PRICE SETTING BEHAVIOUR IN SOUTH AFRICA – ANALYSIS OF CONSUMER AND PRODUCER PRICE MICRODATA

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Abstract

An empirical analysis of the large microdata sample at the unit level of South Africa's Consumer Price Index (CPI) and Producer Price Index (PPI) is to be undertaken for the period 2001 m12 to 2006 m2. This study will allow for findings to be made for the South African economy on the following issues: the frequency of price changes and the related duration of price spells, the frequency of price increases and price decreases, as well findings on the magnitude of price changes, price increases and price decreases. Results are to be presented at both an aggregate and a disaggregated level based on major product categories. An initial analysis of the impact of the inflation rate, the exchange rate and the policy rate on the frequency and magnitude of price changes will also be undertaken. The study is part of a broader research effort into the implications of price setting behaviour for the conduct of monetary policy in South Africa, including an analysis of factors influencing the frequency and magnitude of price changes.

1. Introduction

An empirical analysis of the large microdata sample at the unit level of South Africa's Consumer Price Index (CPI) and Producer Price Index (PPI) is undertaken for the period 2001 m12 to 2006 m2. This includes an analysis of the frequency of price changes and the magnitude of price changes at an aggregate and sectoral level. Furthermore, an analysis is undertaken of whether there is evidence of state-dependent or time-dependent pricing in South Africa over the period, that is, the extent to which price setting responds inter alia to interest rate, exchange rates and general pricing developments, versus the extent to which price setting takes place regularly after particular time intervals.

The structure of this paper is, firstly, to present stylised facts from an analysis of the frequency and magnitude of price changes in aggregate and in product sub-categories of the CPI microdata set. Secondly, there is a presentation of the stylised facts regarding the frequency and magnitude of price changes at an aggregate level and for industry sub-categories based on the PPI microdata set. Thirdly, analysis is undertaken of the time series characteristics of the CPI and PPI microdata in order to test for state- and/or time-dependency in pricing conduct. Finally, the conclusion bring together all of the paper's main findings.

This paper is part of a broader research effort into the implications of price setting behaviour for the conduct of monetary policy in South Africa. An improved micro-level understanding of price setting behaviour will assist in providing a foundation for the formulation and conduct of macro-economic policy.

An analysis of the policy implications of the findings of the study into price setting behaviour would include discussion on the following dialectic. Firstly, an assessment of how interest rate changes influence price setting behaviour by South African firms, which would bring into discussion the relative significance of cost channel effect (as rising interest rates put upward pressure on prices) and negative demand effects (as rising interest rates put downward pressure on prices). Secondly, a discussion on how an

understanding of price setting behaviour influences the conduct of monetary policy, such as, the role which adjustments in the frequency and magnitude of price changes have in leading to interest rate changes. Furthermore, the existence of such price rigidities means that monetary policy decisions are non-neutral and impact on short to medium term output and employment levels. As such, an understanding of pricing behaviour and price rigidities would improve the understanding of the manner in which monetary policy decisions impact on real economic outcomes.

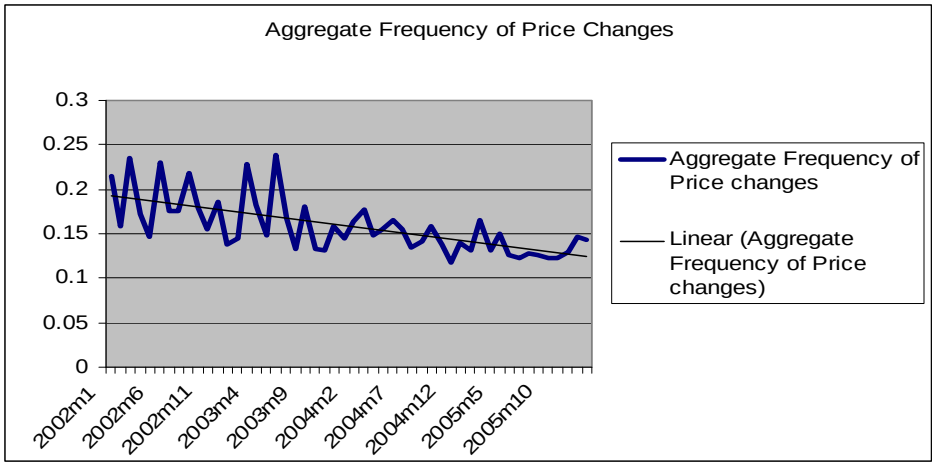
For example, in a model such as that developed by Altissimo et al (2006) would assist in the analysis of monetary policy in the context of varying degrees of price rigidity. Altissimo et al's model is based on a Phillips Curve, IS curve and Taylor rule and is used to show that in comparing situations of high and low degrees of price rigidity, monetary policy should be less aggressive in the face of cost push shocks in order to achieve preferable output, real interest rate and inflation outcomes. This is because if prices are relatively sticky there will be greater short-run real effects due to interest rate changes.

2. Stylised facts from CPI microdata

Findings on frequency of price changes

With regard to the frequency of price changes, the headline finding of the study of unit level CPI prices over the period 2001 m12 to 2006 m2, is that an average of 15,97% of prices change each month.

It is interesting to note that over the 51 month period under consideration there was a significant degree of differentiation in the frequency of price changes with the highest frequency of price changes occurring in 2003m6 at 23,88% and the lowest frequency of price changes occurring in 2004m12 at 11,77%. The diagram below also indicates a downward trend in the frequency of price changes during the period under study.

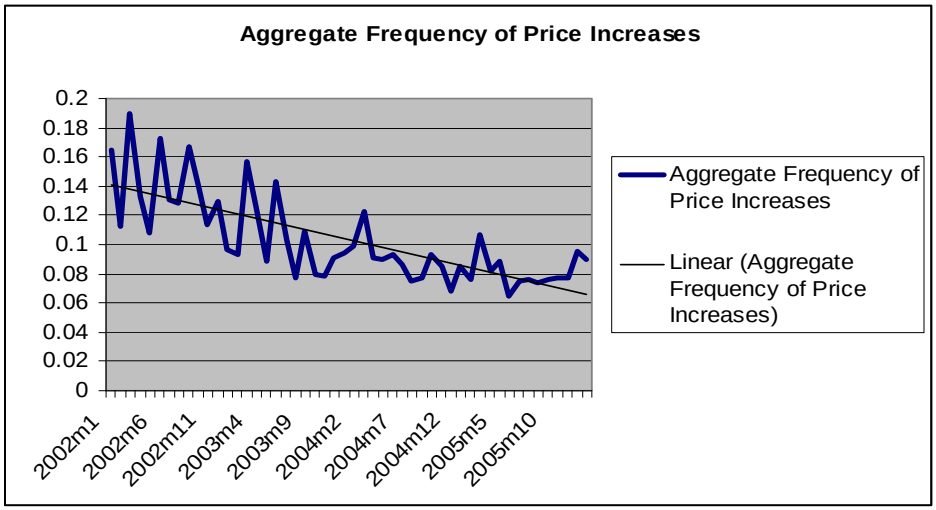


Aggregate Frequency of price increases and price decreases

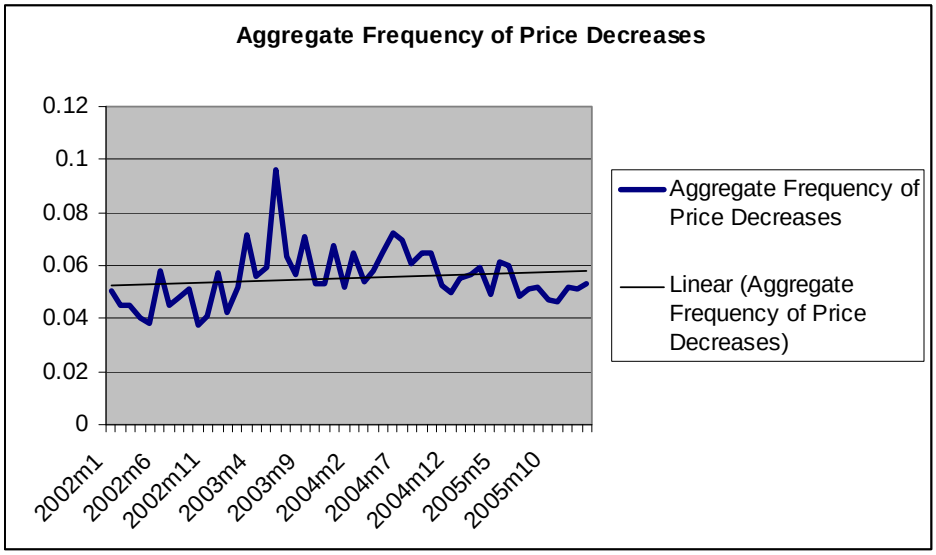
Price increases occurred with an average monthly frequency of 10,50% and price decreases with a frequency of 5,47%. Indicating, a significant degree of asymmetry in price setting in favour of price increases over price decreases.

There was a downward trend in the frequency of price increases over the period. The month recorded with the highest frequency of price increases was 2002m3, with 19,00%

of prices increasing in that month, and the month with lowest frequency of price increases was 2005m6 with 6,52% of prices increasing in that month.



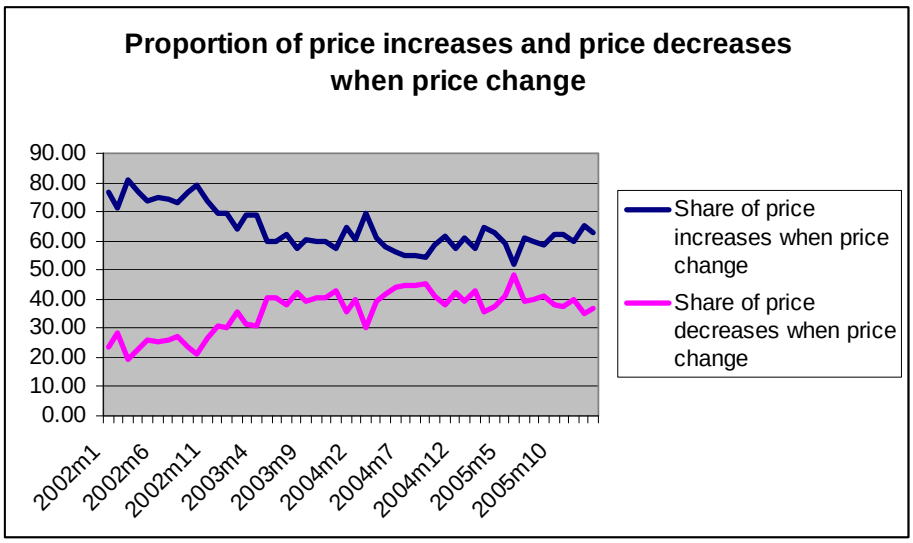
With regard to the frequency of price decreases, there is a slight upward trend over the period. The monthly frequency of price decreases has tended to increase with the highest frequency of price decreases recorded in 2003 m6 (9,60%) and the lowest frequency of price decreases in 2002 m10 (3,75%).



