

New Zealand Consumers Price Index: Retrospective Superlative Index and Impact of Alternative Housing Weights

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Abstract

The New Zealand Consumers Price Index (CPI) Revision Advisory Committee met in June 2004 to undertake an independent review of the practices and methods used to compile the CPI. One of the committee's recommendations was that at each reweighting of the CPI basket, Statistics New Zealand should calculate a 'superlative' index on a retrospective basis to provide information on the effect of upper-level (or commodity) 'substitution' on the fixed-weight CPI.

This paper presents details of a retrospective superlative index calculated between the June 2002 quarter and the June 2006 quarter. The index provides an indication of the effect of commodity substitution on the fixed-weight CPI. It also reflects changes to and improvements in the methods and data sources used to derive the 2006 expenditure weights, particularly for the purchase of new housing.

The paper also presents details of how the CPI would have tracked between the June 2002 quarter and the June 2006 quarter, had alternative weights been used in 2002 for the purchase of new housing and for rentals for housing.

The analytical time series described above were published in February 2007. In addition to presenting results, the paper summarises reaction from users to the analytical series.

1. Introduction

A major review of the New Zealand Consumers Price Index (CPI) was implemented by Statistics New Zealand when the September 2006 quarter index was released in October 2006. The review involved reselecting and reweighting the basket of representative goods and services, updating the sample of retail outlets that prices are collected from, and other changes such as the adoption of a new expenditure classification.

Early in the review process, a seven-member CPI Revision Advisory Committee (appointed by the Government Statistician in consultation with the Minister of Statistics) met to undertake an independent review of the practices and methods used to compile the CPI. The committee's 20 recommendations played a major part in shaping the review of the index. One of the committee's recommendations was that at each reweighting of the CPI basket, Statistics New Zealand should calculate a 'superlative' index on a retrospective basis to provide information on the effect of upper-level (or item) 'substitution' on the fixed-weight CPI. Item substitution occurs when households react to changes in relative prices by choosing to reduce purchases of goods and services showing higher relative price change, and instead buy more of those showing lower relative price change.

This paper presents details of a retrospective superlative index calculated between the June 2002 quarter and the June 2006 quarter. The index provides an indication of the effect of commodity substitution on the fixed-weight CPI. It also reflects changes and improvements in the methods and data sources used to derive the 2006 expenditure weights.

In 2006, a reduced expenditure weight for the purchase of new housing was partly the result of employing a new method that better reflected an ongoing fall in the home-ownership rate. The resulting 2006 housing expenditure weights implied a stronger relative shift from owning to renting than was really the case. This had a downward influence on the superlative index, as house construction prices increased during the four-year period at a greater rate than dwelling rentals.

The paper also provides details of what the expenditure weights for purchase and construction of new dwellings and for rented dwellings would have been in 2002, had the new method been used. The paper shows how analytical time series, constructed using these alternative weights, track between the June 2002 quarter and the June 2006 quarter.

2. Summary of results

The seasonally unadjusted CPI all groups index, calculated using a fixed-weight Laspeyres formula, increased by a total of 11.1 percent from the June 2002 quarter to the June 2006 quarter. The analytical retrospective superlative index, calculated using a Fisher formula, rose by 9.9 percent over the same period. The Laspeyres index number for the June 2006 quarter, expressed on a base of the June 2002 quarter (=1000) was 1111, whereas the Fisher index number was 12 index points lower, at 1099. The Laspeyres index rose by an annual average rate of 2.7 percent during the period, compared with 2.4 percent for the Fisher index.

The retrospective index provides an indication of the effect of commodity substitution on the fixed-weight CPI. It also reflects changes and improvements in the methods and data sources used to derive the 2006 expenditure weights. The reduced expenditure weight for the purchase of new housing (from 8.47 percent in 2002 to 4.66 percent in 2006), was partly the result of employing a new method that better reflects a fall in the home-ownership rate. The reduced weight for the purchase of new housing had a downward influence on the Fisher index, as house construction prices increased during the four-year period at more than twice the rate of dwelling rentals.

The new method was used to re-estimate the 2002 expenditure weights for purchase of new housing and for rentals for housing. These were used to calculate analytical seasonally unadjusted CPI all groups indexes, firstly using a fixed-weight Laspeyres formula and secondly using a Fisher formula. This process reduced the difference between the Laspeyres and Fisher indexes.

The analytical seasonally unadjusted CPI all groups index with alternative housing weights, calculated using a fixed-weight Laspeyres formula, increased by a total of 10.3 percent from the June 2002 quarter to the June 2006 quarter. The analytical retrospective superlative index, calculated using a Fisher formula, rose by 9.6 percent over the same period.

The Laspeyres index number for the June 2006 quarter was 1103, whereas the Fisher index number was 7 index points lower, at 1096. The Laspeyres index rose by an annual average rate of 2.5 percent during the period compared with 2.3 percent for the Fisher index, a difference of a little under 0.2 of a percentage point per year. This result is broadly consistent with international studies.

The alternative 2002 housing weights were used to calculate an analytical all groups CPI series. The 2002 expenditure weights for purchase and construction of new dwellings, and rented dwellings were 8.48 percent and 5.48 percent, respectively. The alternative 2002 weights, calculated using the new method, were 4.60 percent for purchase and construction of new dwellings and 6.62 percent for rented dwellings. The resulting analytical series increased by 10.4 percent from the June 2002 quarter to the June 2006 quarter, compared with 11.1 percent for the all groups CPI.

Differences in annual movements during the period ranged from no difference up to 0.4 of a percentage point. Differences were greatest during the period from the September 2003 quarter to the June 2004 quarter. Subsequent differences were 0.1 or 0.2 of a percentage point.

Annual movements for the CPI all groups index rose above 3.0 percent towards the end of the four-year period, for the four quarters from the September 2005 quarter to the June 2006 quarter. For each of these quarters, the annual movement of the analytical series with alternative housing weights was also above 3.0 percent.

3. Retrospective superlative index

3.01 Introduction

Under normal economic conditions, price and quantity relatives are negatively correlated. Households tend to react to changes in relative prices by reducing purchases of goods and services showing higher relative price change, and instead buying more of those showing lower relative price change. Under such circumstances, a base-weighted Laspeyres index will be greater than a current-weighted Paasche index. A Laspeyres index, based on fixed quantities from some historical period, will overstate price change, whereas a Paasche index will understate price change.

For practical reasons, CPIs are generally calculated using a Laspeyres formula (or a Lowe or Young variant), where weights reflect expenditure shares in some historical period. CPIs are therefore subject to upper-level (or item) substitution bias, unlike indexes calculated using a superlative index formula such as the Fisher index formula (which is the geometric mean of the overstating Laspeyres index and understating Paasche index). As the Paasche index weights reflect current-period expenditure shares, it is not feasible at present to calculate a Fisher index in real time.

International studies have found the difference between superlative and Laspeyres CPI indexes to be between about 0.1 and 0.2 of a percentage point per year in inflation rates. In other words, annual price changes would have been around 0.1 to 0.2 of a percentage point lower if the CPIs allowed for item substitution.

Under a Laspeyres formula, reweighting the basket periodically will minimise the problem of item substitution, but not eliminate it. Substitution occurs continuously and differences accumulate over time, so the longer the period between basket reweights, the larger the potential bias.

The New Zealand index is, on average, reweighted once every three years, which is well within the International Labour Office's (ILO) recommendation of at least once every five years. The 2006 reweight was implemented four years after the previous reweight in 2002, a year later than usual. However, the next reweight will occur in 2008, to bring the CPI back to a three-yearly review cycle.

Once each new set of CPI expenditure weights has been calculated, it is possible to make use of the existing and new weights to calculate a superlative index between the two reweighting periods on a retrospective basis.

