Retail Discounting in New Zealand

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Abstract

This paper uses a comprehensive and sector-level dataset compiled by Statistics New Zealand for the period 2004 – 2009 to characterize the cyclical properties of retail discounting and to quantify its relevance for inflation dynamics. It documents the extent discounting varied over time and by sector and shows that while discounting was a regular occurrence for 30 percent of the items by weight in the CPI, it occurred rarely for 50 percent of the items. While discounting was more frequent in the contractionary rather than the expansionary part of the cycle, and while changes in the frequency of discounting were very persistent, at most fewer than ten percent of the prices in the CPI were discounted. Since quarterly changes in the level of discounting were typically responsible for only a 0.1 percent change in the CPI, discounting appears to be of only modest importance in explaining macro–level changes in the price level.

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1. Introduction

For over two centuries, economists have argued that the frequency with which firms adjust prices is a key factor in determining how economic shocks affect the level of output (Hume, 1752). In the last two decades, the availability of new datasets has enabled researchers in many countries to document that firms vary substantially in the frequency that they alter their prices. In the United States, for instance, some 25-30 percent of firms change prices every month, but the average duration between price changes is six or seven months because a sizeable fraction of firms adjust their prices less than once every two years. (Bils and Klenow, 2004; Klenow and Kryvstov, 2008). Similar patterns are evident in Europe, Canada, and New Zealand, although prices are somewhat stickier in Europe (Amirault *et al.* 2004, Dhyne *et al.* 2006, Coleman and Silverstone 2008). The difference in the frequency of price adjustment across sectors is systematically related to the extent output fluctuates in response to monetary shocks, with more flexible sectors experienced less output changes when monetary policy is altered. (Boivon, Giannoni and Mihov 2009).

One reason why firms vary in the frequency that they change prices is that many firms use temporary discounts as part of their price setting strategy. Rather than have a single price, these firms choose a price schedule comprising a reference price and a series of discounted prices. Firms temporarily discount prices on a regular basis as a means of price discrimination (Pesendorfer 2002). Even if firms only alter their overall price schedule occasionally, variation within the price schedule means the observed price is frequently altered.

Nakamura and Steinsson (2009) analysed the extent that United States firms offer temporary discounts, using the individual store and item prices used by the Bureau of Lbour Statistics to calculate the United States Consumer Price Index. They showed that temporary discounts comprised a large fraction of all price changes, but that the use of discounting as a price strategy varied substantially by sector. The items that were most frequently discounted were in the food, clothing, and household furnishing sectors, while items in utilities, fuel, and transportation goods sectors were only rarely discounted. While this study answered many questions about the economy wide use of discounts, and the effect of discounting on the measured inflation rate, many questions remain. As Klenow and Malin (2010) conclude in their review of the literature, it remains unclear how much the frequency of discounting depends on macroeconomic shocks, and whether discounting should have an important role in macroeconomic models.

This paper attempts to shine additional light on these questions using a comprehensive dataset especially produced by Statistics New Zealand that measures the extent of discounting in New Zealand between 2004 and 2009. The dataset measures the CPI-weighted fraction of items that were subject to discount each quarter, for the whole CPI index, 11 groups and 43 subgroups. While the period is short, it is of some interest as the New Zealand economy moved from a strongly expansionary phase to a contractionary phase during this time.

We use the data to document the extent of discounting in the CPI, to estimate how the amount of discounting varies over the cycle, and to estimate the average size of discounts. The pattern of discounting is similar to that in the U.S., with the level varying from 5 – 8 percent over the period. Although the short length of the series means strong conclusions cannot be offered, in part because changes in the quantity of temporary discounting are very persistent, the amount of discounting appears to be systematically related to the state of the cycle, increasing as the boom ended and the economy went into recession. Our estimates suggest that approximately 70 percent of the change in discounting that took place over the period can be attributed to cyclical factors. Our evidence is quite strong on one point, however. The overall amount of discounting in the economy, in conjunction with the average size of the discounts, means that discounting only has a modest affect on changes in the Consumer Price Index. The increase in the amount of discounting over the whole five year period only caused a 0.7 percent reduction in the CPI, a small fraction of the annual 3 percent inflation rate, while on average quarterly changes in the level of discounting are only responsible for 0.1 percent movements in the CPI.

2. Data

For the last few years, the forms used by Statistics New Zealand to collect price data for the Consumer's Price Index has a place where the collectors indicate whether or not the price is subject to a temporary discount or "on special". In general, a price is considered on special if it is available on special to all customers, but not if a customer has to negotiate a discount with the salesperson.[1] In addition, sales prices that occur because an item is to be discontinued are generally not recorded as discounted prices.

