511.

[2] ***Le choix de la formule de l'IPC canadien, 1962-1994***, internal report of the Prices Division, Statistics Canada, whose results were presented in Statistics Canada at a meeting of the Price Measurement Advisory Committee on May 14, 1996.

2. GENERAL OUTLINE OF THE STUDIES

The two studies in question had similar objectives and they shared the same integrated system of algorithms and computer programs. The input data were composed of series of price indices for each basic category of commodities and of the ***actual values*** (values in current dollars) for these basic categories in all the years covered. Each of the actual values was consecutively re-expressed at price levels found in all these years, using the respective price indices as deflators ("inflators"). This operation created sets of ***hybrid values*** for every basic category, with varying price levels and with quantitative proportions as in the year of the given actual value. The hybrid values corresponding to the same quantitative proportions (the same basket) and expressed at the same price level were then added together within each aggregate analysed (for example, within the Gross Total Manufacturing Production, or the Personal Expenditure on Consumer Goods and Services). These sums, representing hybrid values for the aggregate in question, were stored in a matrix form similar to the schematic Table 1.

Table 1

SCHEMATIC MATRIX OF HYBRID VALUES

Price reference time	**Basket reference time**					
	b - 1	***b***	***b + 1***	...	***t - 1***	***t***
b - 1	$\sum p_{b-1} q_{b-1}$	$\sum p_{b-1} q_{b}$	$\sum p_{b-1} q_{b+1}$	...	$\sum p_{b-1} q_{t-1}$	$\sum p_{b-1} q_{t}$
b	$\sum p_{b} q_{b-1}$	$\sum p_{b} q_{b}$	$\sum p_{b} q_{b+1}$	...	$\sum p_{b} q_{t-1}$	$\sum p_{b} q_{t}$
b + 1	$\sum p_{b+1} q_{b-1}$	$\sum p_{b+1} q_{b}$	$\sum p_{b+1} q_{b+1}$	...	$\sum p_{b+1} q_{t-1}$	$\sum p_{b+1} q_{t}$
...	...	...	...	...	...	...
t - 1	$\sum p_{t-1} q_{b-1}$	$\sum p_{t-1} q_{b}$	$\sum p_{t-1} q_{b+1}$	...	$\sum p_{t-1} q_{t-1}$	$\sum p_{t-1} q_{t}$
t	$\sum p_{t} q_{b-1}$	$\sum p_{t} q_{b}$	$\sum p_{t} q_{b+1}$	...	$\sum p_{t} q_{t-1}$	$\sum p_{t} q_{t}$

These hybrid values served to calculate direct price indices, each of them associated with a basket from a given year (with a ***single-year basket***), which was done by dividing by each other the hybrid values from the same column of the matrix, as follows:

$$P^{(c)}_{t/b} = \frac{\sum p_t q_c}{\sum p_b q_c} \ ,$$

where any of the covered years could have been taken as the observation year ***t***, the base year ***b***, or the basket reference year ***c***. The direct ***Laspeyres***[3] and Paasche price indices are among them. Examples of such direct indices associated with single-year baskets are shown in Table 2.

Table 2

DIRECT PRICE INDICES ASSOCIATED WITH SINGLE-YEAR BASKETS

Aggregate: Modified Final Domestic Demand[4], 1951 time base

Observation years	**Basket reference years**						
	1951	**1952**	**…**	**1970**	**…**	**1988**	**1989**
1951	100.0	100.0	…	100.0	…	100.0	100.0
1952	102.9	102.9	…	102.9	…	102.9	102.9
…	…	…	…	…	…	…	…
1970	165.3	166.3	…	161.7	…	158.9	158.9
…	…	…	…	…	…	…	…
1988	585.0	590.4	…	559.4	…	497.1	495.4
1989	613.0	618.5	…	586.3	…	520.4	518.4

Similarly, direct volume indices associated with ***single-year price regimes*** were obtained by dividing by each other the hybrid values from the same row of the matrix, as follows:

$$Q_{t/b}^{(d)} = \frac{\sum p_d \, q_t}{\sum p_d \, q_b} \quad ,$$

where any of the years covered could have been taken as the observation year ***t***, the base year ***b***, or the price regime reference year ***d***.

Examples are shown in the following Table 3.

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[3] Please note that the term **Laspeyres** formula is used in this paper in the strict sense, i.e. for: $P_{t/b}^{(b)} = \frac{\sum p_t \, q_b}{\sum p_b \, q_b}$.