The 2004 CPI Revision Advisory Committee recommended that Statistics NZ should calculate a retrospective superlative index to provide information on the effect of upper-level substitution on the fixed-weight CPI (Statistics New Zealand, 2004a):

Recommendation 10: At each reweighting of the CPI basket, Statistics New Zealand should calculate a superlative index on a retrospective basis to provide information on the effect of item substitution on the fixed-weight CPI. Consistent with recommendation 8, Statistics New Zealand should also assess the value of providing users with real-time estimates of the effect of item substitution on the CPI.

Statistics NZ has calculated a retrospective superlative index between the June 2002 quarter and the June 2006 quarter. The index provides a broad indication of the effect of item substitution on the fixed-weight CPI. It is, however, important to note that it also reflects:

- changes and improvements in the methods and data sources used to derive the 2006 expenditure weights
- volume adjustments made in 2006 for some goods and services, to reflect trend change in quantities since the 'weight-reference' period of 2003/04.

Statistics NZ has not yet assessed the value or feasibility of providing users with real-time estimates of the effect of item substitution.

Section 3.02 describes how the analytical superlative index was constructed and section 3.03 presents results.

3.02 How the superlative index was constructed

The analytical retrospective superlative index time series from the June 2002 quarter to the June 2006 quarter was based on the CPI seasonally unadjusted basket of sub-index time series and expenditure weights. The seasonally unadjusted CPI all groups index was used because the 2002 expenditure weights assigned to the goods and services used to calculate this index were 'price updated' in a way that is consistent with the way the 2006 all groups CPI expenditure weights were calculated.

At the 2006 reweight, the all groups index became fully seasonally unadjusted. Up until the June 2006 quarter, fresh fruit and vegetable prices used in calculating the all groups index were seasonally adjusted.

The 2002 weights were based on expenditure information from the 2000/01 Household Economic Survey (Statistics New Zealand, 2004b) and other sources, price updated to the June 2002 quarter. The effect of price updating, recommended for CPIs by the International Labour Office and common international practice, was to express the underlying 2000/01 quantities in the prices of the June 2002 quarter price-reference period.

The 2006 weights were based on expenditure information from the 2003/04 Household Economic Survey (Statistics New Zealand, 2004b) and a wide range of other sources, price updated to the June 2006 quarter. The effect of price updating, in this case, was to express the underlying 2003/04 quantities in the prices of the June 2006 quarter price-reference period. As noted above, volume adjustments were made in 2006 (but not in 2002) for some goods and services, to reflect trend change in quantities since the 2003/04 weight-reference period. In some cases, for example cellphone handset purchases, volume adjustments were made by way of using price-updating indicators that did not adjust for changes in quality. As a result, the retrospective superlative index covers the four years from the June 2002 quarter to the June 2006 quarter, but is based on underlying quantities (for 2000/01 and 2003/04) which are three years apart (although in some cases adjustments were made to reflect quantity changes since 2003/04).

There were 672 goods and services in the 2002 CPI basket and there are 685 in the 2006 basket. Some goods and services were removed from the basket and some new ones were added at the time of the 2006 reweight. The majority of goods and services are in both baskets.

The expenditure weights of goods and services added to the basket in 2006 were re-allocated across similar, remaining goods and services. The expenditures of those removed from the basket in 2006 were re-allocated across similar, remaining goods and services.

In some areas of the classification where there were significant changes to the composition of the basket, indexes at slightly higher levels of aggregation were used, to avoid or minimise disruption. Making use of more aggregated indexes in some cases, and accounting for goods and services that were removed from or added to the basket, resulted in a total of 556 index time series being used to construct the Laspeyres and Paasche components of the Fisher time series. The New Zealand Household Expenditure Classification (NZHEC), adopted at the time of the 2006 reweight, was used to calculate Laspeyres, Paasche and Fisher time series at the class, subgroup, group and all groups levels.

The Laspeyres, Paasche and Fisher¹ price index formulae used to calculate the analytical time series are given below in the Appendix.

The Laspeyres, Paasche and Fisher index time series have been expressed on a base of the June 2002 quarter (=1000).

Index numbers presented in this paper have been rounded to the nearest index point, which is in line with standard rounding procedures used for the New Zealand CPI. Similarly, percentage changes are presented to one decimal place. Any differences between the Laspeyres and Fisher series are based on comparisons of the index numbers rounded to the nearest index point. Actual differences, based on unrounded index numbers, may be slightly smaller or larger.

3.03 Analytical retrospective superlative index time series results

Table 1 shows that the analytical Fisher seasonally unadjusted all groups series was 12 index points lower than the analytical Laspeyres seasonally unadjusted all groups CPI at the June 2006 quarter. Over the four-year period, the analytical Fisher series increased by a total of 9.9 percent, compared with a total of 11.1 percent for the seasonally unadjusted all groups CPI.

¹ Tornqvist-Theil and Walsh formulae were also used to calculate indexes for the June 2006 quarter, compared with the June 2002 quarter.

Table 1

Consumers Price Index
Analytical seasonally unadjusted all groups – index numbers
 Base: June 2002 quarter (=1000)

June quarter	Laspeyres	Paasche	Fisher	Index points difference (Laspeyres minus Fisher)
2002	1000	1000	1000	0
2003	1015	1009	1012	3
2004	1039	1026	1032	7
2005	1068	1049	1058	10
2006 ⁽¹⁾	1111	1088	1099	12

(1) Tornqvist-Theil and Walsh index numbers for the June 2006 quarter were 1101 and 1100, respectively.

Figure 1 shows that, as expected, the gap between the seasonally unadjusted all groups Fisher and Laspeyres series grew over time.

Figure 1

Analytical Seasonally Unadjusted CPI Indexes
Quarterly indexes

Base: June 2002 quarter (=1000)