On our request, Statistics New Zealand compiled these data into a weighted index of the fraction of items that are subject to a temporary discount. This FTD (fraction temporarily discounted) index can range from zero to one. The weights are the same as the weights used to compile the CPI, and thus the FTD index can be directly interpreted as the fraction of the items by value that are "temporarily discounted" in any particular quarter.[2] The FTD index has been calculated for each quarter from September 2004 to September 2009. All items are covered, with the exception of fresh fruit and vegetables, motor fuels, and package holidays.[3] In addition to the main index covering all items in the CPI, a FTD index is calculated for all 11 groups and 44 subgroups of the consumer price index. The indices for the five food subgroups whose prices are collected monthly (fruit and vegetables, meat, poultry and fish, grocery items, non-alcoholic drinks, and restaurant meals and takeaway food) are available monthly from May 2004 to August 2009.

[1] There are some exceptions to this rule, for instance when a store offers discounts to customers with a loyalty card and Statistics New Zealand can estimate the fraction of customers with these cards.
[2] We refer to the FTD number as an index as it is calculated in the same way as the consumer price index is calculated, except the prices are replaced with a "1" or "0" depending on whether or not they are temporarily discounted.
[3] These three groups account for just under 5 percent of the CPI, meaning 95% of the index is covered.

3. Basic Statistical Patterns

3.1 The All Groups FTD Index

Figure 1 shows the all groups FTD index from September 2004 to September 2009. The index increases steadily over the period, from 5.5 percent to 8.2 percent. As discussed below, during the period the economy went from an expansionary to a contractionary phase, and there is evidence that the increase in the index over the period is associated with the economic cycle. The sample mean of the index is 6.6 percent, with a standard deviation of 0.9 percent. The mean value is similar to the value reported in Nakamura and Steinsson (2010) of the fraction of items on temporary discount in the U.S. between 1998 and 2005, 7.4 percent.[4] As discussed below, the similarity of the average amount of discounting in the two countries reflects similarity in the amount of discounting in each sector, rather than differences in the weights. The standard deviation of the quarterly change in the index is 0.34 percent.

The length of the series is sufficiently short that the serial correlation properties of the series are uncertain, but the evidence suggests that changes to the level of discounting are persistent. The all groups FTD index has a clear upward trend over the period, as the economy went from a boom to a deep recession, and the unusual length of the downturn may mean the sample autocorrelations are larger than their true values.[5] The sample first order autocorrelation coefficient is 0.98, with a standard error of 0.10. When the series is differenced, the estimated first order autocorrelation coefficient is –0.26, but insignificantly different from zero at a five percent level (see Table 1). If one includes a time trend, the first order autocorrelation coefficient is reduced to a statistically insignificant 0.32, indicating that over the period the movements in the FTD index are sufficiently persistent to be approximated by a time trend. This evidence all suggests that changes in the level of discounting are not quickly reversed.

3.2 Discounting by subgroup.

Tables 2a and 2b shows the amount of discounting by the 11 major groups and 43 subgroups of the CPI.[6] Overall, the sectors with the highest average amount of discounting were food (21%) household contents and services (14%), and alcoholic beverages and tobacco (9%). Housing and household utilities, health, education and transport, sectors that comprise 48% of the CPI, were recorded to have zero or minimal levels of discounting.

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[4] As the U.S. data exclude the housing group, discounting is actually slightly more prevalent in New Zealand. Excluding the housing group, which have a 20 percent weight in the CPI, and noting the three excluded sectors comprise a further 5 percent of the CPI, on average 8.7 percent of prices were discounted in New Zealand.

[5] To see this point, we note that the estimate of the first order serial correlation of the RBNZ output gap estimated using quarterly data (which we use below) over the period 1992 – 2010 is 0.89, whereas the estimate for the period 2004 – 2009 is 1.05, reflecting the persistence of output fluctuations over this short period. If the amounting of discounting is systematically related to the output gap, an estimate of the first order autocorrelation of the FTD estimated over the 2004-2009 period may be higher than the true value.

[6] There are only two years' data for the 44th subgroup, education fees, which is omitted.

Table 2b provides more detail. The table presents the subgroups in order of their average FTD index. There were 5 subgroups that had average FTD indices in excess of 20 percent over the period. These subgroups, primarily different food groups, comprised 12.8 percent of the CPI. There were a further 8 subgroups that had average FTD indices between 10 and 20 percent. These subgroups, primarily household appliances and other household items, comprised 15.6 percent of the CPI. At the other end of the scale, 20 subgroups comprising 44 percent of the CPI had FTD indices less than 1 percent. Of this group, 9 subgroups comprising 8% of the CPI were never recorded as offering discounts (eg hospital, education, insurance, and postal services) and 4 subgroups comprising a further 15 percent of the CPI offered discounts so rarely that the maximum FTD index in any quarter never exceeded 0.2% (eg rents and property rates).

These figures are similar to those observed in the United States. The biggest difference concerns the clothing subgroup: the New Zealand data suggest that clothing is rarely discounted, whereas U.S. data suggests it is frequently discounted. The difference possibly reflects differences in the way the data are calculated, as end-of-line sales prior to goods being discontinued are recorded as sales in the U.S. but not in New Zealand.

