Chapter 7

THE POSSIBLE USE OF SCANNER DATA IN DEALING WITH SEASONALITY IN THE CPI

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1. Introduction

Based on intensive study, Statistics Netherlands decided to use scanner data from several supermarket chains in the production of the official CPI beginning in June 2002.[2]

This paper addresses two questions. First, how can we use scanner data to incorporate seasonal products? Currently, such products are excluded from the scanner data that are used for the Dutch CPI. Second, what are the possible effects of products for which there are frequent promotional sales? Scanner data may provide a solution for dealing with such products.

Section 2 gives a summary of the way in which scanner data are currently employed in the Dutch CPI. Section 3 explores different index number formulas first of all for use with fruit products that exhibit both strong and weak seasonal behaviour, and also for children's napkins (i.e., disposable diapers), a product that exhibits seasonal-like fluctuations in prices and quantities because of frequent promotional sales. Section 4 concludes.

2. The Use of Scanner Data in the Dutch CPI

Following traditional CPI practice, a statistical agency specifies an index basket of products selected from all possible goods and services, and sends interviewers to collect prices for the basket items. The weights used for the CPI are usually for product categories rather than the individual basket products, and are based on household expenditure survey (HES) data supplemented by national accounts data. These weights are not generally associated with actual transactions, and are often held fixed for a year or more at a time.

Statistics Netherlands obtains scanner data from supermarket chains on a weekly basis and uses this data for the official CPI.[3] The scanner data include quantity information corresponding to the product price information, making possible improvements in CPI practice.

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[2] See Schut (2003) for a review.

Citation for this chapter:
Peter Hein van Mulligen and May Hua Oei (2009), "The Possible Use of Scanner Data in Dealing with Seasonality in the CPI," chapter 7, pp. 111-120 in
W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.) (2009),
PRICE AND PRODUCTIVITY MEASUREMENT: Volume 2 -- Seasonality, Trafford Press.
Also available as a free e-publication at www.vancouvervolumes.com and www.indexmeasures.com.

The scanner data are coded according to the European Article Number (EAN) system. Each product has an EAN. For the scanner data part of the CPI, the EANs are used to match sales information by product for each retailer. EANs are grouped according to the COICOP (Classification of Individual Consumption by Purpose) categories. For each COICOP group containing products sold in supermarkets, several index numbers are calculated: one for each supermarket chain providing scanner data, and one for data collected at other points of sale.[4]

For the scanner data indices, fixed baskets of several thousand EANs are determined each year for each of the retailers providing scanner data. Each EAN in this basket gets a weight based on its expenditure share in that year. The price of an EAN in the current month is matched with its price in the previous month. EAN specific price ratios are chained with the corresponding preceding price ratios, yielding the relatives of the current and the base year prices.[5] The scanner data indices are annually chained Lowe indices.[6] Specifically, the following formula is used for the scanner data price index, P_{Ak}^{rt}, for product group A sold by retailer k, where r is the base year and t is the current month and where i denotes an EAN and w_{ik}^{r} is the weight of EAN i for retailer k in base year r (Schut, 2003):

$$(1) \qquad P_{Ak}^{rt} = \sum_{i \in A} w_{ik}^{r} \left(\frac{\bar{p}_{ik}^{t}}{\bar{p}_{ik}^{r}} \right) = \sum_{i \in A} w_{ik}^{r} \prod_{\tau=r+1}^{t} \left(\frac{\bar{p}_{ik}^{\tau}}{\bar{p}_{ik}^{\tau-1}} \right),$$

The price $\bar{p}_{ik}$ is the average price for EAN i across all stores of retailer k in the stated period.

3. Using Scanner Data to Deal with Two Problems: Frequent Sales and Seasonality

Triplett (2003) points out that scanner data measure acquisition rather than consumption behaviour. The search, shopping and inventory behaviour of consumers are embodied in the

[3] For CPI production timeliness reasons, only data from the first two weeks of each month can be used for the compilation of the monthly CPI. Therefore, the assumption is made that prices and sales in the first two weeks properly represent the entire month.

[4] These indices are weighted with the number of price quotes that were collected at each retailer before the implementation of scanner data. Starting from next year, they will be based on actual expenditure shares.

[5] The base year of the CPI is shifted every five years, both for scanner data and non-scanner data. Currently, the base year is 2000. Note that for scanner data, the base year which determines the selection of EANs and their weights in the scanner data index is shifted every year, so that at this moment the base year is 2003.

