

THE ECONOMICS OF PLASTIC BAG LEGISLATION IN SOUTH AFRICA¹

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Abstract

In May 2003 South Africa introduced legislation intended to decrease plastic bag litter. It combined standards and price-based economic tools in an attempt to reduce the public's demand for plastic bags. This paper analyses the short term effects of the legislation on bag demand. It also provides a background to these regulations and a theoretical overview. The assessment uses bag consumption data from four retailers, each representing a different consumer market. These are analysed, and respective price elasticities calculated. The results suggest that plastic bag demand is relatively price inelastic and imply that instruments utilising price alone, would have limited efficacy. However, the combination of standards and pricing successfully curbed plastic bag use in the short run. Further analysis suggests that the effectiveness of the legislation may be declining over time.

JEL Classification: Q58

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The choice of policy tools is a central issue in pollution control literature. While theory points to the superiority of price based tools, regulation still predominates in the real world. Rather than use either of these approaches alone, South Africa recently opted for a regulation/pricing mix to address the problem of plastic bag litter.

This paper presents a preliminary review of the 'plastic bag legislation' in South Africa since its implementation in 2003, it examines consumer responsiveness to this combination of regulatory and market instruments and suggests that while income may affect consumer price responsiveness, those low income consumers who historically paid for heavy duty bags, appear to have benefited from the availability of cheaper but still good quality packets. Charging for the packets means that they are now seen as 'economic goods' with a scarcity value. This cognitive shift has changed the public's general approach to bags and their reuse. International experience suggests that this could not have been achieved by a standards based policy alone, while the low price elasticity of demand for bags suggests that a solely price based policy would also have been unsuccessful.

1. BACKGROUND TO THE SOUTH AFRICAN REGULATIONS²

Prior to the introduction of the new legislation, approximately 8 billion 'flimsy' plastic carrier bags with a thickness of about 17μ were distributed in South Africa annually (Wilson and Smit, 2002). Retailers ostensibly provided bags 'free of charge', in reality

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² Appendix 2 presents the history of the new legislation in tabular form.

incorporating their costs into the prices of goods. The packets were unsuited to commercial recycling and once utilized they entered the waste stream.

The historic extent of the plastic bag externality is unclear. Certainly the bags were unsightly, damaged the environment and contributed to livestock and marine life fatalities. However, prior to the introduction of the legislation policy makers were incompletely informed about the extent of the problem³ as there had been no life cycle analysis of the various carrier bag alternatives.

In early 2000 the Department of Environmental Affairs and Tourism (DEAT) conducted a study of waste in South Africa (Mahlangu, *pers com*, 2004). This highlighted plastics as a problem because of their high visibility and because, unlike other refuse types, plastic litter then had no organisation dedicated to its disposal and recycling.

The primary aim stated in the Schedule of Plastic Bag Regulations (2002:1) was to 'restrict the production of non-reusable plastic bags and unnecessary use of excessive amounts of disposable thin plastic film for packaging'. Through a public participation process involving government, labour and business representatives, regulations were developed to reduce, re-use and recycle plastic bags, while minimising the negative socio-economic costs of the legislation (Overview of the Plastic Bag Agreement, 2003).

An initially proposed outright ban on all plastic bags was soon revised to a ban on plastic packets with a gauge under 80 μ (Gosling, 2003). Business and labour objected, citing negative impacts on jobs, trade, retail efficiency and a negative consumer reaction. They argued that existing machinery could not produce 80 μ bags without substantial capital investment. Consensus was reached in the 'Memorandum of Agreement'⁴ of September 2002 (Appendix 1) whose most important features were:

- (1) A minimum thickness of 30 μ for plastic bags (a 20% margin of flexibility for five years effectively lowered this to 24 μ).
- (2) Specifications on the ink to plastic ratio.
- (3) Transparency regarding the cost of the bags.
- (4) A mandatory levy on each bag.