There is a trend towards increasing upward and downward symmetry in the frequency of price changes. The 'asymmetry gap' reduces over time as there is increasing equivalence

in the likelihood of price increases and decreases. This finding is also consistent with the period's initial high level of inflation followed by disinflation.[1] Furthermore, the finding is not inconsistent with hypothesis that inflation targeting framework introduced at the beginning of the period has gained credibility with price-setters over the period.

An interesting finding is that over the period from 2001m12 to 2005m6, there has been a declining proportion of price increases and an increasing proportion of price decreases.



As can be seen from the previous diagram, in 2005m6, the proportion of price increases (51,97%) to price decreases (48,03%) approaches parity. Thereafter, the proportion of

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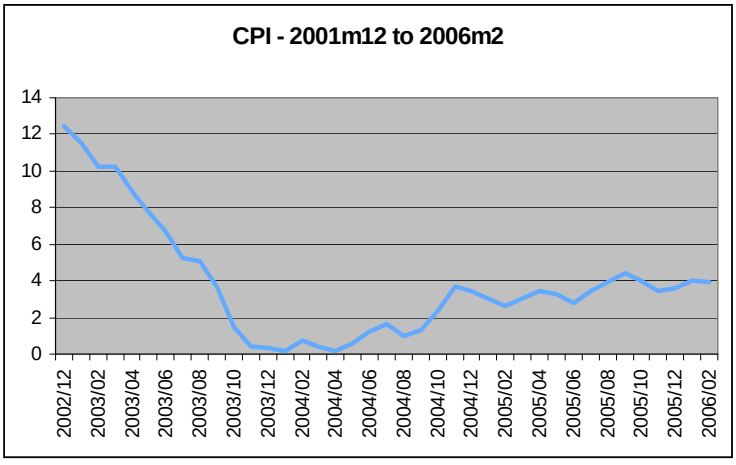


price increases to price decreases diverge once more with price increases (65,02%) assuming dominance over price decreases (34,98%) by 2006m1.

Comparison between goods and services

Average frequency of price changes for goods and services

	Goods	**Services**
Frequency of price change	16,03%	16,39%
Frequency of price increase	10,42%	12,53%
Frequency of price decrease	5,61%	3,86%

In South Africa, in the period under review, the prices of services (16,39%) tended to change more frequently than the prices of goods (16,03%). The findings for goods and services do not tie up with the findings for the aggregate data set, which reflects a price change frequency of 15,97%. This is due to an anomaly that when the data base which classifies items as either a product or a service is integrated with the full price data base for the period certain price records are lost for each period – from 2 772 854 price records to 2 738 093 price records, or a decrease of 1,25%. Within the goods and services data set, the proportion of goods price records is 94,5% to 5,5% of price records classified as services.

Despite this limitation, the study does offer some evidence of sharper asymmetry between the frequency of price increases and price decreases for services than for goods in the South African economy over the period. Whereas goods prices tend to increase with a frequency of 10,42% and decrease with a frequency of 5,61% (comparable with the finding for the aggregate data set of an average monthly frequency for price increases of 10,50% and price decreases with a frequency of 5,47%), services prices tend to increase with a frequency of 12,53% and decrease with a frequency of 3,86%.

Comparison of frequency of price changes of different product categories

The findings on the frequency of price changes by product sub-category are tabulated to show the overall frequency of price changes, the average frequency of price increase and the average frequency of price decreases.

	Frequency of price change	Frequency of price increase	Frequency of price decrease
FOOD	19.15%	12.07%	7.08%
NON ALCOHOLIC BEVERAGES	10.66%	8.30%	2.36%
ALCOHOLIC BEVERAGES	12.06%	9.57%	2.50%
CIGARETTES TOBACCO AND CIGARS	17.14%	15.54%	1.60%
CLOTHING	9.60%	6.44%	3.16%
FOOTWEAR	6.53%	3.67%	2.86%
HOUSING	42.41%	33.86%	8.55%
FUEL AND POWER	13.83%	9.87%	3.96%
FURNITURE AND EQUIPMENT	11.26%	7.23%	4.03%
HOUSEHOLD OPERATION	13.29%	9.15%	4.14%
MEDICAL CARE AND HEALTH EXPENSES	15.67%	9.72%	5.95%
TRANSPORT	16.34%	11.19%	5.15%
COMMUNICATION	8.16%	6.77%	1.39%
RECREATION AND ENTERTAINMENT	12.47%	6.89%	5.58%
READING MATTER	15.86%	14.57%	1.28%
EDUCATION	5.96%	5.96%	0.00%
PERSONAL CARE	11.49%	7.71%	3.79%
OTHER GOODS AND SERVICES	26.17%	18.36%	7.80%

Analysis of frequency of price changes by product sub-category

The table below lists product sub-categories from those with the least frequently changed prices, to those with the most frequently changed prices.

Frequency of price changes (ascending)	
EDUCATION	5.96%
FOOTWEAR	6.53%
COMMUNICATION	8.16%
CLOTHING	9.60%
NON ALCOHOLIC BEVERAGES	10.66%
FURNITURE AND EQUIPMENT	11.26%
PERSONAL CARE	11.49%
ALCOHOLIC BEVERAGES	12.06%
RECREATION AND ENTERTAINMENT	12.47%
HOUSEHOLD OPERATION	13.29%
FUEL AND POWER	13.83%
MEDICAL CARE AND HEALTH EXPENSES	15.67%
READING MATTER	15.86%
TRANSPORT	16.34%
CIGARETTES TOBACCO AND CIGARS	17.14%
FOOD	19.15%
OTHER GOODS AND SERVICES	26.17%
HOUSING	42.41%

It is important to note that education prices are gathered annually, which clearly influences the finding of price stickiness in this sector, where prices are found to change at a low frequency of 5,96%. Footwear and communication prices also change at low frequency 6,53% and 8,16% respectively. The most flexible prices are housing prices changing at a frequency of 42,41%. Prices of other goods and services[2] (26,17%), food (19,15%), cigarettes, tobacco and cigars (17,14%), transport (16,34%), reading matter (15,86%), and medical care and health expenses (15,67%) all change relatively frequently.

Analysis of frequency of price increases by product sub-category

The most frequent price increases have occurred in housing (33,86%), other goods and services (18,36%) and cigarettes, tobacco and cigars (15,54%). The least frequent price increases occurred in footwear (3,67%), education (5,96%) and clothing (6,44%).

[2] Items include in Other Goods and Services include: watches, sunglasses, envelopes, pens and pencils, professional fees, legal fees, cost of funeral, insurance, take away meals, contributions to pension funds, swimming pool equipment and repairs, lobola/dowry payments, religious and traditional ceremonies and fines.

Frequency of price increases (ascending)	
FOOTWEAR	3.67%
EDUCATION	5.96%
CLOTHING	6.44%
COMMUNICATION	6.77%
RECREATION AND ENTERTAINMENT	6.89%
FURNITURE AND EQUIPMENT	7.23%
PERSONAL CARE	7.71%
NON ALCOHOLIC BEVERAGES	8.30%
HOUSEHOLD OPERATION	9.15%
ALCOHOLIC BEVERAGES	9.57%
MEDICAL CARE AND HEALTH EXPENSES	9.72%
FUEL AND POWER	9.87%
TRANSPORT	11.19%
FOOD	12.07%
READING MATTER	14.57%
CIGARETTES TOBACCO AND CIGARS	15.54%
OTHER GOODS AND SERVICES	18.36%
HOUSING	33.86%

Analysis of frequency of price decreases by product sub-category

The most frequent price decreases have been in housing (8,55%), other goods and services (7,80%) and food (7,08%). The least frequent price decreases have been in education (0,00%), reading matter (1,28%) and communication (1,39%).

Frequency of price decreases (ascending)	
EDUCATION	0.00%
READING MATTER	1.28%
COMMUNICATION	1.39%
CIGARETTES TOBACCO AND CIGARS	1.60%
NON ALCOHOLIC BEVERAGES	2.36%
ALCOHOLIC BEVERAGES	2.50%
FOOTWEAR	2.86%
CLOTHING	3.16%
PERSONAL CARE	3.79%
FUEL AND POWER	3.96%
FURNITURE AND EQUIPMENT	4.03%
HOUSEHOLD OPERATION	4.14%

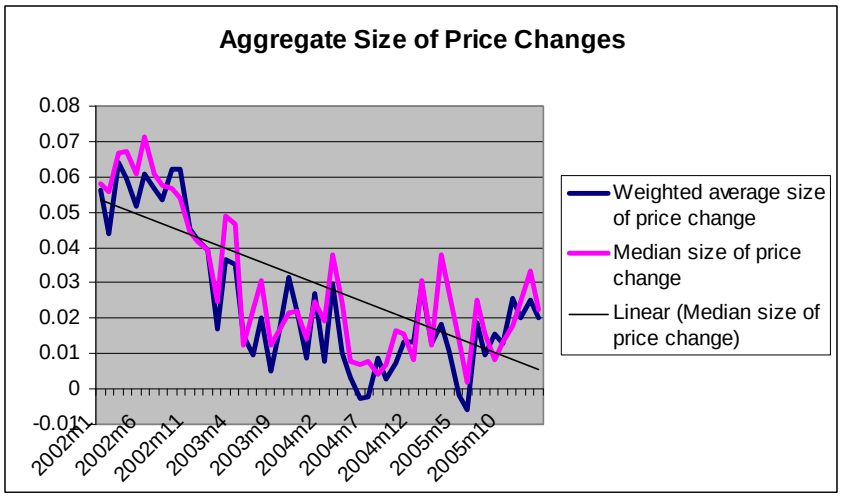
TRANSPORT	5.15%
RECREATION AND ENTERTAINMENT	5.58%
MEDICAL CARE AND HEALTH EXPENSES	5.95%
FOOD	7.08%
OTHER GOODS AND SERVICES	7.80%
HOUSING	8.55%