[6] It appears from the scanner data that the turnover rate of all EANs is very high. Even small changes in the package design or the fact that an article is on sale may lead to a different EAN for this article. EANs constantly enter and exit the market. Only EANs with positive sales figures in at least 48 of the 52 weeks of the base year were considered for basket inclusion. Most seasonal products are therefore excluded. Each year, it occurs fairly often that an EAN disappears, which would result in a missing observation. This problem is solved in a fairly conventional way: when the turnover share of this EAN in its CBL-group (the level of aggregation below a COICOP group) is small, the class mean method is used. In other cases, a replacement EAN is found. When the old EAN and the replacement EAN are deemed too different, a quality adjustment factor is applied. The part of the Dutch CPI that is based on scanner data is therefore a hybrid of traditional matching procedures combined with a new way of collecting data and determining expenditure shares at the lowest level of aggregation.

observed data. Some sorts of consumers tend to hoard some sorts of products, buying these products only when they are on offer (i.e., when they are offered at promotional sale prices), and consuming from household inventories in the periods between promotional sales. With a chained index formula, frequent sales can lead to bias problems.[7] However, scanner data provide statisticians with actual transaction prices, rather than list prices relatively few shoppers may actually pay. Moreover, scanner data allow expenditure weights to be directly based on actual purchases corresponding to the measured prices.

3.1 Seasonal effects in scanner data: the case of fruit

Chapter 22 in the CPI manual (Hill, 2004) deals with the treatment of seasonal products in a CPI. That chapter on seasonal products is referred to hereafter as the manual chapter. Throughout the manual chapter, a modified Turvey artificial data set is used to investigate the effectiveness of alternative methods for dealing with seasonality problems.[8]

In the modified Turvey data (like the original Turvey data), the seasonal patterns for all products are very regular. The strongly seasonal commodities are available in the same months every year. However, actual data on the purchase of fruits and vegetables rarely exhibit these sorts of strictly regular patterns.[9] For example, the scanner data used in this paper show that in 2000, strawberries were available from May through September, but in 2003 they were available from March through June.

Most seasonal products, like fresh fruit, are excluded from the scanner data that were used for the Dutch CPI. One reason for this decision is that many fresh fruits are not sold to customers in fixed quantity lots the way that packaged cereals, for example, come in standard sized boxes. With goods that are not sold in standard lots, individual stores attach product EANs: the so-called in-store EANs. Unfortunately, the in-store EANs are not the same between stores or even in different months. However, articles with a set quantity lot, such as a 500 grams box of strawberries, have their own regular EANs, and could be matched without difficulties.

For this study, five kinds of fresh fruit are used: strawberries, white grapes, red grapefruits, mangos and golden delicious apples. All these products have regular EANs. To simplify calculations, only scanner data from one retailer were used. We have weekly observations over the period of 2000 to 2003. The price and quantity data used for this study are shown in appendix table A1. In that data set, strawberries and grapes are strongly seasonal goods; the other fruits are weakly seasonal.

The CPI manual discusses several price indices, of which three types are considered here: monthly year over year indices, monthly rolling indices, and the Rothwell index.

Year over year indices compare prices in the current month with prices in the same month in the base year. The base year can either be a fixed reference year, yielding a fixed base index, or the previous year, yielding a chained index. Hence, each month only prices are compared of goods that are present in both the current month and the same month in the

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[7] See Feenstra and Shapiro (2003) on the bias problems that can result, and their example for canned tuna sales data.

[8] This data set is also tabled in Diewert, Armknecht and Nakamura (2007).

[9] Price collectors have been traditionally instructed to only collect prices of strongly seasonal products in pre-defined periods. Some of these products have been available in some periods when their prices were not collected.

designated base year. For the n products, the monthly year-to-year Laspeyres ($P_L^{t,m}$) and Paasche ($P_P^{t,m}$) indices for month m of year t and base year t_0 can be written as:

(2) $$P_L^{t,m} = \sum_{i=1}^{n} p_i^{t,m} q_i^{t_0,m} / \sum_{i=1}^{n} p_i^{t_0,m} q_i^{t_0,m} \text{ , and}$$

(3) $$P_P^{t,m} = \sum_{i=1}^{n} p_i^{t,m} q_i^{t,m} / \sum_{i=1}^{n} p_i^{t_0,m} q_i^{t,m} \ .$$

Seasonal effects will be eliminated in a monthly year-to-year index only if the monthly seasonal patterns in the data for both prices and quantities are the same in both years for the price index comparison. However, the actual Dutch data do not exhibit year-to-year monthly regularity. Hence the resulting indexes for these data show strong fluctuations. This is illustrated in figure 1, which shows two monthly Fisher year-to-year indices based on our scanner data: a fixed base index with 2000 as the base year, and a chained base index.[10] Clearly, such year-to-year indices cannot tell us anything about aggregate price changes on a month to month basis.