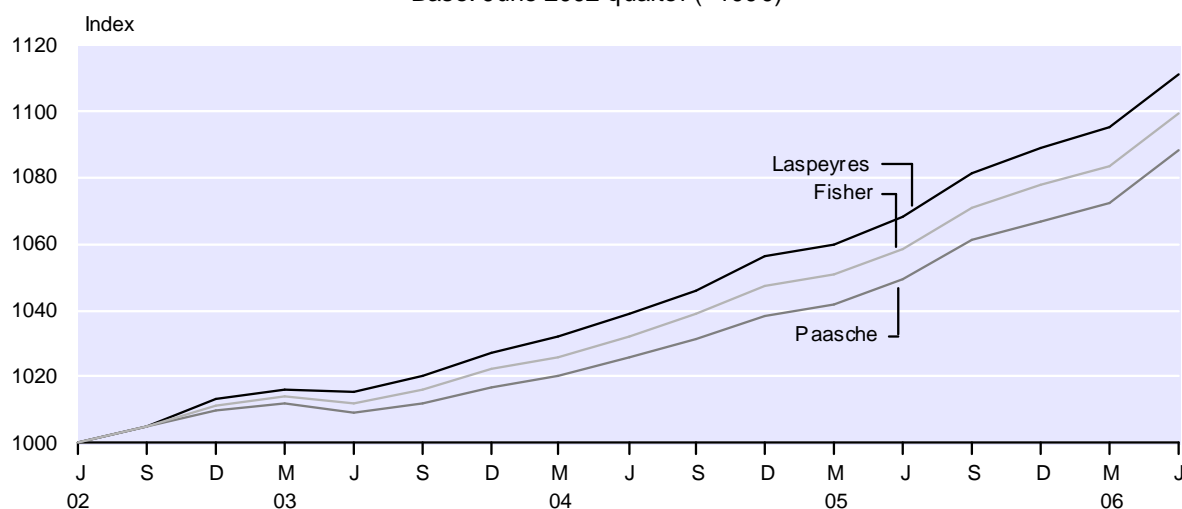
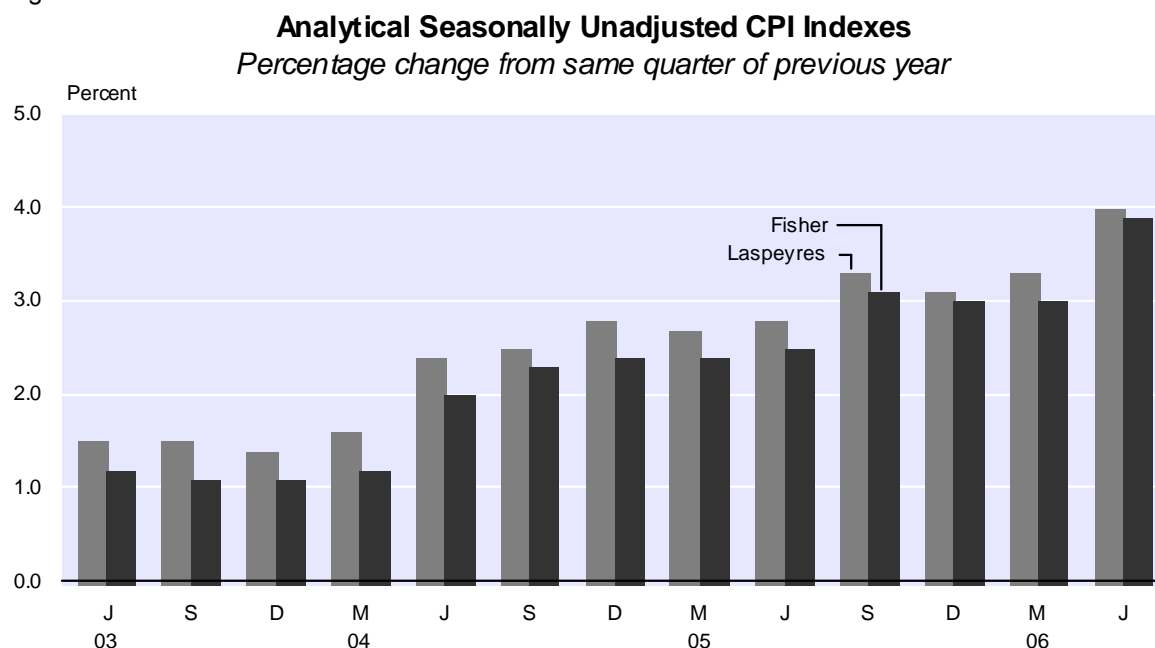


Figure 2 shows differences in annual movements during the period. These differences ranged from 0.1 up to 0.4 of a percentage point.

Figure 2



The retrospective index provides an indication of the effect of commodity substitution on the fixed-weight CPI. It also reflects changes and improvements in the methods and data sources used to derive the 2006 expenditure weights.

Groups showing relatively small differences between the Laspeyres and Fisher series included:

- food
- alcoholic beverages and tobacco
- clothing and footwear
- household contents and services
- health
- transport
- miscellaneous goods and services.

The communication group had 2002 and 2006 expenditure weights of 2.92 percent and 3.26 percent, respectively. The Fisher index was 21 index points lower than the Laspeyres index at the June 2006 quarter.

Over the four-year period, the analytical Fisher series for the communication group decreased by a total of 2.0 percent, compared with little change for the Laspeyres series (up 0.1 percent). This was mainly due to large price decreases and associated large volume increases within the telecommunications equipment subgroup. The volume increase implied by the 2002 and 2006 expenditure weights for this subgroup was partly the result of a volume adjustment made to the 2006 weight to reflect growth since the 2003/04 weight reference period in cellphone connections and improvements in the quality of handsets.

The recreation and culture group had 2002 and 2006 expenditure weights of 9.73 percent and 10.21 percent, respectively. The Fisher index was 32 index points lower than the Laspeyres index at the June 2006 quarter.

Over the four-year period, the analytical Fisher series for the recreation and culture group showed little change (down 0.1 percent), compared with an increase of 3.1 percent for the Laspeyres series. This was mainly due to large price decreases and associated large volume increases within the audio-visual equipment class for goods such as television sets, DVD players and digital cameras. The volume increase implied by the 2002 and 2006 expenditure weights for this class was partly the result of volume adjustments made to reflect very strong growth since the 2003/04 weight reference period in the quantities of audio-visual equipment being acquired by households.

The audio-visual equipment class includes goods that evolve quickly and has a relatively high incidence of new goods and new products. The appearance of new goods between the 2002 and 2006 reweights is partly reflected in the Fisher index through a contribution to the Paasche weights. However, the price movements of new goods prior to being added to the basket at the 2006 reweight, have not contributed to price movements used in the Fisher calculations.

A paper by Ricky Ho (2006) presented an empirical analysis of the potential impact on the index of when new consumer electronic goods are added to the CPI basket. The goods examined were digital cameras, DVD player/recorders and flat panel televisions, which all belong to the audio-visual equipment class.

The results presented in this retrospective superlative index paper were first published in February 2007. Reaction from readers included interest in the impact of the large price decreases and associated large volume increases within the audio-visual equipment class. As a result, Statistics New Zealand is currently investigating whether there is a case for updating the regimen and weights of the Retail Trade Survey Deflators (Statistics New Zealand, quarterly I) for appliance retailing and for department stores, two industries that sell audio-visual equipment.

The heavily weighted housing and household utilities group had 2002 and 2006 expenditure weights of 21.52 percent and 20.02 percent, respectively. The Fisher index was 11 index points lower than the Laspeyres index at the June 2006 quarter.

Over the four-year period, the analytical Fisher series for the housing and household utilities group increased by 23.0 percent, compared with an increase of 24.1 percent for the Laspeyres series. For this group, the difference between the Fisher and Laspeyres index can be largely explained by a change to the method used to estimate the weight for purchase of new housing in 2006.

The expenditure weight for the purchase of new housing fell from 8.47 percent in 2002 to 4.66 percent in 2006. This fall was partly the result of employing a new method that better reflects a fall in the home-ownership rate. The weight of rentals for housing rose from 5.54 percent to 6.87 percent. The 2006 expenditure weights for housing implied a stronger relative shift from owning to renting than was really the case. This had a downward influence on the Fisher index, as house construction prices increased during the four-year period at more than twice the rate of dwelling rentals.

The new method was used to re-estimate the 2002 expenditure weights for the purchase of new housing and for rentals for housing (this is explained in detail below in section 4). These alternative weights for housing were used to calculate an analytical seasonally unadjusted CPI all groups index, using a fixed-weight Laspeyres formula and using a Fisher formula. This reduced the difference between the Laspeyres and Fisher all groups indexes.

The analytical seasonally unadjusted CPI all groups index with alternative 2002 housing weights, calculated using a fixed-weight Laspeyres formula, increased by a total of 10.3 percent from the June 2002 quarter to the June 2006 quarter. The analytical retrospective superlative index, calculated using a Fisher formula, rose by 9.6 percent over the same period.

The Laspeyres index number for the June 2006 quarter was 1103, whereas the Fisher index number was 7 index points lower, at 1096.

Table 2

Consumers Price Index
Analytical seasonally unadjusted all groups with alternative housing weights – index numbers
 Base: June 2002 quarter (=1000)

June quarter	Laspeyres	Paasche	Fisher	Index points difference (Laspeyres minus Fisher)
2002	1000	1000	1000	0
2003	1013	1009	1011	2
2004	1034	1026	1030	4
2005	1061	1049	1055	6
2006 ⁽¹⁾	1103	1088	1096	7

(1) Tornqvist-Theil and Walsh index numbers for the June 2006 quarter were both 1097.