Findings on magnitudes of price changes

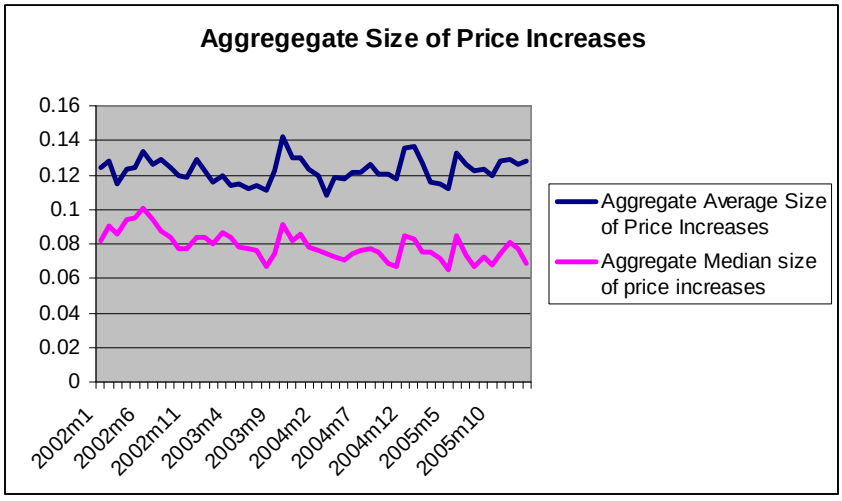
With regard to the magnitude of price changes, the headline findings for the monthly data over the period 2001m12 to 2006m2, is that, conditional on the occurrence of a price change, the weighted average magnitude of price change was 2,91%. For those prices that rose, the average magnitude of price increases was 12,26%. For those prices that declined, the average magnitude of price decreases was -15,05%. The comparative medians were: a 3,58% magnitude of price changes, a 8,05% magnitude of price increases, and a -9,85% magnitude of price decreases, as median levels exclude the impact of extreme price increases and decreases.

It should be noted that, such findings record the monthly average size of price change of those prices that did change in the period. This is distinct from the more familiar inflation-type measure of the monthly average size of price change, taking into account all recorded prices, that is, including both those price that have changed and those prices that have not changed.

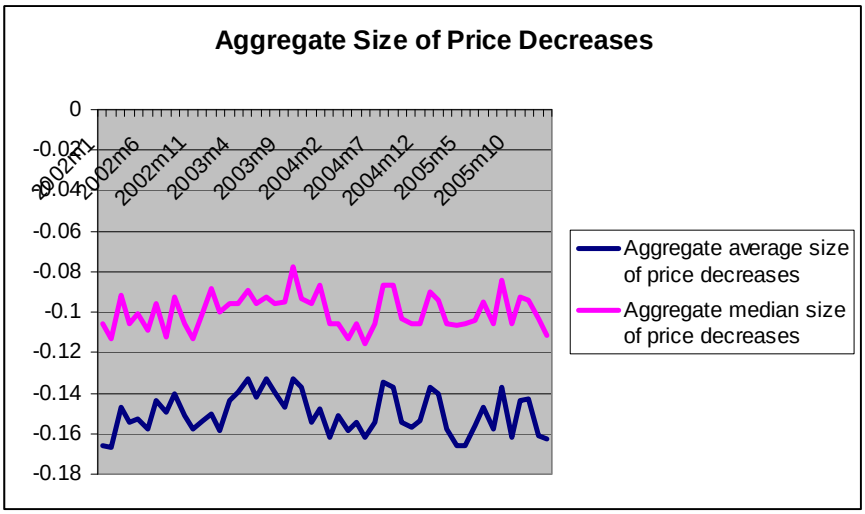
Over the period the maximum overall average size of price change (including both prices that increased and decreased) was 6,42% in 2002m3 and the minimum overall average size of price change was -0,01% in 2005m6. The month with the highest median price change of 7,15% was 2002m6, and with the lowest median price change of 0,19% was 2005m6. Overall there was a downward trend in the average and median size of price changes.



The month with the largest average price increase was 2003m10 at 14,26% and the month with the smallest average price increase was 2004m3 at 10,81%. Monthly median price increases were considerably lower peaking in 2006m6 at 10,10%, with a low median of 6,45% in 2005m5.



The month with the largest absolute value average price decrease was 2002m2 at -16,65% and the month with the smallest absolute value average price decrease was 2003m10 at -13,25%.



Monthly median price decreases have been considerably less in absolute value terms peaking in 2004m6 at -11,53%, with a low absolute value median of -7,80% in 2003m10.

Comparison of the magnitude of price changes between goods and services

Average size of price changes for goods and services

	Goods	**Services**
Size of price changes	2,90%	2,84%
Size of price increases	12,77%	5,05%
Size of price decreases	-15,45%	-4,33%

It is notable that while for goods and services the overall monthly size of price changes is comparable, the average size of price increases and price decreases is much larger for goods than for services, as services experience more moderate price changes. The average size of price increases for goods is 12,77%, whereas for services it is 5,05%. The average size of price decreases for goods is -15,45%, whereas for services it is -4,33%. Due to the large proportion of goods prices in the sample, the size of goods price changes are broadly similar to the aggregate size of price increases, which average 12,26% per month and the size of price decreases which average -15,05% per month.

Analyses of magnitude of price changes by product sub-category

The findings on the size of price changes by product sub-category are tabulated to show the overall average size of price changes where price change, the average size of price increases where prices rose and the average size of price decreases where prices declined.

	Size of price changes	Size of price increases	Size of price decreases
FOOD	2.79%	14.02%	-16.38%
NON ALCOHOLIC BEVERAGES	5.53%	10.59%	-12.24%
ALCOHOLIC BEVERAGES	5.00%	8.32%	-7.72%
CIGARETTES TOBACCO AND CIGARS	4.65%	5.84%	-6.90%
CLOTHING	1.75%	10.94%	-16.95%
FOOTWEAR	2.54%	20.54%	-20.61%
HOUSING	0.93%	1.69%	-2.09%
FUEL AND POWER	4.29%	10.24%	-10.56%
FURNITURE AND EQUIPMENT	2.50%	14.25%	-18.58%
HOUSEHOLD OPERATION	3.87%	11.47%	-12.91%
MEDICAL CARE AND HEALTH EXPENSES	3.15%	10.59%	-9.00%
TRANSPORT	2.81%	9.25%	-11.19%
COMMUNICATION	3.25%	4.32%	-1.99%
RECREATION AND ENTERTAINMENT	0.19%	15.08%	-18.19%
READING MATTER	3.49%	5.86%	-23.49%
EDUCATION	9.23%	9.23%	0.00%
PERSONAL CARE	3.90%	12.56%	-13.71%
OTHER GOODS AND SERVICES	0.87%	2.79%	-3.67%

Analysis of magnitude of price increases by product sub-category

The largest average price increases have been in footwear (20,54%), recreation and entertainment (15,08%), furniture and equipment (14,25%) and food (14,02%). The smallest average price increases have been in housing (1,69%), other good and services (2,79%) and communication (4,32%).

Mean size of price increases (descending)	
FOOTWEAR	20.54%
RECREATION AND ENTERTAINMENT	15.08%
FURNITURE AND EQUIPMENT	14.25%
FOOD	14.02%
PERSONAL CARE	12.56%
HOUSEHOLD OPERATION	11.47%
CLOTHING	10.94%
MEDICAL CARE AND HEALTH EXPENSES	10.59%
NON ALCOHOLIC BEVERAGES	10.59%
FUEL AND POWER	10.24%
TRANSPORT	9.25%
EDUCATION	9.23%
ALCOHOLIC BEVERAGES	8.32%
READING MATTER	5.86%
CIGARETTES TOBACCO AND CIGARS	5.84%
COMMUNICATION	4.32%
OTHER GOODS AND SERVICES	2.79%
HOUSING	1.69%

Analysis of magnitude of price decreases by product subcategory

The largest average price decreases have been in reading matter (-23,49%), footwear (-20,61%), and furniture and equipment (-18,58%). The smallest average price decreases have been in education (0,00%), communication (-1,99%) and housing (-2,09%).

Mean size of price decreases (ascending)	
READING MATTER	-23.49%
FOOTWEAR	-20.61%
FURNITURE AND EQUIPMENT	-18.58%
RECREATION AND ENTERTAINMENT	-18.19%
CLOTHING	-16.95%
FOOD	-16.38%
PERSONAL CARE	-13.71%
HOUSEHOLD OPERATION	-12.91%
NON ALCOHOLIC BEVERAGES	-12.24%
TRANSPORT	-11.19%
FUEL AND POWER	-10.56%
MEDICAL CARE AND HEALTH EXPENSES	-9.00%

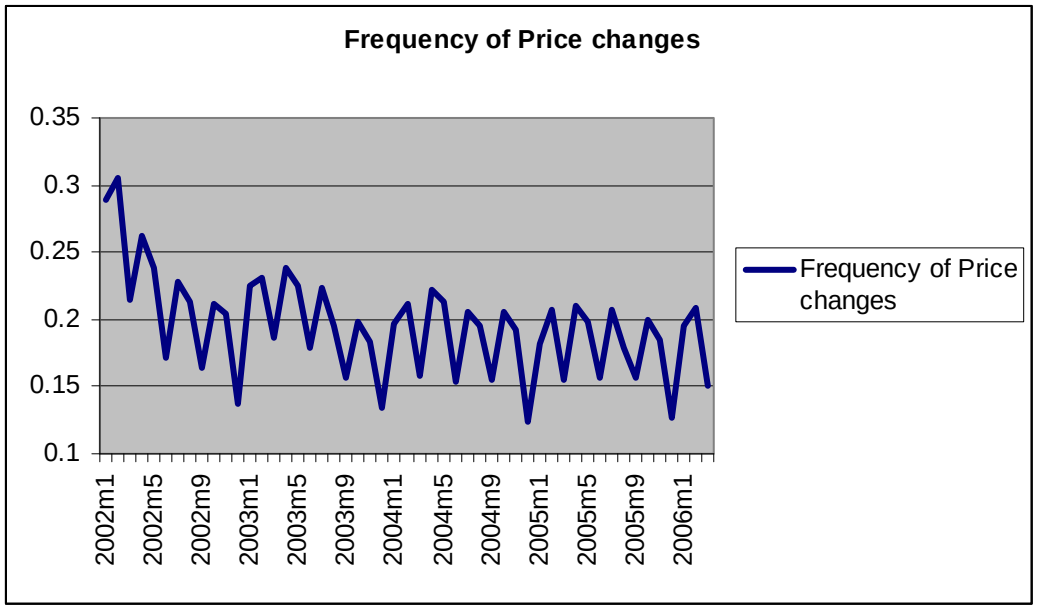
ALCOHOLIC BEVERAGES	-7.72%
CIGARETTES TOBACCO AND CIGARS	-6.90%
OTHER GOODS AND SERVICES	-3.67%
HOUSING	-2.09%
COMMUNICATION	-1.99%
EDUCATION	0.00%

3. Stylised facts from PPI microdata

Findings on frequency of price changes

With regard to the frequency of price changes, the headline finding of the study of unit level PPI prices over the period 2001 m12 to 2006 m2, is that an average of 19,53% of prices change each month.