Although terminology is just a convention, the author regrets that the term in question is being frequently used to cover any price index series associated with the same basket, which can lead to confusion. For example, such well-known statements as "*the Fisher index is a geometric mean of the corresponding Laspeyres and Paasche indices*" or *"the product of the corresponding Laspeyres price index and the Paasche volume index is a ratio of actual values*" hold only when the true Laspeyres formula is used. Incidentally, by extending backwards a series of indices associated with a given basket, improperly called the Laspeyres index series, one would be surprised to discover that it also contains the Paasche index!

[4] See Section 3 for definition.

Table 3

DIRECT VOLUME INDICES ASSOCIATED WITH SINGLE-YEAR PRICE REGIMES

Aggregate: Modified Final Domestic Demand[5], 1951 time base

Observation years	**Price-regime reference years**						
	1951	**1952**	**…**	**1970**	**…**	**1988**	**1989**
1951	100.0	100.0	…	100.0	…	100.0	100.0
1952	109.6	109.6	…	110.2	…	110.6	110.6
…	…	…	…	…	…	…	…
1970	251.6	251.6	…	246.0	…	240.5	240.6
…	…	…	…	…	…	…	…
1988	557.5	557.6	…	535.7	…	473.7	473.2
1989	579.0	579.2	…	556.4	…	490.3	489.7

Next, various crossed index formulae (e.g. the ***Fisher*** formula) and linked formulae were derived. Although the algorithms and computer programs were able to apply any linking frequency, only indices with links every year, every two years, every five and every ten years are shown in this paper. In addition, in the study based on data for the Final Domestic Demand, direct price indices with ***multi-year baskets*** and direct volume indices with ***multi-year price regimes*** were derived from hybrid values combined over several years. Again, the algorithms and computer programs could handle value combinations with any number of years, but only the results of those with triple and quintuple baskets or price regimes are shown in the paper.

3. COMPARATIVE STUDY OF INDEX SERIES FOR FINAL DOMESTIC DEMAND

The study, by B. Schultz, was released in 1990 as an internal report of the Prices Division, Statistics Canada, Empirical ***study of the effect of index formulae and linking on annual price and volume indices for Final Domestic Demand,*** and its results were presented at a meeting of the Price Measurement Advisory Committee on May 31, 1991. The study was based on annual expenditure data for the years 1947-1989, provided by the Income and Expenditure Division of Statistics Canada in both current and constant prices. The grand total aggregate corresponding to the Final Domestic Demand was **modified** in the following way:

- Net Expenditures Abroad were subtracted from the Personal Expenditures on Consumer Goods and Services (because of frequent negative values, untreatable in some of the envisaged analyses),
- the adjusting entries were removed from the expenditures in constant prices and new total values were calculated accordingly for all higher-level aggregates.

[5] See Section 3.

The retained Modified Final Domestic Demand was broken down into 46 basic expenditure categories. Price indices for all the years covered and for all the basic categories were derived indirectly, by dividing the corresponding expenditures in current and in constant prices. Only partial results of the study are shown in this paper.

Table 4 exhibits direct single-basket price indices for 1986 on the 1951 time base, for the aggregate of Modified Final Domestic Demand for 1986. The baskets are drawn from all consecutive reference years, from 1947 to 1989. The results are characterised by a nearly perfect monotonous decrease, as in a textbook case.

Table 4

DIRECT PRICE INDICES ASSOCIATED WITH CONSECUTIVE SINGLE-YEAR BASKETS

Aggregate: Modified Final Domestic Demand

1986 observation year, 1951 time base

Basket reference years	Price indices	Basket reference years	Price indices	Basket reference years	Price indices	Basket reference years	Price indices
1947	530.3	**1958**	533.6	**1969**	513.0	**1980**	485.0
1948	529.1	**1959**	532.2	**1970**	516.2	**1981**	480.1
1949	529.2	**1960**	534.3	**1971**	511.7	**1982**	489.0
1950	527.1	**1961**	528.3	**1972**	505.9	**1983**	486.5
1951	539.1	**1962**	524.9	**1973**	499.1	**1984**	480.1
1952	544.1	**1963**	523.3	**1974**	496.2	**1985**	474.6
1953	541.0	**1964**	520.0	**1975**	494.9	**1986**	470.5
1954	541.6	**1965**	515.5	**1976**	493.2	**1987**	466.0
1955	536.7	**1966**	512.9	**1977**	494.8	**1988**	460.7
1956	529.9	**1967**	514.9	**1978**	492.4	**1989**	459.3
1957	529.2	**1968**	516.5	**1979**	488.1		

Table 5 contains price indices for the same aggregate, and with the same base and observation years as those in Table 4, but calculated using various index formulae and linking frequencies. Only indices associated with selected single-year baskets are compared here with each other. Among them are the Laspeyres and Paasche formulae, which exhibit an expected relationship, the Laspeyres formula providing larger index numbers and the difference between them diminishing with increased of linking frequency.