Use of the alternative 2002 housing weights substantially reduced the gap between the Fisher and Laspeyres series for the housing and household utilities group, from 11 index points (using the original weights) at the June 2006 quarter to 1 index point.

Figure 3 shows that the gap between the Fisher and Laspeyres all groups series with alternative housing weights grew more slowly over time than the series calculated using the original housing weights.

Figure 3

Analytical Seasonally Unadjusted CPI Indexes with Alternative Housing Weights
Quarterly indexes
 Base: June 2002 quarter (=1000)

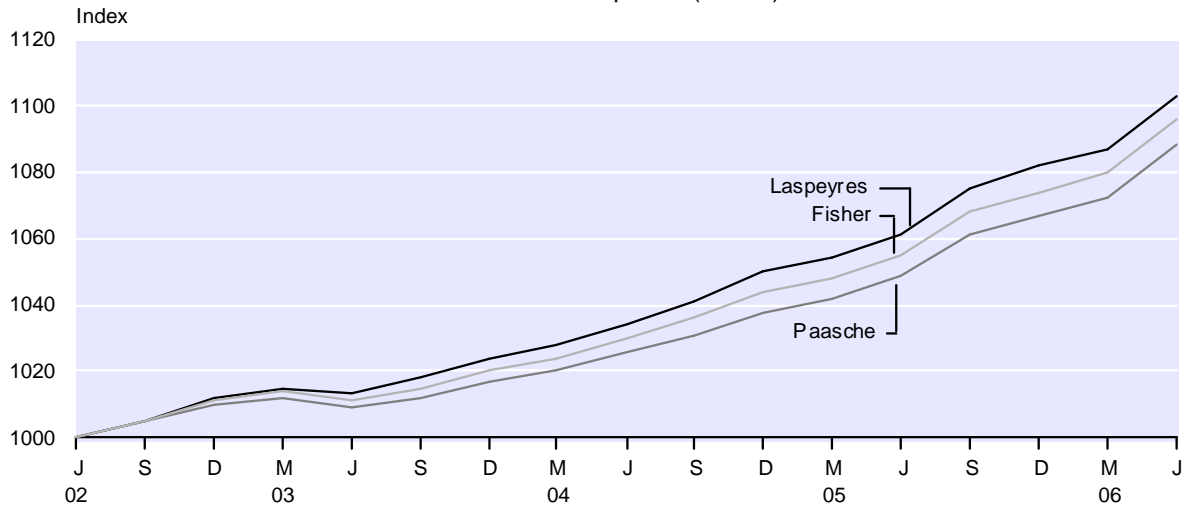
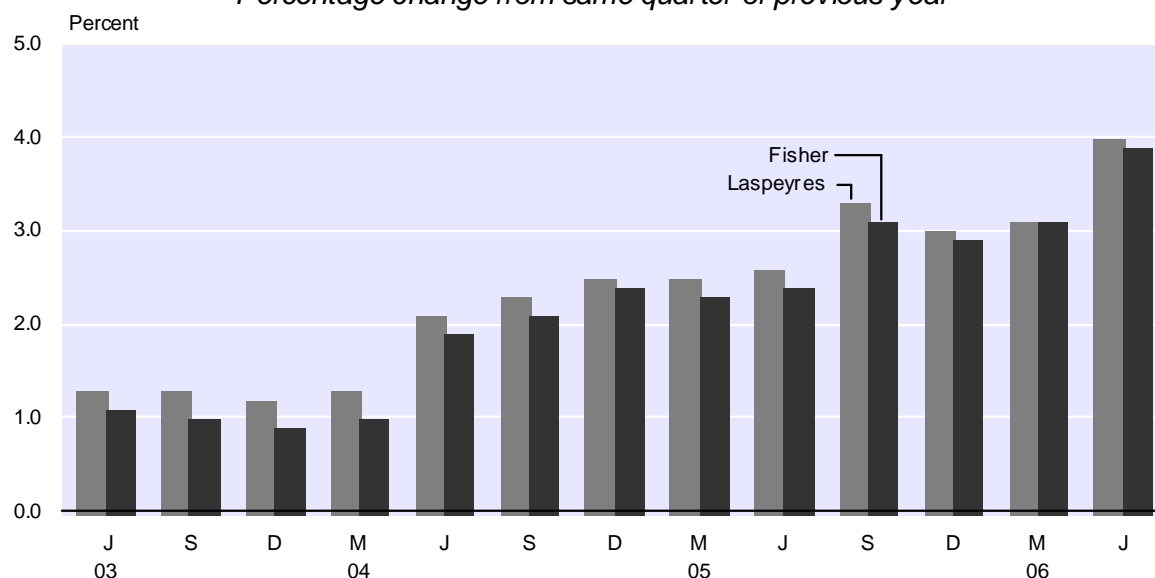


Figure 4 shows differences in annual movements during the period. These differences ranged from no difference up to 0.3 of a percentage point.

Figure 4

Analytical Seasonally Unadjusted CPI Indexes with Alternative Housing Weights
Percentage change from same quarter of previous year



The Laspeyres index rose by an annual average rate of 2.5 percent during the period, compared with 2.3 percent for the Fisher index, a difference of a little under 0.2 of a percentage point per year. This result is broadly consistent with international studies.

As noted in section 3.01 above, the CPI is, on average, reweighted once every three years, which is well within the ILO recommendation of at least once every five years. The frequency at which the CPI could be reweighted is constrained by the main source of expenditure weighting information, the Household Economic Survey, being conducted only once every three years.

However, at the 2006 CPI reweight, a decision was made to publish and fix expenditure weights until the following reweight at the class level of the NZHEC classification. This classification comprises 105 categories, compared with the more-detailed 315 subsections under the old classification at the 2002 reweight. This will provide flexibility to keep the weights below the class level up to date between reweights. This will mitigate the impact of item substitution, but only to the extent that it occurs within classes of the NZHEC classification.

An earlier retrospective superlative index time series was calculated during preparation of papers for the 2004 CPI Revision Advisory Committee. The June 1999 and June 2002 quarter weights were used to calculate Laspeyres, Paasche and Fisher indexes retrospectively between the June 1999 quarter and June 2002 quarter.

The Fisher index for the June 2002 quarter was 1077, 5 index points lower than the Laspeyres index for the same period. The Laspeyres index rose by an annual average rate of 2.7 percent during the period, compared with 2.5 percent for the Fisher index, a difference of a little under 0.2 of a percentage point per year. This earlier result is similar to that using alternative housing weights for the period from the June 2002 quarter to the June 2006 quarter.

4. The impact of alternative housing weights

4.01 Introduction

When the CPI was reweighted in 2006, a new method was used to calculate the expenditure weight for the purchase of new housing. The new method reflected a fall in the home-ownership rate that was not accounted for in the method used previously. This resulted in the 2006 weight for purchase of new housing (4.66 percent) being considerably lower than the 2002 weight for purchase and construction of new dwellings (8.48 percent).

However, the lower 2006 weight does not reflect a real decline of that size. Rather, it can be attributed to:

- the adoption of a new method that reflects the falling home-ownership rate
- about one-fifth of the 2002 weight comprising Household Economic Survey expenditure on alterations, additions and improvements being counted twice, as it would already have been included in the independent estimate, which was based on information sources other than the Household Economic Survey.

Statistics NZ has estimated what the expenditure weights for purchase and construction of new dwellings and for rented dwellings would have been in 2002, had the new method been used. Sections 4.02 and 4.03 below explain how the 2006 weights and the alternative 2002 weights were calculated.