Two types of aggregate index number formulas designed for dealing with seasonal products are considered here: rolling year indices and the Rothwell index. In a rolling year index, the prices in a period of twelve months are compared with the prices in the same months of the reference twelve-month period. With a chained rolling index, the reference period is the same twelve-month period one year earlier.

The Laspeyres ($P_{L,R,fixed}^{t,m}$) and Paasche ($P_{P,R,fixed}^{t,m}$) fixed base rolling year indices for month m of year t (with base year t_0)[11] can then be written as:

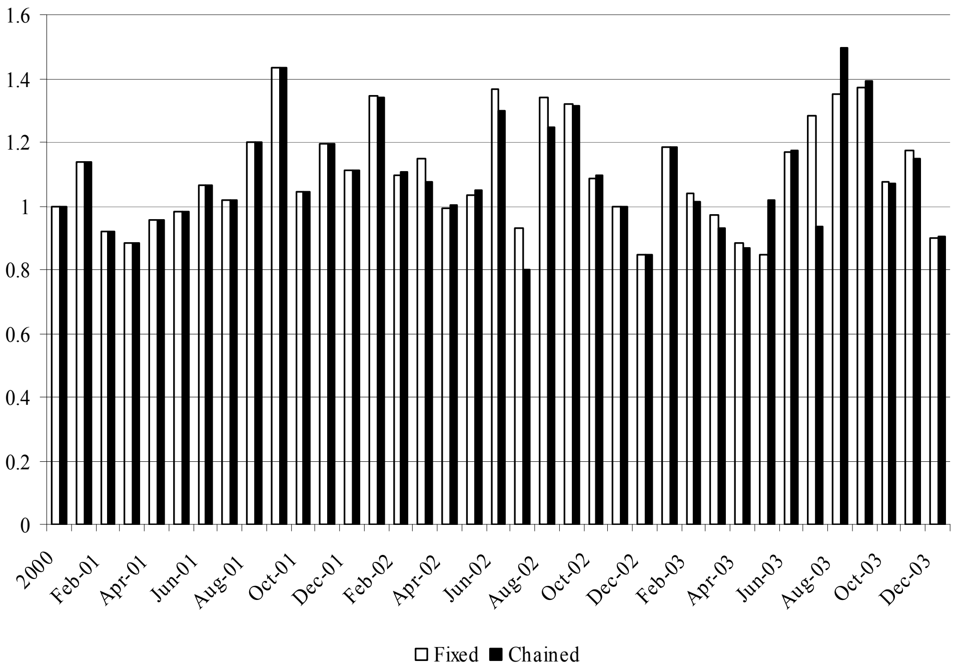
(4) $$P_{L,R,fixed}^{t,m} = \frac{\sum_{j=m+1}^{12} \sum_{i=1}^{n} p_i^{t-1,j} q_i^{t_0,j} + \sum_{j=1}^{m} \sum_{i=1}^{n} p_i^{t,j} q_i^{t_0,j}}{\sum_{j=1}^{12} \sum_{i=1}^{n} p_i^{t_0,j} q_i^{t_0,j}} \text{ , and}$$

(5) $$P_{P,R,fixed}^{t,m} = \frac{\sum_{j=m+1}^{12} \sum_{i=1}^{n} p_i^{t-1,j} q_i^{t-1,j} + \sum_{j=1}^{m} \sum_{i=1}^{n} p_i^{t,j} q_i^{t,j}}{\sum_{j=m+1}^{12} \sum_{i=1}^{n} p_i^{t_0,j} q_i^{t-1,j} + \sum_{j=1}^{m} \sum_{i=1}^{n} p_i^{t_0,j} q_i^{t,j}} \ .$$

[10] These indices and all indices shown in subsequent graphs and tables use weekly data aggregated over months. Since the Dutch CPI only uses the first two weeks of every month all (monthly) indices presented here also refer to the first two weeks each month.