In addition, Table 5 also contains the formulae with baskets drawn from periods preceding the base year by one, two and three years. This was done because, in practice, the baskets from the base year are often not available early enough to be used in the generation of indices right after that base year, and it is important to appreciate how implementation lags affect the results. Their influence looks erratic in direct index series, where each series is subjected to an implementation lag only once. The influence becomes more evident and systematic in chain indices, where the implementation lags intervene at the time of each link and their effects cumulate. This cumulative effect seems to suggest that similar relative price changes prevailed over longer periods of time.

Finally, Table 5 also includes a formula with the basket drawn from the mid-term between the 1951 base year and the 1986 observation year. The formula provided numerical results that lie quite close to those provided by the Fisher formula and by chain indices with linking a frequency of one year, both considered good approximations of indices that are based on the theory of consumer or producer behaviour. Similar relationships were obtained in the second of the studies presented here[6] and, mutatis mutandis, with respect to volume indices. This is an interesting outcome, with potential practical implications. It shows that an aggregative price index formula with a mid-term basket could be used as a decent substitute for the theoretically superior index formulae, while being free of some of the shortcomings of the latter. For example, it could be used without delay in the ongoing index production, it fulfils the mean test and provides additive results, unlike chain indices or indices derived using the Fisher formula.

Table 5

CHAINS OF PRICE INDICES ASSOCIATED WITH SINGLE-YEAR BASKETS

Aggregate: Modified Final Domestic Demand

1986 observation year, 1951 time base

Index formula used	Direct	Ten-year linking frequency	Five-year linking frequency	Two-year linking frequency	One-year linking frequency
Paasche	470.5	481.6	486.3	491.8	494.3
Fisher	503.7	498.8	495.8	496.5	497.2
Mid-term basket	516.5	499.1	501.5	498.4	-
Laspeyres	539.1	516.7	505.5	501.3	500.2
Pre-base basket; one-year lag	527.1	516.7	507.4	505.2	503.9
Pre-base basket; two-year lag	529.2	518.0	511.0	508.0	506.6
Pre-base basket; three-year lag	529.1	521.2	515.6	510.0	508.7

[6] See Section 4.

The index numbers from Table 5, associated with single-year baskets, can be compared with those from Table 6, associated with quintuple-year baskets. Differences are not spectacular, yet the latter exhibit lesser amplitude than the former, both between the Laspeyres and Paasche formulae, and by linking frequency. This can be interpreted as an encouragement for the use of indices associated with multi-year baskets and, particularly, with multi-year moving average baskets.

Table 6

CHAINS OF PRICE INDICES ASSOCIATED WITH QUITUPLE-YEAR BASKETS

Aggregate: Modified Final Domestic Demand

1986 observation year, 1951 time base

Index formula used	Direct	Ten-year linking frequency	Five-year linking frequency	Two-year linking frequency	One-year linking frequency
Paasche-type	469.8	483.4	488.4	493.0	495.0
Fisher-type	502.1	499.2	497.0	496.8	496.9
Mid-term basket	514.7	498.9	499.6	497.0	-
Laspeyres-type	536.6	515.4	505.9	500.5	498.7
Pre-base basket; one-year lag	528.9	518.7	513.8	510.0	508.5
Pre-base basket; two-year lag	529.5	520.1	516.5	512.6	511.2
Pre-base basket; three-year lag	529.7	521.9	518.8	515.3	513.9

The last two tables of this section were created to find out whether linking indices at high levels of aggregation can lead to paradoxical results, similar to those found frequently at micro-aggregation levels. For this purpose, the direct Laspeyres price indices that measure price change over two-year time spans are compared in Table 7 with the corresponding chain Laspeyres indices with mid-term links. It can be seen that the chain index with the 1982 link time is indeed larger than its direct counterpart, which suggests an anomaly. The anomaly likely results from the reversal of relative price change that occurred around 1982 and must have been quite strong. Its effect does not vanish even when one calculates chain indices covering time spans longer than two years, as shown in Table 8.