The decision to charge for bags was originally proposed, not by government, but by retailers unhappy about absorbing the higher cost of new thicker bags into the general food price. DEAT did not have the power to fix prices, but under the Agreement firms undertook to charge consumers 46c per 24l bag. An initial 2c cost-recovery levy was ostensibly earmarked for environmental purposes. In June 2004 the levy increased to 3c with proceeds going to National Treasury (Mahlangu, *pers com*, 2004). Initially all retailers were obliged to charge consumers for bags, but shortly thereafter this obligation became applicable solely to supermarkets.⁵

Environmentally and from the state's perspective, the regulation was 'a resounding success' (Glazewski, 2003:1) with 'reduced litter' and 'less devastation to marine life'. It has nonetheless been criticised as a first world law in a developing country (Cope, *pers. com.* 2004). Even though the section 21 recycling company founded as part of the Agreement envisaged new jobs, concern for job losses was expressed (Isaacs, 2003)

³ Andrady (2003) offers a detailed discussion on the complex relationship between plastics and the environment.

⁴ Henceforth known as the Agreement.

⁵ Primarily in response to a reported increase in shoplifting.

and the Cape Times reported 'over 500 jobs lost' as a result of the law (Naidu, 2004). During the first few months plastic bag manufacturers experienced a 'dramatic' 80% reduction in sales (Dickie,⁶ *pers com*, 2004). In August 2003, as a result of continued grievances by labour and manufactures, plastic bag producers lowered the 24l bag price to 32c. Retailers absorbed 15c of this cost, leaving the public to pay 17c per bag. Following this price decrease, plastic bag sales increased to 30% of the original production capacity (Dickie, *pers. com.* 2004) and continued to rise thereafter.

Some retailers, predominantly in the poorer sector where there was a demand for strong bags to carry goods long distances, already used or sold alternative thicker bags (Bland,⁷ *pers. com.* 2004). In response to the regulation, retailers targeting middle to higher income consumers introduced substitute re-useable shopping bags which provided the first feasible substitute for the regular plastic bag.

An early study into the management of packaging waste (Tolosana, 1993) found that survey respondents supported the 'Polluter Pays Principle'. *Who* the polluter was, unfortunately, remained open to dispute. The public believed the plastic industry was responsible while the industry refused accountability.

A 1996 survey of consumer attitudes towards plastic bags (Ryan and Rice) found that 82% of respondents viewed an environmental levy on bags positively. If faced with such a levy, 56% said that they would bring their own shopping bags.

NEDLAC⁸ (2000-2002) commissioned a 'Fridge'⁹ study on the socio-economic impact of the proposed plastic bag legislation. The report investigated the potential effects of increased bag thickness (to 30 μ and 80 μ), focusing on employment and the influence of alternative products.¹⁰ The report indicated that the manufacture of thicker bags would require new machinery, more than double production costs, and expose small plastic manufacturers to increased risk of closure. The report estimated that improved packing efficiency alone could yield a 30% reduction in plastic bag consumption.

Wilson and Smit (2002) assessed the 2002 amended plastic bag proposal by surveying stakeholders in the plastic bag industry. Problem areas they cited included a shortage of polymer, a lack of capacity to produce thicker bags, and an increase in the cost of bags. They argued that the extent of the impact would predominantly depend on the change in consumer demand.¹¹ The report concluded that a 50% reduction in demand would result in a contraction of the plastic bag industry, but that demand would be unlikely to decline to that level (Wilson and Smit, 2002:33). Unfortunately, none of these earlier studies explored likely price elasticities of demand.

⁶ Marketing Director Nampak South Africa.

⁷ Managing Director of Boxer Holdings.

⁸ National Economic Development and Labour Council.

⁹ A NEDLAC research structure: "Fund for Research into Industrial Development, Growth and Equity".

¹⁰ Cloth bags were excluded from the study on the erroneous grounds that their higher cost would prevent them being a viable substitute. The use of direct pricing was not evaluated as the report presumed retailers would absorb the costs but indirectly transfer them to consumers.

¹¹ A function of price charged, larger bag size and increased re-use rates.

2. THEORETICAL CONTEXT

Inherently plastic bags are quasi-public goods: they are depletable, have a market value and can be sold as private goods. Historically, however, the manner of their retail distribution in South Africa meant that they were treated as free public goods.¹² Consumers consequently demanded them to the point of personal satiety. Negative externalities emerged largely because both the markets for packaging and for packaging wastes were incomplete.