[11] Note that when $t=1$, then $t-1$ and t_0 coincide.

Figure 1. Fixed and chained monthly year-to-year Fisher indices, fruit



Chained rolling year Laspeyres ($P^{t,m}_{L,R,chained}$) and Paasche ($P^{t,m}_{P,R,chained}$) indices in month m of year t are defined as:[12]

$$(6)\qquad P^{t,m}_{L,R,chained} = \prod_{\tau=t_0}^{t}\left[\frac{\sum_{j=m+1}^{12}\sum_{i=1}^{n} p_i^{\tau-1,j} q_i^{\tau-2,j} + \sum_{j=1}^{m}\sum_{i=1}^{n} p_i^{\tau,j} q_i^{\tau-1,j}}{\sum_{j=m+1}^{12}\sum_{i=1}^{n} p_i^{\tau-2,j} q_i^{\tau-2,j} + \sum_{j=1}^{m}\sum_{i=1}^{n} p_i^{\tau-1,j} q_i^{\tau-1,j}}\right], \text{ and}$$

$$(7)\qquad P^{t,m}_{P,R,chained} = \prod_{\tau=t_0}^{t}\left[\frac{\sum_{j=m+1}^{12}\sum_{i=1}^{n} p_i^{\tau-1,j} q_i^{\tau-1,j} + \sum_{j=1}^{m}\sum_{i=1}^{n} p_i^{\tau,j} q_i^{\tau,j}}{\sum_{j=m+1}^{12}\sum_{i=1}^{n} p_i^{\tau-2,j} q_i^{\tau-1,j} + \sum_{j=1}^{m}\sum_{i=1}^{n} p_i^{\tau-1,j} q_i^{\tau,j}}\right].$$

Unfortunately, the rolling year type of index has two drawbacks that may be significant for statistical agencies. CPI indexes have traditionally been viewed (and, for some purposes used) as short-term statistics for measuring month to month measure of inflation, whereas a rolling year index measures annual inflation as of a given month. In a rolling index, price

[12] Note that, when $t=1$, then $t-1$ and $t-2$ equal t_0, and when $t=2$, then $t-2$ equals t_0.

changes in general are smoothed out; not only seasonal effects. These are therefore different concepts of inflation which cannot easily be aligned. For central banks and other parties interested primarily in annual inflation, a rolling year index may be an adequate measure of price change, but for some other users, seems less suitable. Second, because a rolling year index is the average measure of price change over the past twelve months, it actually measures the average annual price change of six months ago.

Different statistical agencies use different methods to seasonally correct their price indices. One popular method of seasonal adjustment is the Rothwell index, of which several variants are in use.[13] In its basic form, the Rothwell index in month m of the current year t compares prices in this month with the annual average prices of the base year, t_0. We refer to this index as the fixed base Rothwell index, because the quantities used are those in the corresponding month m in the base year t_0:

$$(8) \qquad P_{R,fixed}^{t,m} = \sum_{i=1}^{n} p_i^{t,m} q_i^{t_0,m} / \sum_{i=1}^{n} p_i^{t_0} q_i^{t_0,m} \text{ , with}$$

$$(9) \qquad p_i^{t_0} = \sum_{m=1}^{12} p_i^{t_0,m} q_i^{t_0,m} / \sum_{m=1}^{12} q_i^{t_0,m}.$$

The Rothwell is a short-term price index, showing monthly price change including seasonal fluctuations. However, the Rothwell index still misses price changes when the seasonal pattern *changes over the years*, as in our data. A changing pattern for strongly seasonal products results in a situation where for some months, $p_i^{t,m}$ is not observed when $q_i^{t_0,m} > 0$, and vice versa. To prevent this from happening, an alternative specification of the Rothwell index could include current quantities in (8) rather than quantities for the base year, yielding what we will refer to as a current base Rothwell index:

$$(8') \qquad P_{R,current}^{t,m} = \sum_{i=1}^{n} p_i^{t,m} q_i^{t,m} / \sum_{i=1}^{n} p_i^{t_0} q_i^{t,m} \text{ ,}$$

together with (9) above in unchanged form.

For our data, there are several months when the differences between the two Rothwell indices are quite substantial. This is especially the case in July and August of 2003. Inspection of the scanner data reveals that in July and August of 2003, strawberries had been no longer available whereas they were available in these months in each of the preceding years. This change in the seasonal pattern caused a large difference between the indexes.