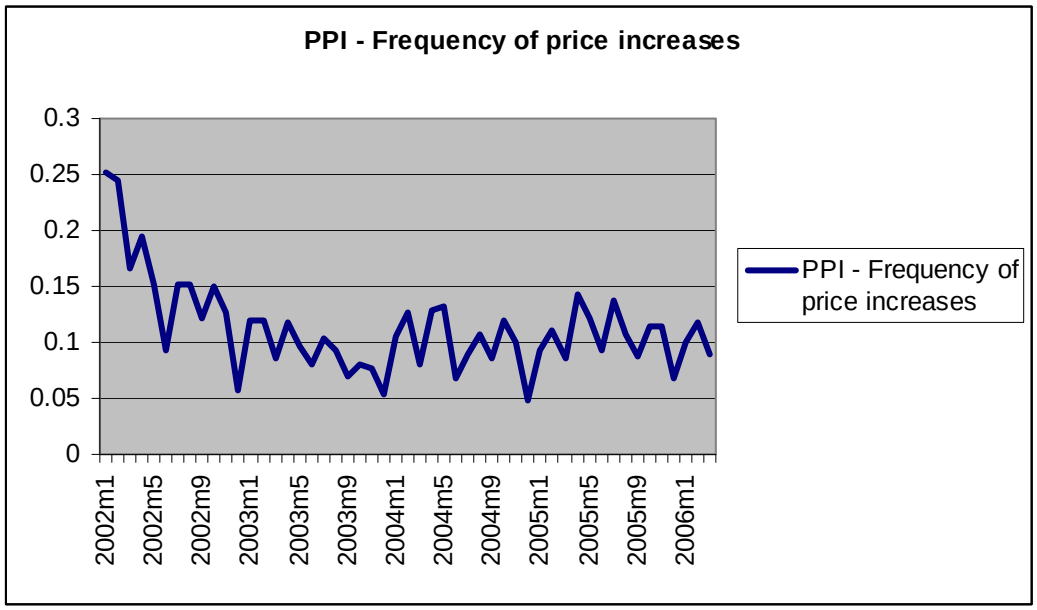
It is interesting to note that over the 51 month period under consideration there was a significant degree of differentiation in the frequency of price changes with the highest frequency of price changes occurring in 2002m2 at 30,52% and the lowest frequency of price changes occurring in 2004m12 at 12,31%. The diagram below also indicates a downward trend in the frequency of PPI price changes during the period under study.



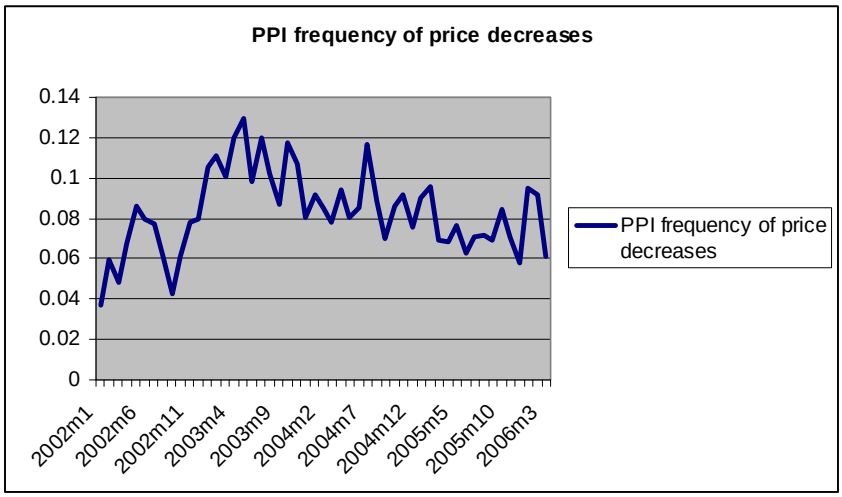
Aggregate frequency of price increases and price decreases

Price increases occurred with an average monthly frequency of 11,23% and price decreases with a frequency of 8,30%. Indicating, a degree of asymmetry in price setting in favour of price increases over price decreases.

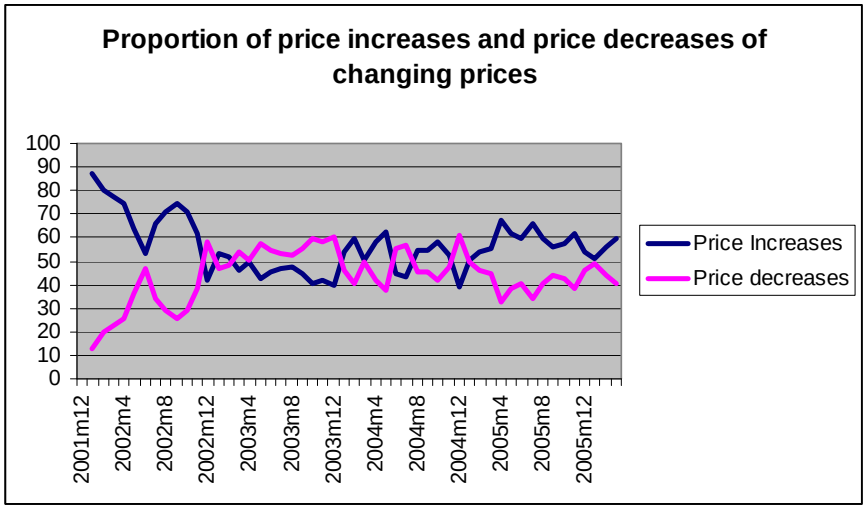
There was a downward trend in the frequency of price increases over the period. The month recorded with the highest frequency of price increases was 2002m1, with 25,15% of prices increasing in that month, and the month with lowest frequency of price increases was 2004m12 with 4,76% of prices increasing in that month.



With regard to the frequency of price decreases, there is initially an upward trend as the frequency of price decreases rises from 3,69% in 2002m1 to 12,94% in 2003m5. The monthly frequency of price decreases then broadly tends to decline over the remaining period.



These finding are also consistent with the period's initial high level of PPI inflation followed by PPI disinflation and then increasing PPI inflation again.



The proportion of price increases was much higher than the proportion of price decreases in the initial part of the period under study. From the end of 2002 to the end of 2003 the proportion of price decreases rose above the proportion of price increases and again in the middle and end of 2004. Thereafter, there was a higher proportion of price increases than price decreases. There is a greater symmetry in price increases and price decreases in the PPI price data than in the CPI price data in which price increases were consistently more prevalent than price decreases, although decreasingly, over the period.

Comparison of frequency of price changes of different industry categories

The findings on the frequency of price changes by industry category are tabulated to show the overall frequency of price changes, the average frequency of price increase and the average frequency of price decreases.

	Frequency of price changes	Frequency of price increases	Frequency of price decreases
Agriculture	49.39%	25.46%	23.93%
Forestry and Fishing	10.91%	10.18%	0.73%
Mining and quarrying	51.45%	26.80%	24.66%
Food at manufacturing	24.01%	13.28%	10.73%
Beverages	9.32%	7.35%	1.97%
Tobacco products	12.26%	10.53%	1.73%
Textiles and made-up goods	11.73%	6.86%	4.87%
Wood and wood products	12.71%	9.34%	3.37%
Paper, paper products and printing	19.33%	10.41%	8.91%
Products of petroleum and coal	70.16%	40.45%	29.71%
Chemicals and chemical products	15.83%	9.35%	6.48%
Rubber and plastic products	12.67%	8.65%	4.02%
Non-metallic mineral products	16.14%	10.80%	5.34%
Basic metals	29.73%	17.13%	12.59%
Metal products	14.86%	8.93%	5.93%
Non-electrical machinery and equipment	14.24%	8.01%	6.22%
Electrical machinery and apparatus	13.95%	9.09%	4.86%
Radio, TV, communication equipment and apparatus	12.72%	6.56%	6.15%
Transport Equipment	16.94%	9.57%	7.37%
Furniture	8.82%	7.21%	1.60%
Other manufactures	10.88%	6.41%	4.48%
Electricity	44.77%	27.78%	16.99%
Construction	9.63%	5.36%	4.27%

Analysis of frequency of price changes by industry category

The table below lists industry categories from those with the least frequently changed prices, to those with the most frequently changed prices.

Frequency of price changes - ascending	
Furniture	8.82%
Beverages	9.32%
Construction	9.63%
Other manufactures	10.88%
Forestry and Fishing	10.91%
Textiles and made-up goods	11.73%
Tobacco products	12.26%

Rubber and plastic products	12.67%
Wood and wood products	12.71%
Radio, TV, communication equipment and apparatus	12.72%
Electrical machinery and apparatus	13.95%
Non-electrical machinery and equipment	14.24%
Metal products	14.86%
Chemicals and chemical products	15.83%
Non-metallic mineral products	16.14%
Transport Equipment	16.94%
Paper, paper products and printing	19.33%
Food at manufacturing	24.01%
Basic metals	29.73%
Electricity	44.77%
Agriculture	49.39%
Mining and quarrying	51.45%
Products of petroleum and coal	70.16%

Furniture (8,82%), Beverages (9,32%) and Construction (9,63%) prices change at a relatively low frequency. The most flexible prices are products of petroleum and coal which change at a frequency of 70,16%. Mining and quarrying prices (51,45%), Agriculture prices (49,39%) and Electricity prices (44,17%) also change relatively frequently.

Analysis of frequency of price increases by industry category

The most frequent price increases have occurred in products of petroleum and coal (40,45%), electricity (27,78%), mining and quarrying (26,80%), and agriculture (25,46%). The least frequent price increases occurred in construction (5,36%), other manufactures (6,41%), radio, TV, communication equipment (6,56%) and textiles and made-up goods (6,86%).

Frequency of price increases (ascending)	
Construction	5.36%
Other manufactures	6.41%
Radio, TV, communication equipment and apparatus	6.56%
Textiles and made-up goods	6.86%
Furniture	7.21%
Beverages	7.35%
Non-electrical machinery and equipment	8.01%
Rubber and plastic products	8.65%
Metal products	8.93%
Electrical machinery and apparatus	9.09%
Wood and wood products	9.34%
Chemicals and chemical products	9.35%
Transport Equipment	9.57%
Forestry and Fishing	10.18%
Paper, paper products and printing	10.41%
Tobacco products	10.53%
Non-metallic mineral products	10.80%
Food at manufacturing	13.28%
Basic metals	17.13%
Agriculture	25.46%
Mining and quarrying	26.80%
Electricity	27.78%
Products of petroleum and coal	40.45%

Analysis of frequency of price decreases by industry category

The most frequent price decreases have been in products of petroleum and coal (29,71%), mining in quarrying (24,66%) and agriculture (23,93%). The least frequent price decreases have been in forestry and fishing (0,73%), furniture (1,60%), tobacco products (1,73%) and beverages (1,97%).