To help CPI users understand the impact of these alternative 2002 housing weights, Statistics NZ has used them to calculate analytical time series from the June 2002 quarter to the June 2006 quarter for the housing group and for all groups. Results are presented in Section 4.04. As the aim was to assess what the impact would have been of using the 2006 methodology in 2002, the analysis is based on the old CPI classification system (not on the NZHEC classification system, which was adopted at the time of the 2006 reweight).

4.02 Purchase of new housing weights

Under the 'acquisitions' conceptual framework used to compile the New Zealand CPI, the expenditure weight allocated to purchase of housing represents the value of the net increase in the stock of owner-occupied housing during the weight reference period. Expenditure on newly constructed dwellings by owner-occupiers is included, as are alterations and additions to established owner-occupied dwellings.

Sales within the household sector of established owner-occupied dwellings do not add to the stock of owner-occupied dwellings, as netting results in each purchase (positive expenditure) being cancelled out by a corresponding sale (negative expenditure). However, any net shift of dwellings in either direction between owner-occupation and renting or small-business use should be included, as it would result in a net addition (towards owner-occupation) or net reduction (towards renting or business use) to the stock of owner-occupied housing.

For the 2002 CPI reweight, the method used to derive the expenditure weight for purchase of housing was to estimate owner-occupiers' share of the value of new residential building work put in place (including alteration and additions).

The method used in 2006 involved applying an average new private dwelling value to the net change in the number of owner-occupied dwellings, then adding an estimate of owner-occupiers' share of the value of residential building additions and alterations to established dwellings.

The net change in the number of owner-occupied dwellings reflects the overall effect of households:

- acquiring newly constructed dwellings for occupation
- demolishing established owner-occupied dwellings
- selling established owner-occupied dwellings to landlords, small businesses, developers or government
- acquiring established dwellings (for owner-occupation) from landlords, small businesses, developers or government.

The underlying assumption in 2002 was that there had not been any, or any significant, net shift in either direction of established dwellings between owner-occupation and renting or small-business use. However, information from the Census of Population and Dwellings, the Household Economic Survey and other sources indicated that there had been a trend over a lengthy period towards lower home-ownership rates.

Information from the 1991, 1996, and 2001 Censuses of Population and Dwellings (Department of Statistics New Zealand, 1992; Statistics New Zealand, 1996; Statistics New Zealand, 2001), the 2000/01 and 2003/04 Household Economic Survey and research by the Reserve Bank (Phil Briggs, 2006) on the impact of family trusts on published home-ownership rates was used to conservatively extrapolate tenure proportions (ie home-ownership and renting rates) beyond the 2001 Census of Population and Dwellings. These extrapolated home-ownership rates were applied to Statistics NZ's time series estimates of the total number of dwellings (included in dwelling estimates by tenure statistics (Statistics New Zealand, quarterly II)) to derive time series estimates of the number of owner-occupied dwellings. The dwelling estimates by tenure figures available at the time held tenure proportions constant beyond the 2001 Census.

To smooth the impact of cyclical highs or lows in activity, the weight reference period was extended, from the one year used at previous reweights to the three years ending with the Household Economic Survey period, to derive annual average CPI expenditure weights for the purchase of housing (and related services such as conveyancing and real estate fees) and rentals for housing. For the latest review, information for the three years to June 2004 was used.

The derived time series estimates of the number of owner-occupied dwellings for the years to June 2001, 2002, 2003 and 2004 were used to calculate the net annual change for each of the three years to June 2004. These net annual changes were multiplied by the average cost of constructing a new dwelling during the year to June 2004 (derived from Statistics NZ's building consents statistics (Statistics New Zealand, monthly), and value of building work put in place statistics (Statistics New Zealand, quarterly III)). Figures for each of the three years were averaged.

The values of residential building additions/alterations to established dwellings for the years to June 2002, 2003 and 2004 were multiplied by the extrapolated home-ownership rates referred to above, to estimate owner-occupiers' share of the value of improvements to established dwellings. Figures for each of the three years to June 2004 were expressed in 2003/04 prices, averaged, then added to the annual average value assigned to the net change in the number of owner-occupied dwellings.

The final step was to price update to the June 2006 quarter. The price updating indicator that was used for purchase of housing was not the CPI index for purchase and construction of new dwellings; rather, an average house price indicator based on building consents and value of building work put in place data was used. This was to reflect an increase in the size of new houses since 2003/04 (as shown by building consents data), and increased costs as a result of the introduction of a more stringent building consents and inspection process. Changes to the building consents regime have in some cases resulted in improvements to the materials used in constructing the new houses being tracked in the CPI survey. The

impact these improvements had on surveyed prices was stripped out of the CPI index for purchase and construction of new dwellings.

The 2006 expenditure weight for purchase of new housing was 4.66 percent. This compares with a 2002 expenditure weight for purchase and construction of new dwellings of 8.48 percent. The lower 2006 weight can be attributed both to the adoption of a new method that reflects the falling home-ownership rate, and to about one-fifth of the 2002 weight comprising Household Economic Survey expenditure on alterations, additions and improvements. These would already have been included in the independent estimate based on the value of building work put in place data.

Using information for the three years to June 2001, the new method (with minor differences) was used to estimate an alternative 2002 expenditure weight for purchase and construction of new dwellings. Household Economic Survey expenditure on alterations, additions and improvements, already included in the independent estimate based on the value of building work put in place data, was also removed. The resulting alternative 2002 expenditure weight for purchase and construction of dwellings was 4.60 percent, which is slightly lower than the 2006 expenditure weight for purchase of new housing of 4.66 percent.

The minor differences included using the CPI index for purchase and construction of new dwellings to price update (rather than an average house price indicator based on building consents and value of building work put in place data), as the CPI index provided more plausible results over that time period.

Notes:

1. For the purposes of deriving the CPI expenditure weight for purchase of housing, households that held the homes they occupy in family trusts were treated as being owner-occupiers (even though this might not be true in a strict legal sense).
2. Expenditure by landlords on, or relating to, the properties they rent out is not included in the CPI.

4.03 Rentals for housing weights

To provide consistency with purchase of housing, the 2006 expenditure weight of rentals for housing was estimated from data for the three years to June 2004.

Administrative data for the three years to June 2004 was used to estimate the expenditure weight allocated to Housing New Zealand² dwellings. Figures for each of the three years to June 2004 were expressed in 2003/04 prices, averaged, then price updated to the June 2006 quarter using the CPI pricing indicator for Housing New Zealand properties.

As noted above, a range of information was used to extrapolate tenure proportions beyond the 2001 Census of Population and Dwellings. These rates were applied to Statistics NZ's time series estimates of the total number of dwellings (included in household estimates by tenure statistics) to derive time series estimates of the number of households renting non-Housing New Zealand dwellings. These households were classified by number of bedrooms, using ratios from the 2001 Census of Population and Dwellings. To estimate expenditure, the resulting figures were multiplied by corresponding average prices from the CPI rented-dwellings collection. These average prices excluded Housing New Zealand properties.

Figures for each of the three years to June 2004 were expressed in 2003/04 prices, averaged, then price updated to the June 2006 quarter. In dollar-value terms, the price-updated expenditure weight of rentals for housing is slightly lower (by about 3.4 percent) than it would have been if based solely on the 2003/04 Household Economic Survey.

² Housing New Zealand is a central government agency that provides low-rent dwellings to low-income households.

The 2006 expenditure weight of rentals for housing was 6.87 percent. This compares with a 2002 expenditure weight for rented dwellings of 5.48 percent.