The subgroups can also be sorted by the standard deviation of the FTD indices. Seven subgroups comprising 8 percent of the CPI had standard deviations in excess of 3 percent; all except one were household appliances or items such as floor coverings, audio-visual equipment, or tableware. It appears that even though food items are the most frequently discounted on average, the level of discounting varies most in the household contents and services sector. Eight subgroups comprising a further 20 percent of the CPI, including the three food subgroups with the highest average level of discounting, had a standard deviation between 2 and 3 percent. Subgroups comprising 51 percent of the CPI had a standard deviation less than 1 percent; all of these subgroups had average levels of discounting less than 1 percent as well, confirming that approximately half of the subgroups in the CPI are discounted very rarely.

In addition to having high variability, subgroups in the household contents group tended to have greater cyclicality, experiencing considerably larger increases in the amount of discounting as the economy deteriorated in 2008 in 2009. For example, the FTD index for furniture and home furnishings increased from 8 percent to 23 percent over the cycle, whereas the amount of discounting in the sector with the highest average quantity of discounting, fruit and vegetables, increased only from 33 to 42 percent.

4. The cyclical pattern of price discounting.

The extent that retailers change the frequency that they discount over the economic cycle is not yet properly understood (Klenow and Malin, 2010). To investigate the extent that discounting increases over the economic cycle, we regressed the FTD index against two measures of the state of the cycle, the output gap and the unemployment rate. Two sets of regressions were estimated. In the first set, we examined how the FTD index depended on output gap. In the second set, we analyse

whether the FTD index could be used to predict the output gap. The measure of the output gap is that used by the Reserve Bank of New Zealand in May 2011. This measure decreased by 6 percentage points during the period, from 3.8 in June 2006 to –2.3 in September 2009. The unemployment rate is the official measure from the Household Labour Force Survey. It proved not to be a significant explanatory variable, and the results of these regressions are not reported. The relationships between the output gap and the fraction of temporary discounts were calculated for the all groups index, and also for the Food, the Alcohol and Tobacco, and the Household Contents and Services groups.

We estimated how the output gap affected the FTD index using the Cochrane-Orcutt model because of the serial correlation in the FTD series:

$$f_{it} = \alpha_{i0} + a_{i1} Y^{g}_{t} + e_{it} \qquad e_{it} = \rho_i e_{it-1} + u_{it} \tag{1}$$

where f_{it} is the FTD index of the ith group

Y^{g}_{t} is the output gap.

A two-stage feasible generalized least squares estimator was used. Because the estimates of ρ_i were high, the differenced regression was also estimated:

$$\Delta f_{it} = \beta_{i0} + \beta_{i1} \Delta Y^{g}_{t} + v_{it} \tag{2}$$

The results of these regressions are presented in Table 3a.

In the best regression, for the Alcohol and Tobacco group (which is dominated by the alcohol subgroup), the estimate for ρ is small and statistically insignificant, and the estimate for α_1 is –0.85 with a standard error of 0.08. This is clear evidence that the quantity of discounting is affected by the cycle: in fact, three quarters of the increase in discounting over the period can be explained by the deterioration in the output gap.[7] In the Food group, the estimate for α_1 is –0.75 with a standard error of 0.16, and the estimate for ρ is 0.52 (0.18). This suggests that 70 percent of the 6.4 percentage point increase in the Food FTD index over the period can be attributed to the economic cycle, a figure similar to the Alcohol and Tobacco group. The results for the other regressions are less clear, however, due to the short series and the high level of serial correlation. In the Household Contents group, the estimate for α_1 is –0.91 with a standard error of 0.40, and the estimate for ρ is 0.67 (0.15), closer to one than zero. In the All groups regression, the estimate for β_1 is –0.31 with a standard error of 0.09, and the estimate for ρ 0.74 is (0.14). The high levels of serial correlation in these regressions suggest that there are important explanatory variables for the level of the discounting that have been omitted, raising questions as to the accuracy of the output gap coefficients. Nonetheless, it is noticeable that the spot estimate of α_1 for the All Groups regressions also suggests that 70 percent of the increase in the FTD index can be attributed to the decline in the output gap.

In the second set of regressions, we analysed whether the FTD index could be used to estimate the output gap. In particular, we estimated if the FTD index provided information additional to that already used by the Reserve Bank of New Zealand in real time to estimate the output gap: to do this, we regressed the May 2011 measure of the output gap against the Bank's historic real-time estimates of the output gap and the FTD index:

[7] The FTD index increased from 6.6 to 13.2, of which (-0.85 times -6.1) can be attributed to the 6.1 deterioration of the output gap.

$$Y_t^g = \lambda_{i0} + \lambda_{i1}\hat{Y}_t^g + \lambda_{i2} f_{it} + e_{it}' \qquad e_{it}' = \rho_i' e_{it}' + u_{it}' \tag{3}$$

where $\hat{Y}_t^g$ is the real-time estimate of the output gap.