Frequency of price decreases (ascending)	
Forestry and Fishing	0.73%
Furniture	1.60%
Tobacco products	1.73%
Beverages	1.97%
Wood and wood products	3.37%

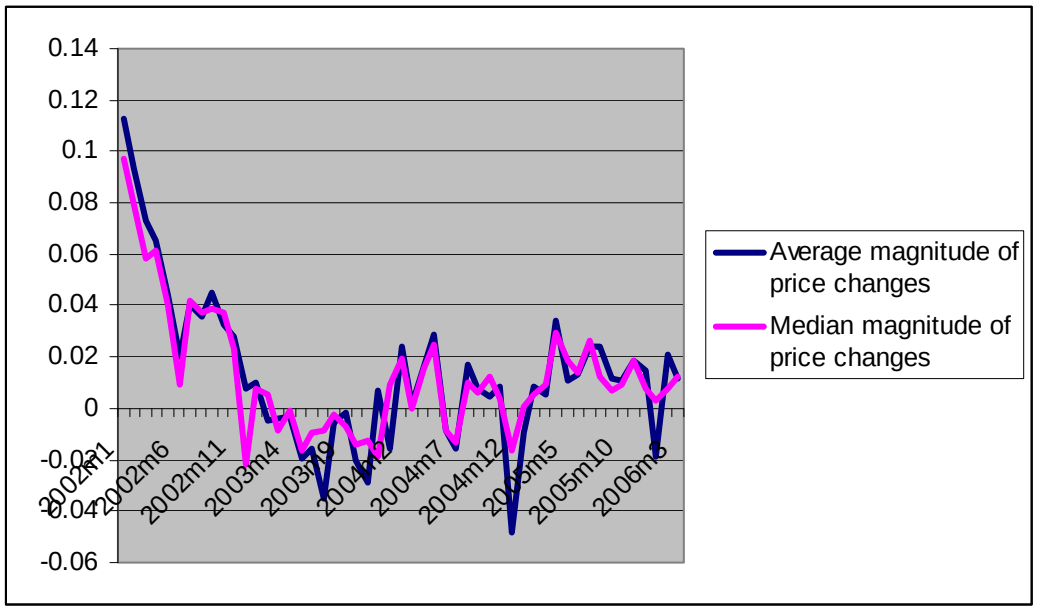
Rubber and plastic products	4.02%
Construction	4.27%
Other manufactures	4.48%
Electrical machinery and apparatus	4.86%
Textiles and made-up goods	4.87%
Non-metallic mineral products	5.34%
Metal products	5.93%
Radio, TV, communication equipment and apparatus	6.15%
Non-electrical machinery and equipment	6.22%
Chemicals and chemical products	6.48%
Transport Equipment	7.37%
Paper, paper products and printing	8.91%
Food at manufacturing	10.73%
Basic metals	12.59%
Electricity	16.99%
Agriculture	23.93%
Mining and quarrying	24.66%
Products of petroleum and coal	29.71%

Magnitude of price changes

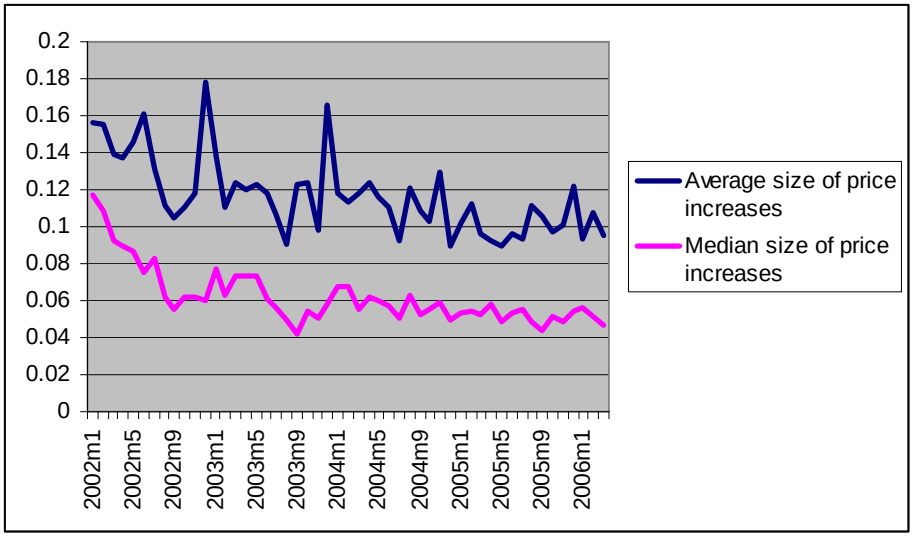
With regard to the magnitude of price changes, the headline findings for the monthly data over the period 2001m12 to 2006m2, is that, conditional on the occurrence of a price change, the weighted average magnitude of price change was 1,63%. For those prices that rose, the average magnitude of price increases was 11,84%. For those prices that declined, the average magnitude of price decreases was -12,20%. The comparative medians were: a 1,43% magnitude of price changes, a 6,45% magnitude of price increases, and a -5,68% magnitude of price decreases, as median levels exclude the impact of extreme price increases and decreases.

This is distinct from the more familiar inflation-type measure of the monthly average size of price change, taking into account all recorded prices, that is, including both those price that have changed and those prices that have not changed.

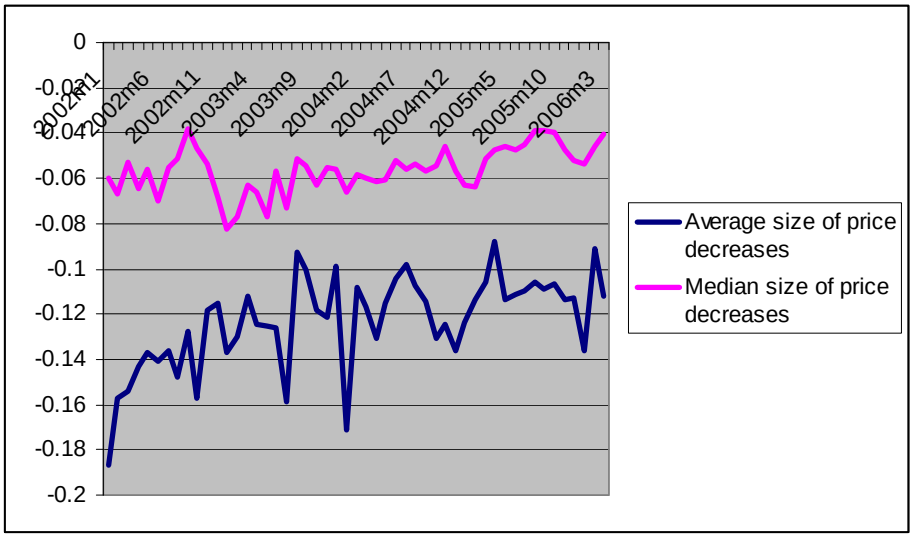
Over the period the maximum overall average size of price change (including both prices that increased and decreased) was 11,24% in 2002m1 and the minimum overall average size of price change was -4,87% in 2004m12. The month with the highest median price change of 9,70% was 2002m1, and with the lowest median price change of -2,19% was 2002m12. Overall there was a downward trend in the average and median size of price changes.



The month with the largest average price increase was 2002m12 at 17,82% and the month with the smallest average price increase was 2005m5 at 8,92%. Monthly median price increases were considerably lower peaking in 2002m1 at 11,75%, with a low median of 4,15% in 2003m9.



The month with the largest absolute value average price decrease was 2002m1 at -18,70% and the month with the smallest absolute value average price decrease was 2005m4 at -8,77%.



Analyses of magnitude of price changes by industry category

The findings on the size of price changes by industry category are tabulated to show the overall average size of price changes where price change, the average size of price increases where prices rose and the average size of price decreases where prices declined.

	Magnitude of price changes	Magnitude of price increases	Magnitude of price decreases
Agriculture	-0.18%	11.90%	-13.04%
Forestry and Fishing	8.41%	9.70%	-96.88%
Mining and quarrying	0.27%	22.43%	-23.82%
Food at manufacturing	1.25%	8.25%	-7.42%
Beverages	8.62%	13.95%	-11.24%
Tobacco products	8.65%	13.79%	-22.64%
Textiles and made-up goods	1.68%	12.17%	-13.07%
Wood and wood products	5.08%	11.54%	-12.83%
Paper, paper products and printing	1.63%	12.13%	-10.65%
Products of petroleum and coal	0.94%	12.68%	-15.04%
Chemicals and chemical products	2.03%	10.57%	-10.30%
Rubber and plastic products	3.31%	12.05%	-15.47%
Non-metallic mineral products	3.08%	8.60%	-8.08%
Basic metals	1.87%	10.31%	-9.60%
Metal products	3.54%	11.55%	-8.54%
Non-electrical machinery and equipment	1.75%	11.71%	-11.07%
Electrical machinery and apparatus	1.71%	10.03%	-13.86%
Radio, TV, communication equipment and apparatus	0.27%	13.55%	-13.89%
Transport Equipment	1.32%	10.76%	-10.92%
Furniture	9.48%	15.78%	-18.85%
Other manufactures	2.64%	17.29%	-18.32%
Electricity	1.53%	6.14%	-6.01%
Construction	1.42%	6.04%	-4.39%

Analysis of magnitude of price increases by industry category

The largest average price increases have been in mining and quarrying (22,43%), other manufactures (17,29%) and furniture (15,78%). The smallest average price increases have been in construction (6,04%), electricity (6,14%%) food at manufacturing (8,25%) and non-metallic mineral products (8,6%).

Mean size of price increases (descending)	
Mining and quarrying	22.43%
Other manufactures	17.29%
Furniture	15.78%
Beverages	13.95%
Tobacco products	13.79%
Radio, TV, communication equipment and apparatus	13.55%
Products of petroleum and coal	12.68%
Textiles and made-up goods	12.17%
Paper, paper products and printing	12.13%
Rubber and plastic products	12.05%
Agriculture	11.90%
Non-electrical machinery and equipment	11.71%
Metal products	11.55%
Wood and wood products	11.54%
Transport Equipment	10.76%
Chemicals and chemical products	10.57%
Basic metals	10.31%
Electrical machinery and apparatus	10.03%
Forestry and Fishing	9.70%
Non-metallic mineral products	8.60%
Food at manufacturing	8.25%
Electricity	6.14%
Construction	6.04%

Analysis of magnitude of price decreases by industry category

The largest average price decreases have been in forestry and fishing (-96,88%), mining and quarrying (-23,82%), and tobacco products (-22,64%). The smallest average price decreases have been in construction (-4,39%), electricity (-6,01%) and food at manufacturing (-7,42%).