Using information for the three years to June 2001, the 2006 method was used to estimate an alternative 2002 expenditure weight for rented dwellings. The resulting alternative 2002 expenditure weight was 6.62 percent, compared with the 2006 expenditure weight of rentals for housing of 6.87 percent. Two of the reasons for the alternative 2002 rented dwellings weight of 6.62 percent being higher than the original weight of 5.48 percent are:

- The lower alternative weight for purchase and construction of new dwellings increased the relative weight of remaining goods and services in the basket. This added nearly a quarter of a percentage point to the weight for rented dwellings.
- The original 2002 weight for rented dwellings was based on 2001 Census of Population and Dwellings figures for the number of households renting non-Housing New Zealand dwellings. However, estimates of the number of households renting non-Housing New Zealand dwellings used to calculate the alternative 2002 rented dwellings weight (and the 2006 weight) were based on household estimates by tenure statistics. These figures for the March 2001 quarter were higher than those from the 2001 Census, mainly because they include estimates of the net 2001 Census undercount, and the estimated number of households temporarily elsewhere in New Zealand or overseas on census night.

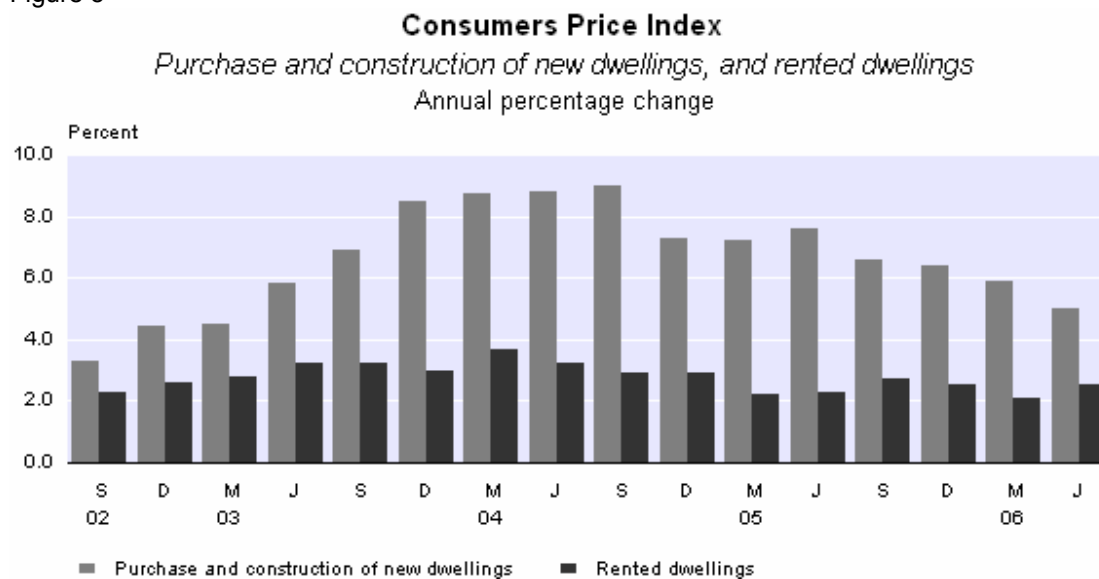
Note: Educational accommodation is included in rentals for housing under the NZHEC classification system, whereas it was included in the accommodation and board section within the old classification system's leisure and recreation subgroup.

4.04 Analytical index time series using alternative housing weights

The alternative 2002 expenditure weights for purchase and construction of dwellings and for rented dwellings have been used to construct analytical housing and all groups index time series from the June 2002 quarter to the June 2006 quarter.

Figure 5 shows that dwelling construction prices increased at a considerably greater rate than dwelling rental prices during this period.

Figure 5



Dwelling construction prices increased by a total of 30.0 percent from the June 2002 quarter to the June 2006 quarter, compared with smaller increases of 11.7 percent for rented dwellings and 11.1 percent for all groups. The strong increase in dwelling construction prices during the period, relative to the remainder of the CPI, has a smaller impact on the housing group and all groups indexes if the alternative weight for purchase and construction of new dwellings is used, as the alternative weight (4.60 percent) is considerably lower than the original weight (8.48 percent).

Table 3 shows that the analytical all groups series constructed using the alternative housing weights was 8 index points lower than the all groups CPI at the June 2006 quarter. Over the four-year period, the analytical series increased by a total of 10.4 percent, compared with a total of 11.1 percent for the all groups CPI.

Table 3

Consumers Price Index
All groups and all groups with alternative housing weights – index numbers
Base: June 1999 quarter (=1000)

June quarter	All groups	All groups (with alternative housing weights)	Index points difference
2002	1082	1082	0
2003	1098	1097	1
2004	1124	1119	5
2005	1156	1149	7
2006	1202	1194	8

Figure 6 shows that the gap between the all groups CPI and the analytical all groups series grew over time, reflecting relatively strong growth in dwelling construction prices throughout the four-year period.

Figure 6

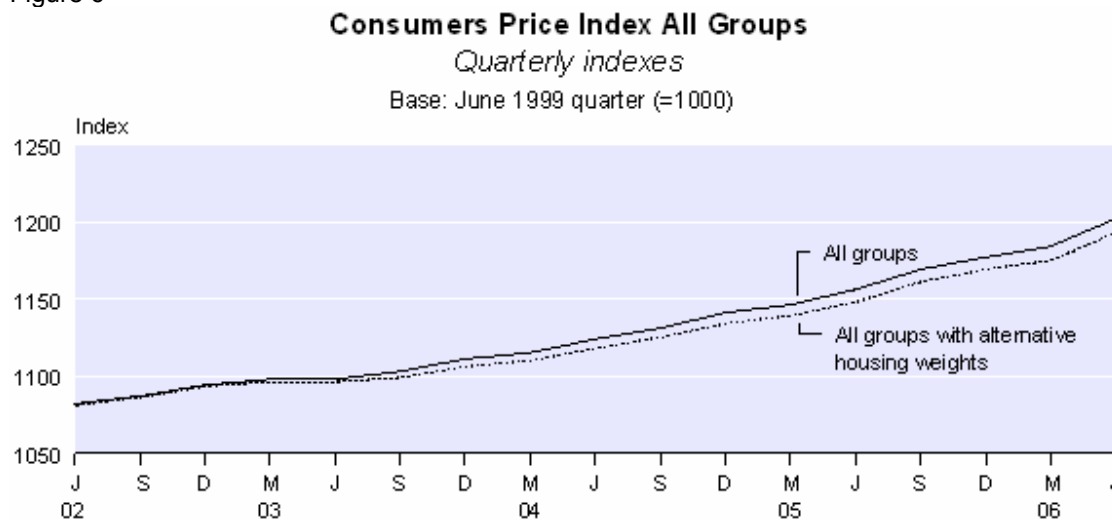
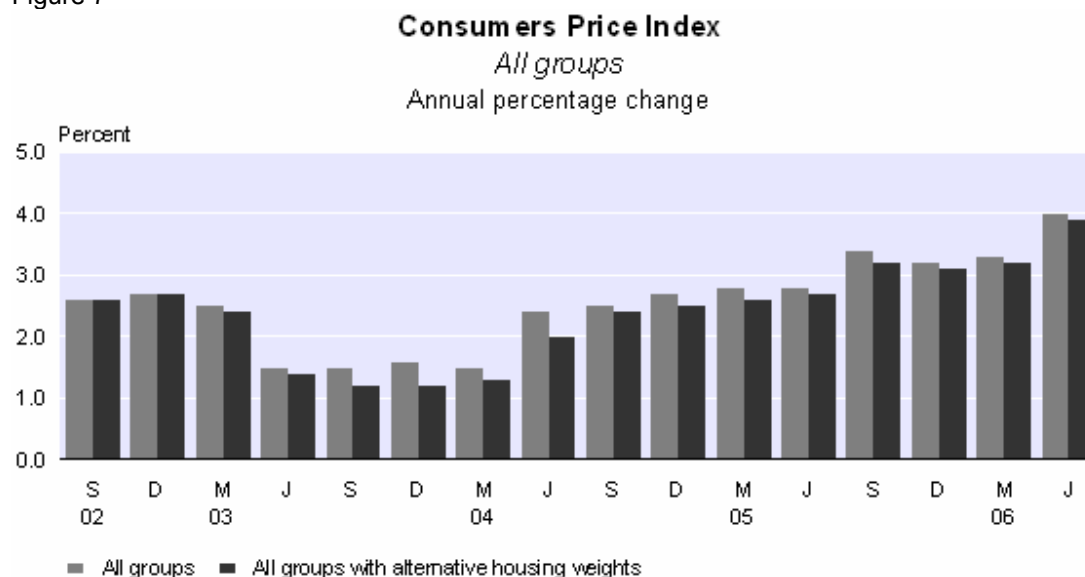


Figure 7 shows differences in annual movements during the period. These differences ranged from no difference up to 0.4 of a percentage point.