The results are in Table 3b. Despite high levels of serial correlation, the results are quite clear: none of the FTD indices was a statistically significant explanatory variable, and thus they do not appear useful for improving the real-time estimates of the output gap. In each case the coefficients of the real-time output gap were very close to 1, indicating that the real-time output gap is a reliable (but not sufficient) indicator of the actual output gap.

5. The size of discounts.

5.1 Regression estimates of the average size of the discount

Statistics New Zealand only collects the actual price of an item, not the usual price of an item. It thus does not collect information that can be used to directly calculate the size of discounts. Nonetheless, it is possible to estimate the average size of discounts indirectly by comparing the quarterly change in the CPI for a subgroup with the quarterly change in the FTD index.

Let P_{it}^R = average reference or pre-discounted price in sector *i* at time t;

P_{it} = average observed price in sector *i* at time t;

f_{it} = fraction of goods in sector *i* discounted at time *t* (the FTD index*)*;

δ_{it} = the average discount of discounted goods in sector *i* at time t.

Then

$$P_{it} = P_{it}^R (1 - f_{it}\delta_{it}) \tag{4}$$

and

$$\begin{aligned} \Delta \ln(P_{it}) &= \Delta \ln(P_{it}^R) + \Delta \ln(1 - f_{it}\delta_{it}) \\ &\cong \Delta \ln(P_{it}^R) + \bar{\delta}_i \Delta f_{it} + \bar{f}_i \Delta \delta_{it} \end{aligned} \tag{5}$$

where $\bar{f}_i$ and $\bar{\delta}_i$ are the sector's time-averaged fraction of items discounted and discount size respectively. The average discount in the i^{th} subgroup can thus be estimated from the following regression:

$$\Delta \ln(P_{it}) = \gamma_{i0} + \gamma_{i1}\Delta\theta_{it} + \gamma_{ij} X_{it}^j + e_{it} \tag{6}$$

where X_{it}^j is a vector of pertinent explanatory variables that are a proxy for $\Delta \ln(P_{it}^R)$. The coefficient γ_{i1} is an estimate of the average discount $\bar{\delta}_i$ in the subgroup. As the term $\Delta\delta_{it}$ is not directly measured, it is part of the error term; however, we have some evidence below that the size of the discount neither has a strong time trend nor is strongly cyclical, so its omission should not bias the estimates of the coefficients. We estimate the results when (i) no additional explanatory variables are included and (ii) we use the quarterly change in the Australian CPI subgroup as an explanatory variable

for the quarterly change in the New Zealand reference price, $x_{it}^{j} = \Delta \ln(CPI_{it}^{AU})$. The change in Australian prices is used because Australian and New Zealand price movements are highly correlated in the medium term. In principle, it will be a useful addition to the regression if it is correlated with the change in the New Zealand subgroup reference price index, but not correlated with the subgroup FTD index. In practice, adding the Australian price movement made little difference to the regression. The regression is estimated for all twenty three subgroups for which the estimated standard deviation of the FTD index is greater than 1 percent, as well as the all groups index.

Table 4 presents the results when the Australian price change was included in the regressions. Given the short length of the series, the regressions have only eighteen degrees of freedom. The regression for the all groups index has a slope of –0.25, but the coefficient is not statistically significant. The results for the individual sectors are more accurately estimated, however, particularly the household contents sectors that had the most variable FTD series. Of the twenty three subgroups, twenty had negative coefficients of which 15 were significant at the ten percent level, 12 were significant at the five percent level, and 7 were significant at the 1 percent level. Not one of the three positive coefficients were statistically significant at the ten percent level. Overall, the weighted average coefficient was –0.16, but the weighted mean and median coefficients of the 15 coefficients that were sufficiently accurately estimated that they were statistically significant at the ten percent level were –0.32 and –0.25. Collectively, this evidence suggests that the average size of a discount is large, approximately 25 percent.

It is of course possible that the estimated relationship between the change in the subgroup price index and the change in the FTD index reflect the common effect of a third variable. For instance, both the price index and the FTD index could depend on the state of the economic cycle. To allow for this possibility, we also included the output gap in the regressions. While the variable was a statistically significant explanatory variable in half of the 23 subgroup regressions, it had very little effect on either the size or the standard error of any of the other estimated coefficients. Thus it appears unlikely that the relationship merely reflects the common effect of the economic cycle. These results are interesting for another reason, however. For six subgroups, the output gap had a statistically significant effect on price changes even though changes in the level of discounting had little observable effect on prices. In these cases, the relationship between the output gap and prices occurred through a mechanism other than discounting. In another six cases the output gap had no effect on prices additional to that caused by changes in the level of discounting, while in a further six both the output gap and the level of discounting were significant factors determining price changes. Overall, therefore, the relationship between the economic cycle and price changes is complex, sometimes occurring through changes in the level of discounting and sometimes occurring through other mechanisms.