Mean size of price decreases (ascending)	
Forestry and Fishing	-96.88%
Mining and quarrying	-23.82%
Tobacco products	-22.64%
Furniture	-18.85%
Other manufactures	-18.32%
Rubber and plastic products	-15.47%
Products of petroleum and coal	-15.04%
Radio, TV, communication equipment and apparatus	-13.89%
Electrical machinery and apparatus	-13.86%
Textiles and made-up goods	-13.07%
Agriculture	-13.04%
Wood and wood products	-12.83%
Beverages	-11.24%
Non-electrical machinery and equipment	-11.07%
Transport Equipment	-10.92%
Paper, paper products and printing	-10.65%
Chemicals and chemical products	-10.30%
Basic metals	-9.60%
Metal products	-8.54%
Non-metallic mineral products	-8.08%
Food at manufacturing	-7.42%
Electricity	-6.01%
Construction	-4.39%

4. Regression Analysis of price setting conduct

Based on prior fundamental research into the frequency and magnitude of price changes underlying South Africa's Consumer Price Index (CPI) and Producer Price Index (PPI) over the period 2001m12 to 2006m2, it is possible to undertake an analytical study of the whether there is any evidence of seasonality in pricing conduct and whether there is evidence of relationships between pricing conduct and current and lagged macroeconomic variables, such as, the policy interest rate (the repo rate), exchange rates and the rate of inflation.

More specifically, it would be important to discern whether there is evidence of seasonality in the frequency and magnitude of price changes, price increases or price decreases as this would be indicative of time-dependent pricing conduct. On the other hand, state-dependent pricing would be indicated if the frequency and magnitude of price increases were found to be positively associated with periods of high inflation, or negatively associated with periods of disinflation. It would be expected that increases in the repo rate should lead either to decreased frequencies of price increases, increased frequency of price decreases, and possibly also decreased magnitudes of prices increases and increased magnitudes of price decreases in absolute terms. Furthermore, the impact on pricing conduct of changes in macroeconomic variables after a 3 month lag will also be included in the analysis.

Regression Model

In order to advance this study, time series regressions are conducted, estimating determinants of a regression model specified alternatively with the frequency of price changes (F), the frequency of price increases (F+) and the frequency of price decreases (F-), the magnitude of price changes (M), the magnitude of price increases (M+) and the magnitude of price decreases (M-) as related to changes in the reported inflation rates (alternatively, year on year consumer price inflation for the CPI microdata and year on year producer price inflation for the PPI microdata), changes in the policy rate (the repo rate) and changes in the nominal effective exchange rate. In addition to real time effects,

the analysis will include analyses of 3 month lag effects. Initially, the paper will focus on studying pricing at the aggregate level, but analysis at the level of goods sub-categories and industry categories is envisaged.

Starting with a study of the consumer price micro-data, in order to understand the influence which various factors have on the frequency of price changes, the following regression model is estimated, for F and then for F+, F-, M. M+ and M-:

$$Ft = a + \sum_{i=1}^{12} B + \kappa CPIt + \lambda REPOt + \sigma NERt + \varepsilon t$$

Where:

Ft = frequency of price changes in a particular month t

a = constant term

$\sum_{i=1}^{12} B$ = seasonal dummies

$CPIt$ = year on year consumer price index in month t

$REPOt$ = policy rate (repo rate) in month t

$NERt$ = nominal exchange rate index in month t

ε = error term

For the PPI microdata study, the year on year PPI replaces the year on year CPI in the regression model.

Analysis of frequency of price changes using CPI micro-data

In order to analyse the potential determinants of the time series variation of the frequency of price adjustments using the CPI micro-data three regressions are run analysing (1) the frequency of price changes (F), (2) the frequency of price increases (F+) and (3) the frequency of price decreases (F-).

	(1)(F)	(2)(F+)	(3)F-
month1	-0.001	0.003	-0.004
	(0.06)	(0.30)	(0.83)
month2	-0.008	-0.008	-0.001
	(0.62)	(0.70)	(0.17)
month3	0.038	0.037	0.001
	(2.59)**	(3.20)***	(0.18)
month4	-0.003	0.003	-0.006
	(0.21)	(0.28)	(1.20)
month5	-0.013	-0.012	-0.001
	(0.90)	(1.06)	(0.17)
month6	0.027	0.011	0.016
	(1.85)*	(0.96)	(3.04)***
month7	-0.005	-0.005	-0.000
	(0.34)	(0.41)	(0.04)
month8	-0.015	-0.014	-0.000
	(1.04)	(1.27)	(0.09)
month9	0.009	0.003	0.005
	(0.62)	(0.31)	(1.06)
month10	-0.006	-0.004	-0.002
	(0.43)	(0.33)	(0.47)
month11	-0.015	-0.009	-0.007
	(1.08)	(0.78)	(1.30)
CPI	-0.003	-0.000	-0.002
	(1.62)	(0.35)	(3.75)***
Repo Rate	0.007	0.002	0.004
	(2.39)**	(0.94)	(4.59)***
Nominal Effective Exchange Rate	-0.001	-0.002	0.001
	(2.46)**	(4.99)***	(4.13)***
Constant	0.202	0.235	-0.033
	(3.59)***	(5.28)***	(1.62)
Observations	50	50	50
R-squared	0.71	0.80	0.67

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The results indicate that there is some degree of seasonality in the frequency of price changes evidenced by the fact that the frequency of price changes and price increases is higher during the month of March, with the former being statistically significant at the 5% confidence level and the latter being statistically significant at the 1% level. There is

also evidence of time-determined price decreases in June each year at a 1% confidence level.

With regard to evidence of state-determined pricing, the frequency of price decreases is negatively associated with inflation. In other words, disinflation periods are associated with an increased frequency of price decreases (at a 1% confidence level). Increases in the repo rate are positively associated with an increased frequency of price decreases (at a 1% confidence level), and with increased frequency of price changes (at a 5% confidence level). Increases in the nominal effective exchange rate (representing a currency appreciation) are positively associated with an increased frequency of price decreases (at a 1% confidence level), negatively associated with the frequency of price increases (at a 1% confidence level) and negatively associated with the frequency of price changes (at a 1% confidence level). All of these exchange rate effects are of the expected signs.

The following table reports the results of a study of whether there is any significant relationship between the frequency of price changes (1), price increases (2) and price decreases (3) and changes in the explanatory variables after a three month lag.[3]

	(1)(F)	(2)(F+)	(3)(F-)
month1	0.009	0.014	-0.005
	(0.65)	(1.17)	(1.11)
month2	0.002	0.004	-0.002
	(0.15)	(0.33)	(0.43)
month3	0.050	0.048	0.002
	(3.27)***	(3.71)***	(0.40)
month4	0.002	0.007	-0.004
	(0.15)	(0.51)	(0.90)
month5	-0.005	-0.005	-0.000
	(0.35)	(0.37)	(0.10)
month6	0.036	0.022	0.013
	(2.30)**	(1.71)*	(2.75)***
month7	0.003	0.006	-0.002
	(0.21)	(0.44)	(0.51)
month8	-0.010	-0.005	-0.005
	(0.64)	(0.40)	(0.97)
month9	0.012	0.010	0.002
	(0.80)	(0.76)	(0.50)

[3] A justification for the choice of the 3 month lag is the finding of Blinder's study (1994) of pricing conduct in the US economy where the mean lag in price adjustments in response to demand and cost shocks is found to be between 2,76 months for a positive cost shock and 3,27 months for a negative cost shock. The study also finds price adjustment lags in response to demand shocks of 2,88 months in response to an increase in demand and 2,90 month in response to a decrease in demand.

month10	-0.002	0.006	-0.008
	(0.16)	(0.45)	(1.74)*
month11	-0.012	-0.003	-0.008
	(0.76)	(0.25)	(1.76)*
L3. CPI	-0.003	-0.002	-0.001
	(1.57)	(1.11)	(2.03)**
L3. Repo Rate	0.006	0.001	0.005
	(1.98)*	(0.54)	(4.90)***
L3. Nominal Effective Exchange Rate	-0.001	-0.002	0.001
	(2.78)***	(5.56)***	(6.19)***
Constant	0.209	0.261	-0.052
	(3.88)***	(5.72)***	(3.11)***
Observations	50	50	50
R-squared	0.66	0.73	0.70

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

With regard to state-based pricing, it is apparent that the frequency of price decreases is negatively associated with the rate of inflation after a 3 month lag (at a 5% confidence level). So if inflation was high three months prior there is a decrease in the frequency of price decreases, or if inflation decreased three months prior this is associated with an increase in the frequency of price decreases. With regard to responsiveness to the repo rate, price decreases are positively associated with increases in the repo rate after a 3 month lag (at a 1% confidence level). Such a finding is consistent with an understanding of the workings of the monetary policy transmission mechanism, but it is not as strong as the finding for the PPI micro-data, where after a three month lag, both the frequency of price increases is reduced and the frequency of price decreases is increased.

After a three month lag, changes in the nominal effective exchange rate are negatively associate with changes in the frequency of price changes. A currency appreciation is associated with a declining frequency of price changes after a three month lag, or a currency depreciation is associated with an increase in the frequency of price changes after a three month lag (with a 1% confidence level). A currency appreciation is negatively associated with the frequency of price increases and a currency appreciation is positively associated with the frequency of price decreases. This is a strong finding as these results are at a 1% confidence level, indicative of the important influence which

exchange rate fluctuations have on price setting conduce in South Africa's relatively open economy.

Analysis of magnitude of price changes using CPI micro-data

In order to analyse the potential determinants of the time series variation of the magnitude of price adjustments three regressions are run analysing (1) the average magnitude of price changes of price that change (M), (2) the average magnitude of price increases where prices increase (M+) and (3) the average magnitude of price decreases where prices decrease (M-).