Figure 7



Differences were greatest during the period from the September 2003 quarter to the June 2004 quarter. Subsequent differences were of 0.1 or 0.2 of a percentage point. Annual all groups CPI movements rose above 3.0 percent³ towards the end of the four-year period, for the four quarters from the September 2005 quarter to the June 2006 quarter. For each of these quarters, the annual movement of the analytical series with alternative housing weights was also above 3.0 percent.

As would be expected, the use of alternative weights for purchase and construction of new dwellings and for rented dwellings had a bigger impact on the housing group than at the all groups level. Table 4 shows that the analytical housing series constructed using the alternative housing weights was 22 index points lower than the CPI housing group at the June 2006 quarter. Over the four-year period, the analytical housing series increased by a total of 22.2 percent, compared with a total of 24.3 percent for the CPI housing group.

Table 4

Consumers Price Index
Housing group and housing group with alternative weights – index numbers
Base: June 1999 quarter (=1000)

June quarter	Housing group	Housing group (with alternative weights)	Index points difference
2002	1045	1045	0
2003	1094	1091	3
2004	1172	1161	11
2005	1239	1220	19
2006	1299	1277	22

Figure 8 shows that the gap between the housing group series and the analytical housing series grew during the four-year period.

³ The Policy Targets Agreement between the Minister of Finance and the Governor of the Reserve Bank states that: "the policy target shall be to keep future CPI inflation outcomes between 1 per cent and 3 per cent on average over the medium term".

Figure 8

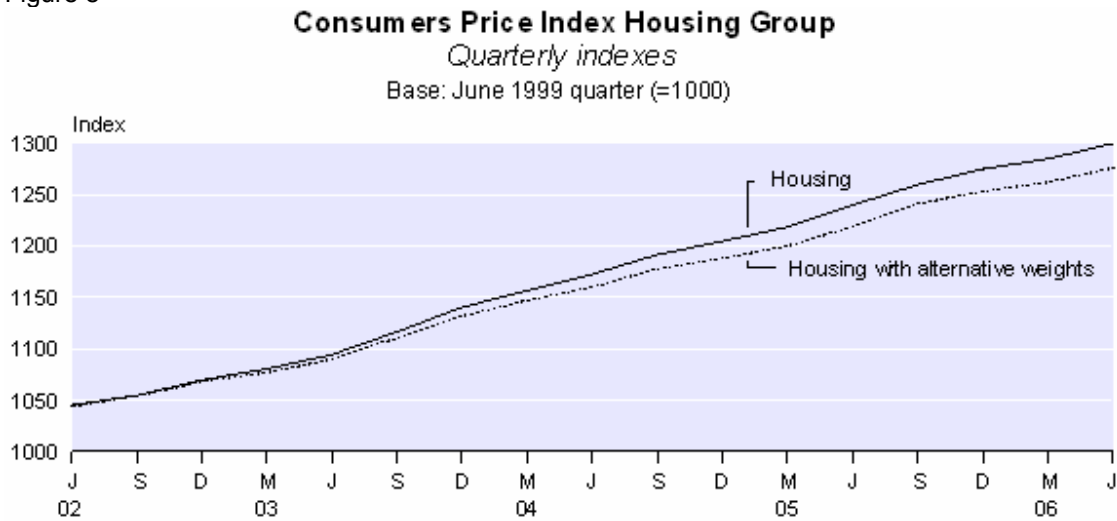
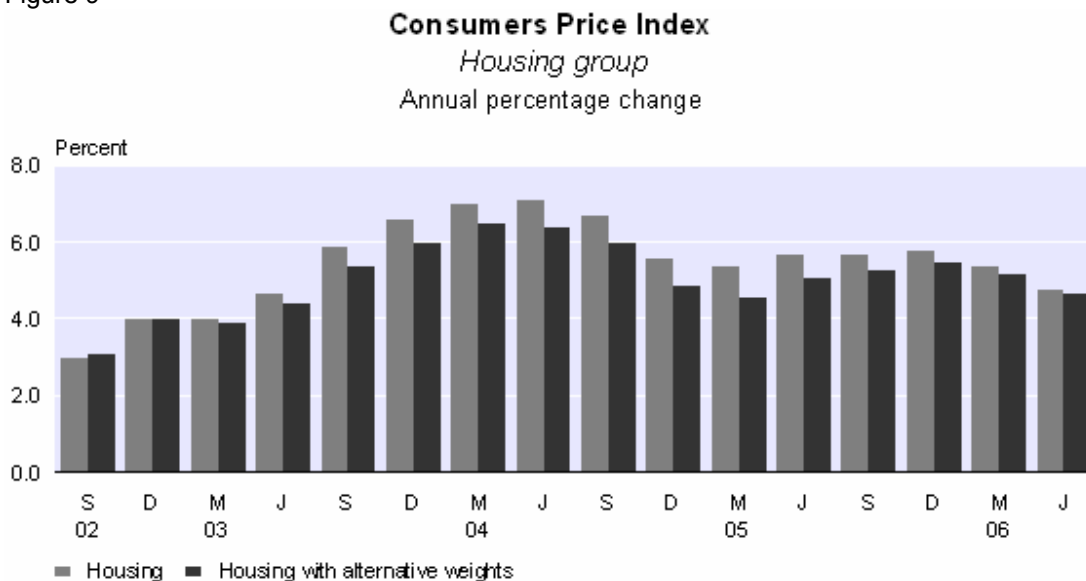


Figure 9 shows that, except for the September and December 2002 quarters, annual movements for the analytical housing series were lower than those for the housing group. During the period when annual movements for the analytical series were lower, the differences in annual movements ranged from 0.1 up to 0.8 of a percentage point.

Figure 9



5. Conclusion

Statistics NZ published the analytical time series presented in this paper to provide users with an indication of the impact on the CPI of both item substitution and changes to the methods used to compile housing-related expenditure weights.

The seasonally unadjusted CPI all groups index, calculated using a fixed-weight Laspeyres formula, rose by an annual average rate of 2.7 percent from the June 2002 quarter to the June 2006 quarter, compared with 2.4 percent for the Fisher index. After accounting for changes between 2002 and 2006 in the way

that the housing-related expenditure weights were calculated, the Laspeyres index rose by an annual average rate of 2.5 percent during the period compared with 2.3 percent for the Fisher index, a difference of a little under 0.2 of a percentage point per year. This result is broadly consistent with international studies, which have found the difference between superlative and Laspeyres CPI indexes to be between about 0.1 and 0.2 of a percentage point per year in inflation rates.

The alternative 2002 housing-related weights were used to calculate an analytical all groups CPI series. The resulting analytical series increased by 10.4 percent from the June 2002 quarter to the June 2006 quarter, compared with 11.1 percent for the all groups CPI. Differences in annual movements during the period ranged from no difference up to 0.4 of a percentage point. Annual all groups CPI movements rose above 3.0 percent towards the end of the four-year period, for the four quarters from the September 2005 quarter to the June 2006 quarter. For each of these quarters, the annual movement of the analytical series with alternative housing weights was also above 3.0 percent.