The positive coefficients, while not significantly different from zero, are curious. The coefficient for fruit and vegetables (excluding fresh fruit and vegetables) is quite large, which makes little sense unless there is a tendency for retail outlets to increase the level of discounting in response to an increase in prices as a means of tempering the price increase. If the level of discounting does depend on the level of prices in this manner, the estimated coefficients will suffer simultaneity bias.

5.2 The size of discounts over time

The above analysis estimates the average discount in different sectors over the period, but cannot indicate whether the size of the discount varied over time. To analyse this question, Statistics New Zealand provided us with additional information on eleven individual items such as a particular brand of chocolate biscuits, or dishwasher detergent. In particular, they provided the average price of items that were temporarily discounted, the average price of items that were not temporarily discounted, and the average price overall. The ratio of the average price in stores where the item was discounted and the average price in stores where the item was not discounted is an estimate of the average discount. Note that this estimate will be biased if stores differ in both the frequency with which they discount and their average prices: for instance, if stores that frequently discount have lower average non-discounted prices than stores that do not, the average discount will be over-estimated. Details on the items, which were selected from a list of items whose average prices are regularly published by Statistics New Zealand, are listed in Table 4. The mean and median discount was 19 percent, similar albeit a little smaller to that estimated above. The estimated discounts in the individual series were very volatile.

The data are difficult to analyse formally because the weights on the sample of firms in the CPI changed in June 2006. The "before" and "after" measures of the average price in the firms that did and did not offer discounts in this quarter differed substantially for many of the goods; for instance, the average discounted price for beer changed from 6 percent below the non-discounted price to 20 percent below the non-discounted price, while the discounted price for whiskey decreased from 16 percent to seven percent below the non-discounted price.[8] While any attempt to estimate a trend in the average discount data has to take this break into account, the resultant series are very short. Regression analysis of the average discount over the 11 goods against a time trend, including a dummy to represent the break in the data, suggest while the measured average discount increased by approximately 4 percent in June 2006, there was not a statistically significant time trend over the whole period. If anything, the average discount increased between 2004 and 2006 before decreasing as the economy slipped into a recession.

While this evidence is weak, in conjunction with earlier results it suggests (i) the assumption that the term $\bar{f}_i \Delta \delta_{it}$ could be ignored in equation 3 is not obviously fallacious and (ii) the frequency of temporary price discounts changed much more than the size of these discounts over time.

6. Conclusion

This paper is the first systematic analysis of the macroeconomic role of discounting in New Zealand. While the strength of the conclusions is limited by the shortness of the data series, several results are apparent.

[8] These goods were selected for analysis due to their importance in the consumption baskets of several of the likely readers of this paper.

First, the paper provides support to the analysis by Nakamura and Steinssonn (2008) of U.S. data showing the extent that discounting varies by sector. Only 30 percent by weight of prices in New Zealand are regularly discounted, while 50 percent are almost never temporarily discounted. Discounting is most prevalent in the Food, Alcohol and Tobacco, and Household Contents and Services sectors as is the case in the United States.

Secondly, there is some evidence that the amount of temporary discounting is persistent and cyclical, increasing during recessions and declining during booms. The evidence is strongest for the Food and Alcohol sectors, where 70 percent of the change in temporary discounting over the period can be attributed to the changing state of the economic cycle.

Thirdly, while the size of discounts varies across sectors, the average size of discounts is about 20 – 25 percent. Our data are not sufficiently detailed to make strong conclusions about the variability of discounts through time, but we find no evidence that discounts were particularly cyclical or had time trends.

If the average discount is 25 percent, a one percent increase in the fraction of items temporarily discounted would reduce the price level by 0.25 percent. The standard deviation of the quarterly change in the all groups FTD index over the period was 0.34 percent, while the index itself varied over a 2.8 percent range over the period. This means that quarterly changes in the level of discounting on average only account for a 0.1 percent movement in the consumers price index, while over the economic cycle they were only responsible for a 0.7 percent movement. These movements are not particularly large, compared to the average inflation rate of 0.75 percent per quarter over the period in question. Consequently, it can be concluded that unless the average inflation rate were significantly lower – say 1 percent per annum –the macroeconomic economic significance of discounting is minimal.

Figure 1. The All groups FTD (fraction temporarily discounted) index, 2004-2009.