	(1)(M)	(2)(M+)	(3)(M-)
month1	0.005	-0.006	0.000
	(0.80)	(1.32)	(0.04)
month2	-0.008	-0.008	-0.006
	(1.16)	(1.88)*	(1.05)
month3	0.007	-0.017	0.000
	(0.93)	(3.63)***	(0.01)
month4	0.000	-0.014	-0.005
	(0.03)	(2.92)***	(0.79)
month5	-0.012	-0.014	-0.002
	(1.72)*	(3.05)***	(0.28)
month6	-0.015	-0.007	-0.004
	(2.18)**	(1.42)	(0.62)
month7	-0.004	-0.009	0.005
	(0.64)	(2.02)*	(0.88)
month8	-0.010	-0.010	0.007
	(1.49)	(2.15)**	(1.11)
month9	-0.005	-0.009	0.012
	(0.78)	(2.01)*	(1.92)*
month10	-0.001	-0.007	0.004
	(0.12)	(1.44)	(0.59)
month11	0.001	-0.008	0.004
	(0.13)	(1.71)*	(0.58)
CPI	0.002	0.000	-0.002
	(1.92)*	(0.22)	(2.31)**
Repo Rate	-0.002	-0.001	0.004
	(1.58)	(1.56)	(3.78)***
Nominal Effective Exchange Rate	-0.002	-0.000	0.000
	(6.96)***	(1.71)*	(2.37)**
Constant	0.170	0.165	-0.225
	(6.17)***	(9.12)***	(9.24)***
Observations	50	50	50
R-squared	0.83	0.43	0.46

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

There appears to be no strong evidence of seasonality in the magnitude of price changes. Although, there is some evidence that the magnitude of price increases is relatively lower in March, April and May, all statistically significant at the 1% confidence level. December is the month with the highest magnitude of price increases.

With regard to state determined pricing, there is some evidence that an increase in inflation is associate with an increase in the magnitude of price changes (at the 10% confidence level) and the magnitude of price decreases is found to be negatively associated with inflation (at the 5% confidence level), that is, disinflation periods are associated with a larger magnitude of price decreases. The magnitude of price decreases is also associated with the repo rate (at the 1% confidence level), as an increase in the repo rate will be associated with a larger magnitude of price decreases. An appreciation of the exchange rate is associated with a decrease in the magnitude of price changes at the 1% confidence level.

The following table reports the results of a study of whether there is any significant relationship between the magnitude of price changes (1), price increases (2) and price decreases (3) and changes in the explanatory variables after a three month lag.

	(1)(M)	(2)(M+)	(3)(M-)
month1	0.013	-0.005	-0.000
	(1.80)*	(1.19)	(0.02)
month2	-0.000	-0.008	-0.006
	(0.01)	(1.76)*	(1.05)
month3	0.013	-0.017	0.002
	(1.73)*	(3.76)***	(0.30)
month4	0.001	-0.014	-0.003
	(0.11)	(3.11)***	(0.43)
month5	-0.008	-0.014	-0.000
	(1.11)	(3.17)***	(0.03)
month6	-0.007	-0.006	-0.004
	(0.92)	(1.28)	(0.67)
month7	0.004	-0.009	0.005
	(0.50)	(1.94)*	(0.85)
month8	-0.002	-0.009	0.005
	(0.23)	(1.95)*	(0.77)
month9	0.001	-0.009	0.011
	(0.11)	(1.91)*	(1.66)
month10	0.010	-0.005	0.000
	(1.31)	(1.12)	(0.01)

month11	0.005	-0.007	0.002
	(0.75)	(1.61)	(0.39)
L3. CPI	0.000	-0.000	-0.000
	(0.25)	(0.49)	(0.05)
L3. Repo Rate	-0.003	-0.001	0.003
	(2.15)**	(1.03)	(2.12)**
L3. Nominal Effective Exchange Rate	-0.002	-0.000	0.000
	(9.24)***	(1.90)*	(2.12)**
Constant	0.212	0.161	-0.209
	(8.25)***	(10.26)***	(9.34)***
Observations	50	50	50
R-squared	0.81	0.44	0.41

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

With regard to state-based pricing, it is apparent that after a three month lag the magnitude of price changes is negatively associated with an appreciation of the exchange rate (at a 1% confidence level). After a three month lag, the magnitude of price changes are negatively associated with changes in the repo rate and the magnitude of price decreases is also associated with the repo rate, as an increase in the repo rate will be associated with a larger magnitude of price decreases. These lagged relations between the magnitude of price changes and the repo rate are both significant at the 5% level.

Analysis of frequency of price changes using PPI micro-data

In order to analyse the potential determinants of the time series variation of the frequency of price adjustments using the PPI micro-data three regressions are run analysing (1) the frequency of price changes (F), (2) the frequency of price increases (F+) and (3) the frequency of price decreases (F-).

	(1)(F)	(2)(F+)	(3)(F-)
month1	0.075	0.056	0.019
	(7.37)***	(4.91)***	(3.10)***
month2	0.092	0.070	0.022
	(9.20)***	(6.27)***	(3.61)***
month3	0.034	0.031	0.003
	(3.41)***	(2.83)***	(0.42)
month4	0.093	0.076	0.016
	(8.77)***	(6.50)***	(2.49)**
month5	0.077	0.054	0.023
	(7.23)***	(4.58)***	(3.49)***
month6	0.020	0.006	0.014
	(1.90)*	(0.53)	(2.16)**

month7	0.077	0.051	0.026
	(7.32)***	(4.38)***	(4.00)***
month8	0.054	0.039	0.015
	(5.10)***	(3.34)***	(2.25)**
month9	0.016	0.016	0.000
	(1.55)	(1.38)	(0.03)
month10	0.063	0.040	0.022
	(5.89)***	(3.42)***	(3.39)***
month11	0.055	0.038	0.018
	(5.30)***	(3.24)***	(2.75)***
PPI	-0.001	0.001	-0.002
	(0.90)	(1.48)	(4.16)***
Repo Rate	-0.002	-0.011	0.009
	(1.49)	(6.93)***	(10.17)***
Nominal Effective Exchange Rate	-0.002	-0.004	0.002
	(4.55)***	(7.15)***	(5.58)***
Constant	0.344	0.489	-0.145
	(6.30)***	(8.03)***	(4.32)***
Observations	51	51	51
R-squared	0.89	0.88	0.86

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

It would appear that prices changes occur more frequently in the first part of the year from January to May (all with a confidence level of 1%). The frequency of price increases follows a similar pattern, but the frequency of price decreases does not.

With regard to evidence of state-determined pricing, the frequency of price decreases in the PPI basket is negatively associated with PPI inflation. In other words, periods of PPI disinflation periods are associated with an increased frequency of price decreases (at a 1% confidence level). Increases in the repo rate are positively associated with an increased frequency of price decreases (at a 1% confidence level), and with decreased frequency of price increases (at a 1% confidence level). Increases in the nominal effective exchange rate (representing a currency appreciation) are positively associated with an increased frequency of price decreases (at a 1% confidence level), negatively associated with the frequency of price increases (at a 1% confidence level) and negatively associated with the frequency of price changes (at a 1% confidence level). All of these exchange rate effects are of the expected sign as lower import price associated with a

stronger currency would tend to reduce the frequency of price increases and increase the frequency of price decreases.

The following table reports the results of whether there is any significant relationship between the frequency of price changes (1), price increases (2) and price decreases (3) and changes in the explanatory variables after a three month lag.

	(1)(F)	(2)(F-)	(3)(F+)
month1	0.087	0.073	0.014
	(6.99)***	(3.79)***	(1.40)
month2	0.104	0.086	0.017
	(8.37)***	(4.49)***	(1.76)*
month3	0.044	0.043	0.001
	(3.53)***	(2.24)**	(0.08)
month4	0.097	0.082	0.014
	(7.29)***	(4.00)***	(1.37)
month5	0.084	0.065	0.019
	(6.42)***	(3.21)***	(1.81)*
month6	0.033	0.029	0.004
	(2.53)**	(1.42)	(0.42)
month7	0.087	0.068	0.019
	(6.65)***	(3.35)***	(1.82)*
month8	0.065	0.061	0.004
	(4.96)***	(2.99)***	(0.41)
month9	0.025	0.033	-0.008
	(1.93)*	(1.63)	(0.74)
month10	0.075	0.064	0.011
	(5.73)***	(3.16)***	(1.05)
month11	0.061	0.048	0.014
	(4.72)***	(2.37)**	(1.31)
L3. PPI	-0.001	0.001	-0.001
	(0.67)	(0.53)	(1.88)*
L3. Repo Rate	-0.001	-0.009	0.008
	(0.87)	(3.61)***	(5.93)***
L3. Nominal Effective Exchange Rate	-0.002	-0.003	0.001
	(3.00)***	(2.87)***	(1.81)*
Constant	0.293	0.357	-0.065
	(4.65)***	(3.66)***	(1.28)
Observations	51	51	51
R-squared	0.83	0.64	0.62

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

It is apparent that the frequency of price decreases is negatively associated with the rate of PPI inflation after a 3 month lag (at a 10% confidence level). With regard to responsiveness to the repo rate, price decreases are positively associated with increases in

the repo rate after a 3 month lag (at a 1% confidence level) and price increases are negatively associated with an increase in the repo rate after a three month lag. These relations between pricing conduct and changes to the repo rate are significant at the 1% confidence level and may be regarded as indicative of the workings of the monetary policy transmissions mechanism where changes to the policy rate influence price setting conduct in the expected manner.

After a three month lag, changes in the nominal effective exchange rate are negatively associated with changes in the frequency of price changes (with a 1% confidence level). A currency appreciation is negatively associated with the frequency of price increases (at a 1% confidence level) and a currency appreciation is positively associated with the frequency of price decreases (at a 10% confidence level).

Analysis of magnitude of price changes using PPI micro-data

In order to analyse the potential determinants of the time series variation of the magnitude of price adjustments using the PPI micro-data three regressions are run analysing (1) the average magnitude of price changes of price that change (M), (2) the average magnitude of price increases where prices increase (M+) and (3) the average magnitude of price decreases where prices decrease (M-).