A retrospective superlative index covering the period from the June 2006 quarter to the June 2008 quarter will be compiled after the next CPI reweight in 2008. In the interim, Statistics NZ plans to use available information to keep the weights below the class level of the NZHEC classification up to date.

When the CPI was reweighted in 2006, expenditure information from the 2003/04 Household Economic Survey and other sources was price updated to the price-reference period of the June 2006 quarter. The effect of price updating, recommended for CPIs by the ILO and common international practice, was to express the underlying 2003/04 quantities in the prices of the June 2006 quarter price-reference period. In general, the indicators used to price update the weights were the lower-level CPI indexes corresponding to the goods and services in the new basket.

By holding underlying weight reference period quantities fixed, price updating assumes that households do not react to changes in relative prices by reducing purchases of goods and services showing higher relative price change, and instead buy more of those showing lower relative price change. For some types of goods and services, the approach of holding quantities fixed might best reflect household behaviour, but for other goods and services the alternative approach of not price updating (ie holding expenditure shares fixed and letting quantity shares vary) might better reflect household behaviour. Statistics NZ plans to undertake further research on this issue, by compiling analytical time series based on 2003/04 expenditure weights that are not price updated to reflect subsequent price change.

6. Reaction from users

Statistics NZ's intention to publish a retrospective superlative CPI had been well signalled in advance. Publication of the retrospective superlative index results met a recommendation made – and published – in 2004 by the CPI Revision Advisory Committee. Imminent publication of the retrospective superlative index was also flagged in the 2006 CPI review information paper published in September 2006 (Statistics New Zealand, 2006).

When updated expenditure weights were published in September 2006 as part of the 2006 CPI review, there was interest and comment on the substantial reduction in the relative weight assigned to purchase of housing. Much of the interest was about how the index would have tracked had the new method used to calculate the 2006 weight been used at the previous reweight in 2002. Given the interest in the impact of the change in method and, coincidentally, the impact that the change had on the retrospective superlative index results, Statistics NZ decided to address both issues at the same time.

The results presented earlier in this paper were first published in February 2007 as an information paper (Statistics New Zealand, February 2007), to provide users with an indication of the impact on the CPI of both item substitution and changes to the methods used to compile housing-related expenditure weights. The paper, with minor additions (Statistics New Zealand, June 2007), was also presented at a well-attended session at the New Zealand Association of Economists conference in June 2007.

Releasing information of the type included in the February 2007 paper provided an opportunity for Statistics NZ to be open and transparent, to keep users well informed, and to help them better understand the CPI and its measurement limitations. It also involved some potential risks, such as having an adverse impact on the perception or credibility of the CPI.

To date, known reaction from users has been relatively low key and largely positive. There have not been any strongly negative comments that have required damage control of any kind. The February 2007 paper generated interest in – and discussion on – the impact of the large price decreases and associated large volume increases within the audio-visual equipment class. As a result, Statistics New Zealand is currently investigating whether there is a case for updating the regimen and weights of the Retail Trade Survey Deflators (Statistics New Zealand, quarterly I) for appliance retailing and for department stores, two industries that sell audio-visual equipment.

References

- Briggs, Phil (2006). *Family trusts: ownership, size, and their impact on measures of wealth and home ownership*. Reserve Bank of New Zealand, Wellington.
http://www.rbnz.govt.nz/research/discusspapers/dp2006.html#P29_2861
- Department of Statistics (1992). *1991 Census of Population and Dwellings National Summary*. Department of Statistics, Wellington.
- Ho, Ricky (2006). *New Goods and the CPI: An Empirical Analysis on the Impact of When New Goods Are Introduced into the Index*. Paper presented at the 2006 New Zealand Association of Economists conference, Wellington. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/about-us/events/nzae-conference-2006.htm>
- Statistics New Zealand (1996). *1996 Census of Population and Dwellings – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/1996-census.htm>
- Statistics New Zealand (2001). *2001 Census of Population and Dwellings – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/2001-census.htm>
- Statistics New Zealand (2004a). *Report of the Consumers Price Index Revision Advisory Committee 2004*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/developments/2004-cpi-revision.htm>
- Statistics New Zealand (2004b). *Household Economic Survey – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/hes-info-releases.htm>
- Statistics New Zealand (2006). *Consumers Price Index Review*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/NR/rdonlyres/B7CF79EA-FCAB-4CA3-AE38-409BBF0F51F4/0/ConsumersPriceIndexReviewSeptember2006.pdf>
- Statistics New Zealand (February 2007). *Consumers Price Index: Retrospective Superlative Index and Impact of Alternative Housing Weights*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/developments/price-index-developments/cpi-retro-superlative-index.htm>
- Statistics New Zealand (June 2007). *Consumers Price Index: Retrospective Superlative Index and Impact of Alternative Housing Weights*. Paper presented at the 2007 New Zealand Association of Economists conference, Christchurch. Statistics New Zealand, Wellington.
- Statistics New Zealand (monthly). *Building Consents Issued – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/building-consents-issued.htm>
- Statistics New Zealand (quarterly I). *Retail Trade Survey – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/rts-info-releases.htm>
- Statistics New Zealand (quarterly II). *Dwelling and Household Estimates*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/additional-information/dwel-hhold-estimates>
- Statistics New Zealand (quarterly III). *Value of Building Work Put in Place – Information releases*. Statistics New Zealand, Wellington.
<http://www.stats.govt.nz/products-and-services/info-releases/value-of-building-info-releases.htm>

Appendix – Price Index Formulae

The **Laspeyres** price index formula, expressed in terms of expenditure weights and price relatives is:

$$P_L = \frac{\sum_{i=1}^n w_{i0} \left(\frac{p_{i1}}{p_{i0}} \right)}{\sum_{i=1}^n w_{i0}}$$

The **Paasche** price index formula, expressed in terms of expenditure weights and price relatives is:

$$P_P = \frac{\sum_{i=1}^n w_{i1}}{\sum_{i=1}^n w_{i1} \left(\frac{p_{i0}}{p_{i1}} \right)}$$

The **Fisher** price index is the geometric mean of the Laspeyres and Paasche price indexes:

$$P_F = \sqrt{P_L \times P_P}$$

The **Tornqvist-Theil** price index is a weighted geometric mean of price relatives, with the weights being the arithmetic mean of expenditure shares in periods 0 and 1:

$$P_T = \prod_{i=1}^n \left(\frac{p_{i1}}{p_{i0}} \right)^{\left(\frac{s_{i0} + s_{i1}}{2} \right)}$$

The **Walsh** price index formula, expressed in terms of expenditure shares and price relatives is:

$$P_W = \frac{\sum_{i=1}^n (s_{i0} s_{i1})^{(1/2)} \left(\frac{p_{i1}}{p_{i0}} \right)^{(1/2)}}{\sum_{i=1}^n (s_{i0} s_{i1})^{(1/2)} \left(\frac{p_{i0}}{p_{i1}} \right)^{(1/2)}}$$

Where:

P_L = Laspeyres price index

P_P = Paasche price index

P_F = Fisher price index

P_T = Tornqvist-Theil price index

P_W = Walsh price index

w_{i0} = expenditure weight of the i th good or service for the base period 0

w_{i1} = expenditure weight of the i th good or service for the current period 1

s_{i0} = expenditure share of the i th good or service for the base period 0

s_{i1} = expenditure share of the i th good or service for the current period 1

p_{i0} = price or index number of the i th good or service for the base period 0

p_{i1} = price or index number of the i th good or service for the current period 1