We prefer the current base Rothwell index. It seems to give the best reflection of current seasonal patterns. In our view, Baldwin's (1990) recommendation of the Rothwell index should be modified to stipulate that the quantities in the index are the current quantities rather than the base year ones. Of course, in conventional statistical practice, current quantities are generally not available. Scanner data, however, do contain current quantities sold: a distinct advantage of using scanner data for the treatment of seasonal products. Thus, although the conventional Rothwell

[13] Statistics Netherlands also uses a variant of the Rothwell index.

index suffers from the fact that a change in the seasonal pattern over the years can create a serious mismatch between current prices and base year quantities, with scanner data and an alternative specification of the Rothwell index that makes use of the current quantity data, this mismatch problem can be eliminated.

If the goal is to smooth out seasonal patterns altogether, a different approach is necessary. An annual index like the rolling year index succeeds well in eliminating seasonal fluctuations in an aggregate price index. However, for CPI purposes, we feel that the current base Rothwell index is the most suitable way to deal with seasonal fluctuations in prices and quantities.

3.2 Promotional sales effects: the case of children's napkins

Children's napkins is a product group where promotional sales are fairly frequent. Many consumers only buy napkins when they are on promotional sale, drawing on household inventories for current consumption in between the promotional sale periods. This pattern of acquisitions is illustrated in figure 2 which shows the quantities purchased of all brands of napkins included in our data set. The promotional sale periods can easily be distinguished.

In the measurement of price changes, acquisition is generally assumed to equal consumption. However, as shown in figure 2, this assumption does not hold for the non-durable (but storable) product of children's napkins.

Feenstra and Shapiro (2003) point out that chained indices of articles with frequent promotional sales can suffer from severe biases. For example, for the Laspeyres index, they report this bias is upward because the price decline in the period when it is on offer gets a much smaller quantity weight than the price increase when the price returns to its pre-sale level.

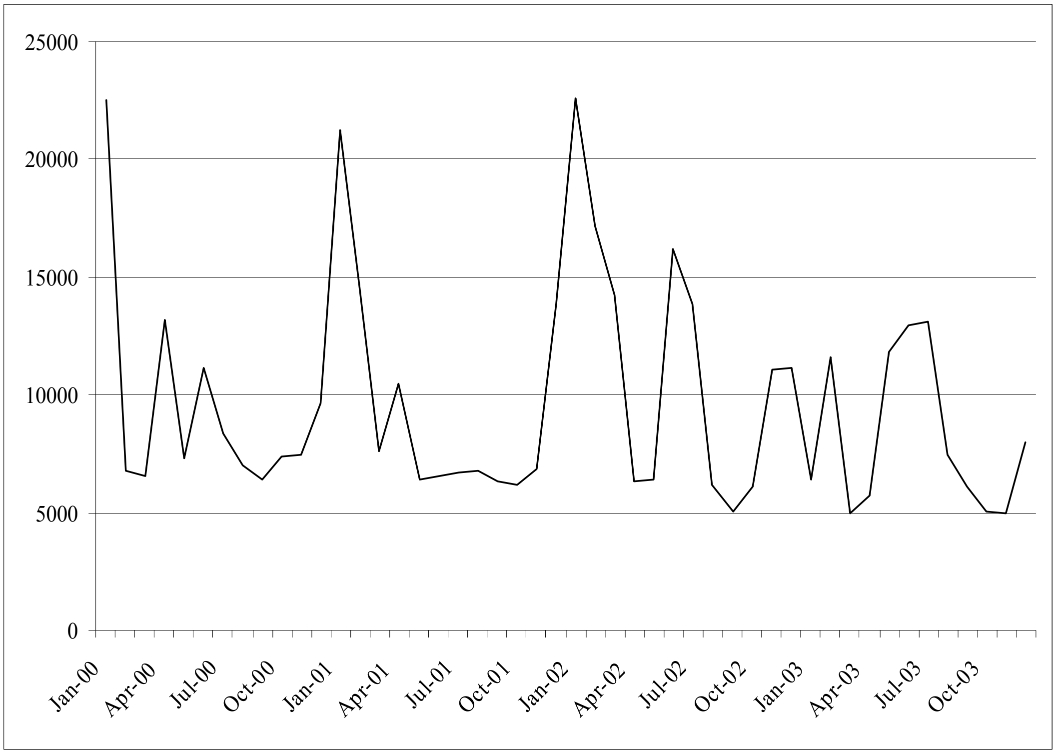
When Statistics Netherlands first acquired scanner data from two major retailers, the first aim was to construct chained Fisher indices (Schut, 2001). However, the chained indices were found to contain substantial biases. One of the causes of these biases seems to be that some articles are frequently on promotional sale. Hence, the decision was made to use a fixed base Laspeyres index, with the base year shifted every year. The formula is shown in (1).