	(1)(M)	(2)(M+)	(3)(M-)
month1	0.004	-0.028	-0.024
	(0.35)	(2.40)**	(2.46)**
month2	0.020	-0.027	0.004
	(1.98)*	(2.40)**	(0.43)
month3	0.013	-0.032	0.003
	(1.27)	(2.82)***	(0.30)
month4	0.024	-0.030	0.003
	(2.32)**	(2.51)**	(0.29)
month5	0.011	-0.031	0.003
	(1.01)	(2.57)**	(0.29)
month6	-0.008	-0.029	0.007
	(0.75)	(2.44)**	(0.68)
month7	-0.000	-0.041	-0.002
	(0.04)	(3.46)***	(0.19)
month8	0.009	-0.040	0.012
	(0.82)	(3.33)***	(1.13)
month9	0.007	-0.038	0.012
	(0.64)	(3.17)***	(1.18)

month10	-0.003	-0.039	-0.003
	(0.28)	(3.24)***	(0.33)
month11	0.003	-0.032	0.001
	(0.31)	(2.75)***	(0.13)
PPI	0.002	-0.001	0.001
	(2.56)**	(1.06)	(0.79)
Repo Rate	-0.011	-0.001	0.002
	(7.51)***	(0.51)	(1.41)
Nominal Effective Exchange Rate	-0.003	-0.002	0.002
	(6.32)***	(3.12)***	(3.87)***
Constant	0.350	0.299	-0.296
	(6.45)***	(4.84)***	(5.54)***
Observations	51	51	51
R-squared	0.83	0.55	0.65

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

There appears to be evidence that the magnitude of price increases is largest in December as the reported magnitudes of all other months are reported as less than in December, with the results for all months having a high degree of statistical significance.

With regard to state determined pricing, there is some evidence that an increase in PPI inflation is associated with an increase in the magnitude of price changes (at the 5% confidence level). The magnitude of price changes is also negatively associated with the repo rate (at the 1% confidence level), as an increase in the repo rate will be associated with a reduced magnitude of price changes. An appreciation of the exchange rate is negatively associated with the magnitude of price changes and price increases and is positively associated with the magnitude of price decreases (all at the 1% confidence level).

The following table reports the results of whether there is any significant relationship between the magnitude of price changes (1), price increases (2) and price decreases (3) and changes in the explanatory variables after a three month lag.

	(1)(M)	(2)(M+)	(3)(M-)
month1	0.016	-0.019	-0.034
	(1.02)	(1.75)*	(2.92)***
month2	0.032	-0.018	-0.005
	(2.04)**	(1.67)	(0.43)

month3	0.020	-0.023	-0.005
	(1.31)	(2.22)**	(0.42)
month4	0.027	-0.030	-0.001
	(1.60)	(2.61)**	(0.05)
month5	0.018	-0.027	-0.004
	(1.09)	(2.36)**	(0.28)
month6	0.010	-0.020	-0.004
	(0.59)	(1.82)*	(0.29)
month7	0.013	-0.033	-0.010
	(0.80)	(2.94)***	(0.83)
month8	0.026	-0.032	0.003
	(1.60)	(2.84)***	(0.20)
month9	0.020	-0.032	0.005
	(1.21)	(2.88)***	(0.39)
month10	0.017	-0.029	-0.014
	(1.03)	(2.56)**	(1.12)
month11	0.011	-0.028	-0.004
	(0.68)	(2.47)**	(0.30)
L3. PPI	0.001	-0.002	0.000
	(0.64)	(2.02)*	(0.49)
L3. Repo Rate	-0.010	-0.002	0.002
	(4.92)***	(1.12)	(0.98)
L3. Nominal Effective Exchange Rate	-0.002	-0.002	0.001
	(3.37)***	(4.35)***	(2.51)**
Constant	0.295	0.344	-0.248
	(3.73)***	(6.37)***	(4.17)***
Observations	51	51	51
R-squared	0.56	0.59	0.49

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

With regard to state-based pricing, it is apparent that after a three month lag the magnitude of price changes and the magnitude of price increases are negatively associated with an appreciation of the exchange rate (at a 1% confidence level). Furthermore, the magnitude of price decreases is positively associated with an exchange rate appreciation (at a 5% confidence level). After a three month lag, the magnitude of price changes is negatively associated with changes in the repo rate. There is also some evidence that, at a 10% confidence level, the magnitude of price increases is negatively associated with the level of the PPI after a three month lag, yet this association would appear to be counterintuitive, unless it indicates that after the three month lag period factors other than the general rate of change of producer prices, are leading to a decreasing magnitude of price increases.

Further Refinements in the analysis

A number of extensions and refinements of the basic regression model would assist in advancing the objectives of the study. Firstly, analysis of time- and state- dependency in pricing conduct at the level of goods sub-categories and industry categories is envisaged. Secondly, it would be useful to include an analysis of the impact of inflation expectations on pricing conduct. This could be achieved by including in the basic regression model published data on surveys of inflation expectations, as well as inflation expectations as indicated by the relationship between long-term bonds and inflation-linked bonds of similar maturity. Thirdly, an analysis could be undertaken to establish whether changes in the frequency or magnitude of price changes can be regarded as impacting on interest rate setting in South Africa either in real time or as a leading indicator.

5. Conclusion

With regard to the CPI microdata set, this study outlined the following key findings:

- For the CPI microdata there is an overall average monthly frequency of price change of 15,97%, the average frequency of price changes tended to fall over the period from a high of 23,88% (2003 m6) to a low of 11,77% (2004 m12).
- Price increases occurred with an average monthly frequency of 10,50% and price decreases with a frequency of 5,47%. Indicating a significant degree of asymmetry in price setting in favour of price increases over price decreases.
- The highest frequency of price increases occurred in 2002m3 in the immediate aftermath of the sharp currency depreciation, with 19% of prices recorded in the sample increasing in that month (compared to a low of 6,52% of prices increasing in 2005m6).
- Initially there was a higher frequency of price increases (about 80%) than price decreases (about 20%), but by 2005m6, the proportion of price increases (51,97%) to price decreases (48,03%) approached parity, only for the proportion of price increases to price decreases to diverge once again with price increases (65,02%) assuming dominance over price decreases (34,98%) by 2006m1.
- The average magnitude of price increases was 12,26%. The average magnitude of price decreases was -15,05%. Overall, there was a downward trend in the average and median size of price changes over the period.
- There is some distinction between the pricing of goods and services. When prices rise, services prices (5,05%) increase by less than goods prices (12,77%) and when prices fall, services prices (-4,33%) fall by less than goods prices (-15,45%). In addition to falling by a smaller magnitude, services prices (3,86%) decline less frequently than goods prices (5,61%).
- There is significant heterogeneity in CPI pricing conduct with education prices, footwear and communication price changing least frequently and housing prices, prices of other goods and services, food, cigarettes, tobacco

and cigars, transport, reading matter, and medical care and health expenses all changing relatively frequently.

With regard to the PPI microdata set, this study outlined the following key findings:

- PPI prices changed with an average monthly frequency of 19,53% over the period. The highest frequency of price changes occurring in 2002m2 at 30,52% and the lowest frequency of price changes occurring in 2004m12 at 12,31%. Overall there was a downward trend in the frequency of PPI price changes during the period.
- Price increases occurred with an average monthly frequency of 11,23% and price decreases with a frequency of 8,30%. Indicating, a degree of asymmetry in price setting in favour of price increases over price decreases.
- The proportion of price increases was much higher than the proportion of price decreases in the initial part of the period under study. From the end of 2002 to the end of 2003 the proportion of price decreases rose above the proportion of price increases and again in the middle and end of 2004. Thereafter, there was a higher proportion of price increases than price decreases. There is a greater symmetry in price increases and price decreases in the PPI price data than in the CPI price data in which price increases were consistently more prevalent than price decreases.
- The average magnitude of price increases was 11,84% and the average magnitude of price decreases was -12,20%. Overall there was a downward trend in the average and median size of price changes.
- There is significant heterogeneity in PPI pricing conduct with furniture, beverages and construction prices changing at a relatively low frequency and the most flexible prices being products of petroleum and coal, mining and quarrying prices, agriculture prices and electricity prices.

With regard to the regression analysis for time and state determination of pricing conduct, this study outlined the following key findings based on the CPI data set:

- There is some degree of seasonality in the frequency of price changes with statistically significant findings that the frequency of price changes and price increases are higher during March and the frequency of price decreases being higher in June.
- The frequency of price decreases is negatively associated with inflation. Increases in the repo rate are positively associated with an increased frequency of price decreases and with increased frequency of price changes. Increases in the nominal effective exchange rate (representing a currency appreciation) are positively associated with an increased frequency of price decreases, negatively associated with the frequency of price increases and negatively associated with the frequency of price changes.
- The frequency of price decreases is negatively associated with the rate of inflation after a three month lag. So if inflation was high three months prior there is a decrease in the frequency of price decreases. The frequency of price decreases is positively associated with increases in the repo rate after a 3 month lag. After a three month lag, changes in the nominal effective exchange rate are negatively associated with changes in the frequency of price changes. A currency appreciation is negatively associated with the frequency of price increases and a currency appreciation is positively associated with the frequency of price decreases.
- The magnitude of price increases is relatively lower in March, April and May and December is the month with the highest magnitude of price increases.
- An increase in inflation is associated with an increase in the magnitude of price changes and the magnitude of price decreases is found to be negatively associated with inflation. An increase in the repo rate is associated with a larger magnitude of price decreases. An appreciation of the exchange rate is associated with a decrease in the magnitude of price changes.
- After a three month lag the magnitude of price changes is negatively associated with an appreciation of the exchange rate. After a three month lag, the magnitude of price changes are negatively associated with changes in the

repo rate and an increase in the repo rate will be associated with a larger magnitude of price decreases.

With regard to the regression analysis for time and state determination of pricing conduct, this study outlined the following key findings based on the PPI data set:

- Prices changes occur more frequently in the first part of the year from January to May. The frequency of price increases follows a similar pattern, but the frequency of price decreases does not.
- The frequency of price decreases in the PPI basket is negatively associated with PPI inflation. Increases in the repo rate are positively associated with an increased frequency of price decreases and with decreased frequency of price increases.
- Increases in the nominal effective exchange rate (representing a currency appreciation) are positively associated with an increased frequency of price decreases, negatively associated with the frequency of price increases and negatively associated with the frequency of price changes.
- The frequency of price decreases is negatively associated with the rate of PPI inflation after a 3 month lag. Price decreases are positively associated with increases in the repo rate after a 3 month lag and price increases are negatively associated with an increase in the repo rate after a three month lag.
- After a three month lag, changes in the nominal effective exchange rate are negatively associated with changes in the frequency of price changes. A currency appreciation is negatively associated with the frequency of price increases and a currency appreciation is positively associated with the frequency of price decreases.
- There is evidence that the magnitude of price increases is largest in December.
- There is evidence that an increase in PPI inflation is associated with an increase in the magnitude of price changes. The magnitude of price changes is also negatively associated with the repo rate. An appreciation of the exchange rate is negatively associated with the magnitude of price changes

and price increases and is positively associated with the magnitude of price decreases.

- After a three month lag the magnitude of price changes and the magnitude of price increases are negatively associated with an appreciation of the exchange rate. The magnitude of price decreases is positively associated with an exchange rate appreciation. After a three month lag, the magnitude of price changes is negatively associated with changes in the repo rate.

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