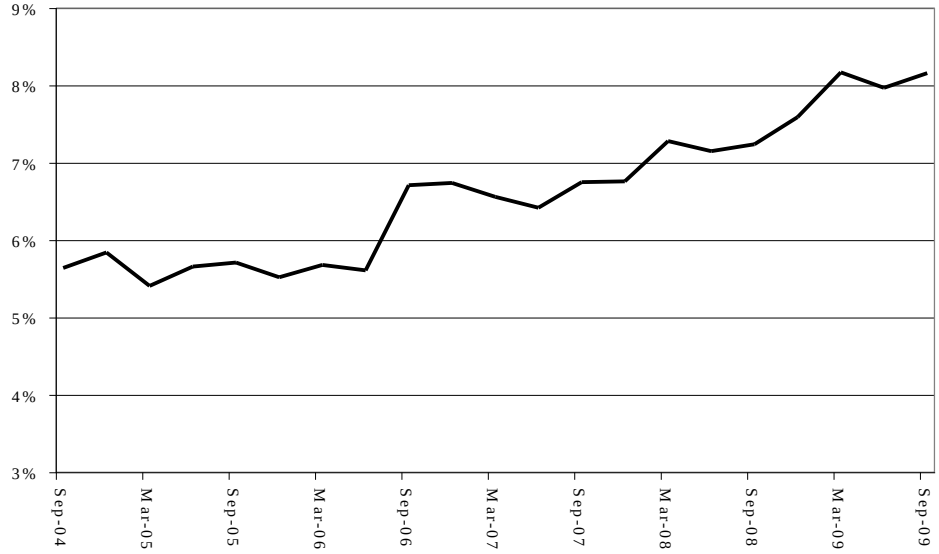

Table 1. Statistical properties of the FTD (all groups) series, 2004:3 – 2009:3.

mean	range	st. deviation		
0.066	0.054 – 0.082	0.009		
First order autocorrelation regressions				
$f_t = 0.028 + 0.977\, f_{t-1} + e_t$ $n = 20$ $R^2 = 0.86$ $Durbin\_h = -1.1$ (0.006) (0.10)				
$f_t = 0.035 + 0.32\, f_{t-1} + 0.0010t + e_t$ $n = 20$ $R^2 = 0.91$ $Durbin\_h = 0.54$ (0.01) (0.22) (0.0003)				
$\Delta f_t = 0.0015 - 0.26\Delta f_{t-1} + e_t$ $n = 19$ $R^2 = 0.07$ $Durbin\_h = -0.74$ (0.008) (0.23)				

Table 2a. Average discounts by sector: groups

	weight	Mean	std	min	max
All Groups		6.6%	0.9%	5.4%	8.2%
Food[(1)]	17.38	21.1%	1.8%	18.7%	25.1%
Alcoholic beverages and tobacco	7.2	9.0%	1.8%	6.6%	13.2%
Clothing and footwear	4.75	4.7%	1.2%	3.0%	7.3%
Housing and household utilities	20.02	0.2%	0.1%	0.1%	0.4%
Household contents and services	5.49	14.3%	3.1%	9.5%	20.3%
Health	5.23	1.1%	0.4%	0.5%	2.0%
Transport[(2)]	17.24	1.1%	0.4%	0.4%	2.3%
Communication	3.26	0.1%	0.1%	0.0%	0.3%
Recreation and culture[(3)]	10.21	5.3%	1.4%	2.9%	8.4%
Education	2.08	0.0%	0.0%	0.0%	0.0%
Miscellaneous goods and services	7.13	5.7%	0.8%	4.5%	7.1%

Table 2b. Average discounts by sector: subgroups.

	weight	mean	std	min	max	Accumulated Weight
Fruit and vegetables(1)	2.2	36.4%	2.6%	32.7%	42.2%	2.20
Non-alcoholic beverages	1.62	29.1%	2.6%	24.6%	34.0%	3.82
Grocery food	6.7	27.3%	2.1%	23.9%	30.8%	10.52
Meat, poultry and fish	1.33	26.5%	3.7%	21.7%	35.8%	11.85
Other household supplies and services	0.93	23.8%	4.0%	15.9%	30.5%	12.78
Personal care	2.14	19.1%	1.3%	17.2%	22.2%	14.92
Furniture, furnishings and floor coverings	2.07	14.9%	4.5%	8.1%	23.3%	16.99
Alcoholic beverages	7.2	12.7%	2.6%	8.9%	17.7%	24.19
Household appliances	1.16	12.5%	4.0%	6.8%	22.8%	25.35
Recreational equipment and supplies	0.37	12.2%	1.6%	9.8%	16.5%	25.72
Audio-visual and computing equipment	1.83	11.7%	3.5%	4.8%	17.1%	27.55
Tools and equipment for house and garden	0.45	11.2%	1.9%	8.3%	15.1%	28.00
Glassware, tableware and household utensils	0.35	10.0%	3.3%	4.4%	16.9%	28.35
Footwear	0.8	7.1%	2.2%	3.4%	12.0%	29.15
Medical products, appliances &equipment	1.13	6.2%	1.6%	3.8%	10.4%	30.28
Household textiles	0.53	6.0%	2.3%	2.8%	11.0%	30.81
Personal effects	0.58	4.6%	1.6%	2.3%	8.5%	31.39
Clothing	3.95	4.2%	1.6%	2.1%	7.7%	35.34
Telecommunication equipment	0.15	3.6%	3.6%	0.5%	15.7%	35.49
Major recreational and cultural equipment	0.42	2.4%	2.3%	0.0%	6.9%	35.91
Property maintenance	2.24	2.2%	1.0%	0.9%	4.6%	38.15
Newspapers, books and stationery	1.58	2.0%	2.0%	0.1%	8.9%	39.73
Purchase of vehicles	5.24	1.9%	1.0%	0.5%	4.8%	44.97
Private transport supplies and services	9.27	0.9%	0.7%	0.0%	2.6%	54.24
Restaurant meals and ready-to-eat food	4.03	0.7%	0.3%	0.2%	1.5%	58.27
Recreational and cultural services	2.88	0.4%	0.6%	0.0%	1.9%	61.15
Cigarettes and tobacco	2.23	0.3%	0.9%	0.0%	3.5%	63.38