Because we have no information on the way products on sale are promoted and when they are promoted during the promotional sale period, we cannot form a priori expectations about the likely direction of bias the way that Feenstra and Shapiro (2003) do. The chained Törnqvist index (which compares prices in each month with those in the previous month) is given by:

$$(10) \qquad P_T = \exp\left[\sum_{i=1}^{n} \frac{1}{2}\left(w_i^{m-1} + w_i^{m}\right)\ln\left(\frac{p_i^{m}}{p_i^{m-1}}\right)\right].$$

We chose 2000 as our base period. This means that for January 2001, p_i^{m-1} is the average price of product i in month m in 2000, and w_i^{m-1} is the corresponding expenditure weight.

Figure 2 Quantity Sold of Baby's Napkins, 2000-2003



The resulting chained Törnqvist index is rather volatile: in some months the index value change versus the previous month is more than ten percent. As expected, the chained Laspeyres was found to have a strong upward bias.

All the indices turned out to have more or less the same volatile pattern, caused by periodic promotional sales. Rather than an upward bias, the chained Törnqvist was found to have a downward trend vis-à-vis the fixed base indices. Based on taking a closer look at the data, it appears that after a period of sale, in most cases the quantity sold of an article that was on promotional sale dips below the pre-promotional sale period quantity. When this is the case, the price increase after a sale has a larger weight than the price decrease during a sale.

However, the pattern of purchases of napkins that are regularly on sale tells another story as well. While the quantity purchased of napkins that are on sale may be somewhat smaller just after compared with just before the promotional sale, both the before and after quantities are dwarfed by the quantity sold during the promotional sale period. This suggests that there are many consumers who only buy napkins when they are on sale: what Triplett (2003) termed the inventory shoppers. For such consumers, only price changes from one period of sale to the next are relevant, rather than the monthly price changes measured with traditional indices.

Clearly, consumption and acquisition of napkins do not coincide. A solution for this problem is to expand the unit time interval for the index. In the case of napkins, a horizon of one year rather than one month seems reasonable. Within a given year, consumption and acquisition of napkins are more likely to coincide. Choosing such a long price level measurement period, however, implies that the price index for napkins can only be computed over annual time spans; not monthly ones.

A rolling annual index can be updated monthly. As described in the previous section, a rolling index compares the prices in a period of twelve months (the ‘rolling year’) with those in the same months in the base twelve-month period.

The periodicity of promotional sales is quite regular in the case of napkins. This is actually quite common for both durable and non-durable consumer goods. A rolling year Fisher index seems ideally equipped to deal with ‘inventory shoppers’ and with the discrepancy between acquisition and consumption, which is a problem area when traditional monthly indices are used with scanner data.

4. Summary and Conclusions

This paper uses scanner data to evaluate and compare alternative methods that can be used for dealing with two problem areas in price index measurement: seasonal products and articles with frequent sales.

We argue that if the goal is to smooth out seasonal fluctuations, rolling year indices offer a way of doing this. Rolling year indices also appear to provide a way to deal with the discrepancies between the periods of acquisition and consumption for storable non-durable goods like children’s napkins.

However, rolling year provide a measure of annual price change, rather than a short-term monthly index. Also, rolling indices have a lag of six months; i.e., they provide the average price change over the past 12 months, which equals the average annual price change of six months ago. Thus we conclude that a Rothwell index using current quantities is the best method to use for seasonal commodities in a CPI.