Table 7

EFFECT OF LINKING LASPEYRES PRICE INDICES

Aggregate: Modified Final Domestic Demand
Mid-term links, indices over two years

Time spans covered	Mid terms	Direct indices D	Chain indices C	Difference in % (C-D) / D
1980/78	**1979**	118.64	118.56	- 0.118
1981/79	**1980**	121.38	121.22	- 0.132
1982/80	**1981**	121.89	121.79	- 0.082
1983/81	**1982**	115.02	115.14	+ 0.104
1984/82	**1983**	108.96	108.96	0.000
1985/83	**1984**	107.21	107.17	- 0.037
1986/84	**1985**	106.89	106.88	- 0.009
1987/85	**1986**	107.51	107.50	- 0.009
1988/86	**1987**	108.08	108.06	- 0.019
1989/87	**1988**	108.80	108.76	- 0.037

Table 8

EFFECT OF LINKING LASPEYRES PRICE INDICES

Aggregate: Modified Final Domestic Demand
Mid-term links, varying length of time coverage

Mid terms	Difference in % between chain and direct indices (C-D) / D				
	Indices over two years	Indices over four years	Indices over six years	Indices over eight years	Indices over ten years
1980	- 0.132	- 0.235	- 0.373	- 0.478	- 0.626
1981	- 0.082	- 0.229	- 0.486	- 0.626	- 0.448
1982	+ 0.104	- 0.015	- 0.200	- 0.448	- 0.167
1983	0.000	+ 0.089	+ 0.078	- 0.167	+ 0.039
1984	- 0.037	+ 0.052	+ 0.136	+ 0.039	+ 0.097
1985	- 0.009	- 0.087	+ 0.064	+ 0.097	-
1986	- 0.009	- 0.078	- 0.199	-	-
1987	- 0.019	- 0.068	-	-	-

4. COMPARATIVE STUDY OF INDEX SERIES FOR THE MANUFACTURING INDUSTRY

The study, by B. Szulc et al.[7], was released in 1985 as an internal report of the Prices Division, Statistics Canada, ***Alternative price index series of industrial production,*** and its results were presented at a meeting of the Price Measurement Advisory Committee on December 6, 1985. The study was based on annual shipment data in current prices for the years 1961-1981, provided by the Input-Output Division of Statistics Canada. They covered all the 20 manufacturing industries at the middle level of aggregation, from M8 to M27, broken down by some 600 basic commodity categories at the lowest level of aggregation (L level). Price indices for all these basic categories were assigned by the Input-Output Division. Their main source was the Industry Selling Price Index series, generated by the Prices Division. Some of the results of the study are shown in Table 9.

Table 9

INDUSTRY PRODUCT PRICE INDICES ASSOCIATED WITH SINGLE-YEAR BASKETS

Aggregate: Total Manufacturing (Gross shipment values)

1961 time base

Index formula used	Observation years			
	1966	1971	1976	1981
Direct Laspeyres	108.3	122.9	203.5	344.5
Chain Laspeyres; ten-year linking frequency	-	-	-	334.1
Chain Laspeyres; five-year linking frequency	-	122.4	198.1	331.7
Chain Laspeyres; two-year linking frequency	-	122.0	-	332.8
Chain Laspeyres; one-year linking frequency	108.1	121.9	197.5	331.8
Direct Fisher	108.0	121.3	196.2	327.3
Chain Fisher; one-year linking frequency	107.9	121.3	195.2	326.0
Direct, mid-term fixed baskets	-	121.6	-	326.0
Chain Paasche; one-year linking frequency	107.7	120.8	193.1	320.4
Chain Paasche; two-year linking frequency	-	120.5	-	318.3
Chain Paasche; five-year linking frequency	-	120.5	191.5	317.4
Chain Paasche; ten-year linking frequency	-	-	-	315.5
Direct Paasche	107.6	119.9	189.2	311.1

[7] B. Szulc was responsible for the general outline of the study, including its algorithms, and for the analysis of effects of using various index formulae and various frequency of index linking. L. MacDonald was responsible for the analysis of effects of using the gross and net shipment concepts. M.Vlasic developed computer programs for the study.