Passenger transport services	2.73	0.2%	0.4%	0.0%	1.9%	66.11
Credit services	0.76	0.1%	0.5%	0.0%	2.1%	66.87
Household energy	3.82	0.0%	0.2%	0.0%	0.7%	70.69
Actual rentals for housing	6.87	0.0%	0.0%	0.0%	0.1%	77.56
Home ownership	4.66	0.0%	0.0%	0.0%	0.2%	82.22
Property rates and related services	2.44	0.0%	0.0%	0.0%	0.1%	84.66
Other miscellaneous services	1.95	0.0%	0.0%	0.0%	0.1%	86.61
Out-patient services	3.42	0.0%	0.0%	0.0%	0.0%	90.03
Telecommunication services	2.96	0.0%	0.0%	0.0%	0.0%	92.99
Hospital services	0.68	0.0%	0.0%	0.0%	0.0%	93.67
Postal services	0.16	0.0%	0.0%	0.0%	0.0%	93.83
Accommodation services	0.66	0.0%	0.0%	0.0%	0.0%	94.49
Early childhood education	0.35	0.0%	0.0%	0.0%	0.0%	94.84
Primary and secondary education	0.7	0.0%	0.0%	0.0%	0.0%	95.54
Tertiary and other post school education	1.03	0.0%	0.0%	0.0%	0.0%	96.57
Insurance	1.7	0.0%	0.0%	0.0%	0.0%	98.27

Table 3a. Estimates of the cyclical patterns of discounts by group (equation 1).

<u>All groups</u>

$f_{it} = 7.1 - 0.31Y_t^g + e_{it}$ $\quad e_{it} = 0.74e_{it-1} + u_{it}$ $\quad R^2 = 0.63$ $\quad n = 21$

$(0.29)\ (0.09)^{***}$ $\quad (0.14)^{***}$

$\Delta f_{it} = 0.09 - 0.15\Delta Y_t^g + e_{it}$ $\quad R^2 = 0.09$ $\quad n = 20$

$(0.08)\ \ (0.11)$

<u>Food</u>

$f_{it} = 22.3 - 0.75Y_t^g + e_{it}$ $\quad e_{it} = 0.57e_{it-1} + u_{it}$ $\quad R^2 = 0.71$ $\quad n = 21$

$(0.45)\ \ (0.16)^{***}$ $\quad (0.18)^{***}$

$\Delta f_{it} = 0.20 - 0.33\Delta Y_t^g + e_{it}$ $\quad R^2 = 0.08$ $\quad n = 20$

$(0.18)\ \ (0.26)$

<u>Alcohol and Tobacco</u>

$f_{it} = 10.5 - 0.85Y_t^g + e_{it}$ $\quad e_{it} = -0.18e_{it-1} + u_{it}$ $\quad R^2 = 0.83$ $\quad n = 21$

$(0.19)\ \ (0.08)^{***}$ $\quad (0.19)$

$\Delta f_{it} = 0.14 - 0.67\Delta Y_t^g + e_{it}$ $\quad R^2 = 0.15$ $\quad n = 20$

$(0.27)\ \ (0.37)$

<u>Household contents and services</u>

$f_{it} = 15.6 - 0.91Y_t^g + e_{it}$ $\quad e_{it} = 0.67e_{it-1} + u_{it}$ $\quad R^2 = 0.46$ $\quad n = 21$

$(1.2)\ \ (0.40)^{**}$ $\quad (0.15)^{***}$

$\Delta f_{it} = 0.32 - 0.34\Delta Y_t^g + e_{it}$ $\quad R^2 = 0.02$ $\quad n = 20$

$(0.40)\ \ (0.54)$

Table 3b. Estimates of the predictability of the output gap (equation 3).