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Appendix

Table A.1 Monthly prices and quantities sold of five kinds of fruit, 2000-2003

	Strawberries		White grapes		Red grapefruits		Mangos		Golden del. apples	
	price	quantity	price	quantity	price	quantity	price	quantity	price	quantity
Jan-00	0.00	0	0.00	0	1.81	10339	0.90	8909	1.56	5000
Feb-00	0.00	0	2.26	2535	1.81	10631	0.96	20388	1.59	4512
Mar-00	0.00	0	2.26	3125	1.81	10947	1.36	6145	1.59	4186
Apr-00	0.00	0	1.81	3026	1.81	11912	1.59	4928	1.59	3794
May-00	2.97	34836	1.81	3598	1.81	11865	1.01	17994	1.59	4610
Jun-00	1.95	66445	1.81	1	1.81	11706	0.96	21541	1.93	4439
Jul-00	1.91	43799	0.00	0	1.36	15571	1.23	5242	2.26	4138
Aug-00	1.99	40965	0.00	0	1.36	9779	0.81	17594	2.26	3760
Sep-00	2.72	346	0.00	0	1.44	10180	1.03	11764	1.70	4213
Oct-00	0.00	0	0.00	0	1.81	10965	1.36	5931	1.58	6004
Nov-00	0.00	0	0.00	0	1.81	10995	1.36	5946	1.69	4865
Dec-00	0.00	0	0.00	0	2.03	9400	1.36	5338	1.80	3593
Jan-01	2.72	1	0.00	0	2.04	10493	1.03	9881	1.80	3650
Feb-01	0.00	0	1.81	3091	1.55	19727	0.98	19786	1.58	3591
Mar-01	0.00	0	1.42	24572	2.04	12403	1.19	10906	1.58	3538
Apr-01	0.00	0	1.44	27452	2.04	13137	1.36	7570	1.58	4185
May-01	2.70	11478	1.49	9239	2.04	14537	1.24	8299	1.58	4050
Jun-01	1.97	83228	1.80	1611	2.23	12206	1.35	8055	2.01	4335
Jul-01	1.74	88415	1.81	2	2.26	10450	1.36	7153	2.25	3877
Aug-01	2.19	49337	0.00	0	2.26	9004	1.36	7538	2.26	4559
Sep-01	3.17	5	0.00	0	2.26	9216	1.36	6711	2.25	4102
Oct-01	0.00	0	0.00	0	2.26	9888	0.96	28565	2.25	3840
Nov-01	0.00	0	0.00	0	2.25	8760	1.36	8397	2.25	3839
Dec-01	0.00	0	0.00	0	2.26	9078	1.36	6604	2.25	3569
Jan-02	0.00	0	1.81	40	2.26	10767	1.36	6629	2.26	4166
Feb-02	0.00	0	1.99	3240	2.26	12192	0.87	24542	2.25	4006
Mar-02	0.00	0	1.98	4056	2.26	13386	1.29	7456	2.26	4612
Apr-02	1.99	3	1.98	4199	1.69	23761	1.29	7676	2.26	4754
May-02	2.49	2514	1.98	11211	2.26	13182	1.03	22790	2.26	4043
Jun-02	2.79	3184	0.00	0	2.26	12266	1.51	7866	2.32	4542
Jul-02	1.12	3458	0.00	0	1.80	10855	1.49	6730	2.38	4291
Aug-02	2.85	1188	0.00	0	1.59	11424	1.46	6694	2.49	5638
Sep-02	0.00	0	0.00	0	1.89	10959	1.37	7458	2.25	5596
Oct-02	0.00	0	0.00	0	1.89	9747	1.40	8315	1.99	4092
Nov-02	0.00	0	0.00	0	1.99	8180	0.99	10803	1.98	3675
Dec-02	0.00	0	0.00	0	1.67	11400	0.99	9723	1.99	3477
Jan-03	0.00	0	0.00	0	1.99	11149	1.22	7876	1.97	3857
Feb-03	0.00	0	1.95	2536	1.66	15150	1.11	6065	2.28	3495
Mar-03	0.00	0	1.75	2704	1.99	12206	0.99	24170	2.28	3776
Apr-03	1.87	24691	1.51	20987	1.42	19400	1.13	8063	2.28	4164
May-03	1.99	44375	1.95	5017	1.99	12777	1.59	7381	2.28	3642
Jun-03	2.49	21	1.77	21059	2.29	11635	1.05	28978	2.28	4372
Jul-03	0.00	0	2.29	6	2.48	9921	1.49	6464	2.28	3991
Aug-03	0.00	0	0.00	0	2.48	10674	1.49	8501	2.28	5483
Sep-03	0.00	0	0.00	0	2.48	9473	1.08	16481	2.28	4365
Oct-03	0.00	0	0.00	0	2.03	12748	1.04	13279	2.28	3355
Nov-03	0.00	0	0.00	0	2.48	8875	0.99	9271	2.27	3201
Dec-03	0.00	0	0.00	0	1.78	14151	0.99	10389	2.28	2801