Table 9 leads to conclusions that are similar to those drawn from Table 5 with price indices for the Modified Final Domestic Demand. In some respects, the message is now even stronger than in the former case. For example, indices associated with mid-term baskets came here closer than in Table 5 to indices obtained using the Fisher formula or through annual linking, and this whether the analysed period covered one decade 1961-1971 or two decades 1961-1981. The difference may result from the fact that the input data for the Manufacturing Industry study were available with much more detail than for the Modified Final Domestic Demand study (about 600 basic categories compared to 46).

Because of the similarity of conclusions between the two studies, no extensive comments will be provided in this section. One point, however, deserves attention. It is well know that in the Laspeyres formulae tend to provide larger numerical results than the corresponding Paasche formulae in the case of consumer and other input-type price indices. According to some theoretical literature on price indices, though, the opposite relationship should prevail in the case of producer and other output-type price indices. The latter relationship did not materialise in the present study; the Laspeyres indices are consistently higher than the Paasche indices.

This result did not surprise me, I have always been suspicious about the alleged dichotomy in question. Indeed, in a normal market economy environment there is no place for two separate markets, one for sellers and another for buyers. One market exists where sellers and buyers meet with each other and make a deal, hence the prices and quantities agreed upon in every transaction apply to both the buyers and sellers. If this is so, then why would the Laspeyres price indices (or the Paasche price indices) for buyers be very different from those for sellers[8]? Such a schizophrenic behaviour of composite price indices could only happen in a Soviet-type economy, in which many non-consumer prices were just bookkeeping figures and where it was possible to report as produced a commodity that has never been actually sold and used. Most certainly, however, none of the price and volume index formulae derived from the theory of consumer or producer behaviour has been conceived with the Soviet-type economy in mind.

Consequently, the difference between index numbers derived using the Laspeyres and Paasche formulae should have the same sign in the case of consumer and other input-type indices as in the case of produces and other output-type indices. What could be this sign? R.G.D. Allen pointed out that a negative difference "*is to be expected in a supply-dominated market*"[9]. The results of the present study (and several other results gathered in Prices Division, Statistics Canada) seem to indicate that such a situation must be

[8] Some deviation at the level of All-item indices is possible because of differences in the contents of production and consumption, if these differences are correlated with differences in price trends. As the evidence shows, the deviation is not likely to be large enough to change the sign of the relationship between the Laspeyres and Paasche indices.

[9] *Index Numbers in Theory and Practice*, Aldine Publishing Company, Chicago, 1975, pp. 62-64.

quite exceptional. There is a good reason for this: buyers bring money, so they are more likely to influence the final outcome of transactions than the sellers are. In any case, though, the discussed relationship between the Laspeyres and Paasche price indices should be the same for both market actors.

5. SOME CONCLUDING REMARKS

As expected, the Laspeyres formula generally led to larger price index numbers for the Final Domestic Demand than the Paasche formula. The same relationship happened among price index numbers for Manufacturing Industry Output, even though some theoretical literature suggests that the opposite relationship should prevail in that case. The author of the paper argues that there is no reason to think that the relationship in question should bear different signs for producers and for users of their products.

Again as expected, linking of indices narrows the gap between index numbers obtained using the Laspeyres and Paasche formulae, particularly when annual linking is applied. In one case, however, linking led to an anomaly, where a chain Laspeyres index was larger than the corresponding direct Laspeyres index, which must have resulted from the reversal of relative prices. The anomaly constitutes a surprise because it occurred at the highest aggregation level, that of the All-item Final Domestic Demand, and because it did not disappear even when the span covered by the two indices was ten years.

The use of multi-year baskets further diminishes the amplitude between the Laspeyres-type and Paasche-type index numbers, as well as between index numbers derived with different linking frequencies. This fact constitutes an encouragement for the use of indices associated with multi-year baskets and, in particular, for the use of multi-year moving average baskets.

One kind of price index formula exhibited particularly interesting properties, namely the formula associated with a single-year, mid-term basket. This formula systematically provided index numbers that lie quite close to those obtained using the Fisher index or a chain index with annual linking. Moreover, unlike the Fisher or chain indices, the aggregative price indices associated with mid-term baskets fulfil the mean test, give additive results and can be generated without delay in the ongoing index production. It seems, therefore, that price indices with mid-term baskets (or volume indices with mid-term price regimes) can be used as decent substitutes for theoretically superior index formulae, without sharing some of the shortcomings of the latter.