<u>All groups</u>					
$Y_t^g = 3.42 + 1.01\hat{Y}_t^g - 0.31 f_{it} + e_{it}$			$e_{it} = 0.60 e_{it-1} + u_{it}$	$R^2 = 0.88$	$n = 21$
$(1.00)^{***}$	$(0.23)^{***}$	(0.36)	$(0.15)^{***}$		
<u>Food</u>					
$Y_t^g = 4.4 + 1.02\hat{Y}_t^g - 0.14 f_{it} + e_{it}$			$e_{it} = 0.58 e_{it-1} + u_{it}$	$R^2 = 0.88$	$n = 21$
(3.5)	$(0.22)^{***}$	(0.16)	$(0.16)^{***}$		
<u>Alcohol and Tobacco</u>					
$Y_t^g = 3.5 + 0.96\hat{Y}_t^g - 0.23 f_{it} + e_{it}$			$e_{it} = 0.35 e_{it-1} + u_{it}$	$R^2 = 0.89$	$n = 21$
(1.4)	$(0.21)^{***}$	(0.15)	$(0.17)^{***}$		
<u>Household Contents and Services</u>					
$Y_t^g = 1.9 + 1.10\hat{Y}_t^g - 0.04 f_{it} + e_{it}$			$e_{it} = 0.61 e_{it-1} + u_{it}$	$R^2 = 0.86$	$n = 21$
(1.2)	$(0.19)^{***}$	(0.08)	$(0.15)^{***}$		

Table 4. Estimates of average discount by subgroup (equation 6).

Group	Estimated discount	(standard error)	R^2	Output gap?	CPI weight
Fruit and vegetables(1)	0.373	(0.315)	0.13	No	2.2
Meat, poultry and fish	-0.434***	(0.098)	0.33	Yes	1.33
Grocery food	-0.251**	(0.111)	0.33	Yes	6.7
Non-alcoholic beverages	-0.137	(0.103)	0.23	Yes	1.62
Alcoholic beverages	0.165	(0.126)	0.16	No	7.2
Clothing	0.09	(0.122)	0.04	Yes	3.95
Footwear	-0.217**	(0.101)	0.25	No	0.8
Property maintenance	-0.048	(0.058)	0.01	Yes	2.24
Furniture, furnishings and floor coverings	-0.175**	(0.063)	0.39	No	2.07
Household textiles	-0.211***	(0.052)	0.48	No	0.53
Household appliances	-0.136*	(0.068)	0.18	No	1.16
Glassware, tableware and household utensils	-0.415***	(0.052)	0.71	No	0.35
Tools and equipment for house and garden	-0.082**	(0.034)	0.36	Yes	0.45
Other household supplies and services	-0.181***	(0.059)	0.36	No	0.93
Medical products, appliances and equipment	-0.325	(0.229)	0.10	No	1.13
Purchase of vehicles	-0.589***	(0.145)	0.14	Yes	5.24
Telecommunication equipment	-0.038	(0.095)	0.23	Yes	0.15
Audio-visual and computing equipment	-0.252**	(0.089)	0.19	No	1.83
Major recreational and cultural equipment	-0.259***	(0.057)	0.64	No	0.42
Other recreational equipment and supplies	-0.13*	(0.069)	0.18	Yes	0.37
Newspapers, books and stationery	-0.487***	(0.096)	0.42	Yes	1.58
Personal care	-0.006	(0.038)	0.02	Yes	2.14
Personal effects	-0.166*	(0.082)	0.11	Yes	0.58
All groups	-0.253	(0.253)	0.55	Yes	

The table reports the estimated mean discount coefficient α_{i1} of the regression $\Delta \ln(P_{it}) = \alpha_{i0} + \alpha_{i1}\Delta\theta_{it} + \alpha_{ij}\Delta \ln(P_{it}^{AU}) + e_{it}$ (equation 3). The standard errors are calculated using the Newey-West procedure. Each regression has 18 degrees of freedom. *, **, *** indicate whether the coefficient is statistically significant at the 10%, 5%, or 1% level. The column "output gap" indicates whether the output gap is a statistically significant explanatory variable if it is also included in the regression. Note that including the Output gap variable did not make a substantial difference on the statistical significance of the coefficient of α_{i1} in any of the regressions.

Table 5. Mean and standard deviation of discounts for different items.

Item	mean	Standard deviation
Chocolate biscuits	24.7%	3.6%
Mixed frozen vegetables	25.4%	5.9%
Minced Beef	19.6%	4.7%
Beer, one dozen bottles	18.3%	4.1%
Diswasher detergent	15.1%	7.3%
Plastic cling_wrap	5.4%	8.8%
Paper tissues, box	15.3%	3.2%
Whiskey, bottle	10.3%	2.9%
“Scrabble” set	18.0%	11.5%
Socks (mens, 1 pair)	34.1%	14.2%
Carpet (Woollen Tuft, per metre)	19.3%	5.0%
Average	18.7%	6.5%

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