Plastic packets generate true technological externalities (See Baumol and Oates, 1988:29). They cause environmental disutility and divert municipal resources from productive uses to litter cleanup; in doing so they shift society's production possibilities frontier inwards, reducing both the economy's productive capacity and the society's aggregate welfare. By contrast, the 'adverse' impacts of the new plastic bag regulations on manufacturers of the packets constitute only pecuniary externalities. The shift to thicker re-useable bags may hurt individual polymer importers and bag manufacturers, but should not decrease the productive capacity of the economy as a whole.

Neoclassical theory argues that marginal cost pricing is necessary to maximise welfare. Certainly this has been disputed,¹³ but it is well established in the literature and provides the only real standard under partial equilibrium. Where use of a product generates an externality, the welfare optimising quantity of that product (Q^*) is reached when its price equals its marginal social cost (MSC).

The policy maker's aim is to achieve this optimal level of output (Q^*). The preferred approach in the literature is the use of market-based instruments (Cropper and Oates, 1992). These typically internalise the value of the externality into the private price paid for the good thereby shifting effective demand. The product charge currently levied on plastic bags is a conventional Pigouvian tax. To be optimal it would have to raise the price of packets till it equalled their marginal social cost.

A Pigouvian tax is 'fair' in the sense that consumption choices are made by individual agents. This enhances efficiency as individuals have the flexibility to pursue their best option (Da Motta, Huber and Ruitenbeek, 1999). Thus, while some shoppers purchase long-life shopping bags, others choose to re-use plastic ones and yet others prefer to pay the tax. Importantly, a tax allows authorities to affect the decentralized decisions of millions of consumers (Cairncross, 1991). A contentious issue is whether this revenue should be earmarked for 'green' causes or simply directed into the National Treasury.¹⁴

A problem with the Pigouvian tax is that it is unlikely to be optimal. Optimality requires that the consumer pay a price per bag just equal to the incremental cost of producing one more packet, plus the external costs which that incremental packet would impose. Limited knowledge of environmental damage precludes accurate assessment of the marginal external cost (MEC) in monetary terms. A further problem is that it would

¹² It was difficult to preclude (exclude) people from using them and an additional bag consumed by one individual did not perceptibly diminish the number available to others.

¹³ Graaff, 1957 (pp1-13) presents the counter-argument and offers a good synopsis of the debate.

¹⁴ This is the 'double dividend' debate (Perman *et al.*, 2003) where revenues from a tax can be directed to reduce other distortions in the market, in this way increasing the efficiency gains for the economy as a whole while also improving the state of the environment.

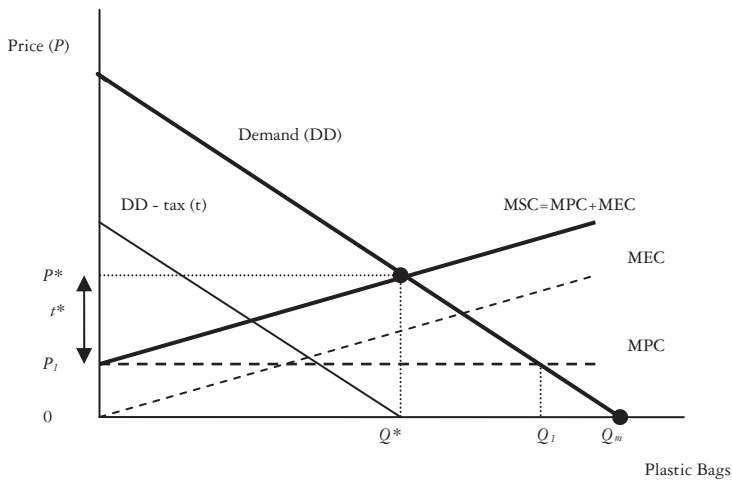


Figure 1. Stylised Diagram Illustrating the Costs of Thin Plastic Bags in South Africa

be a 'flat rate' tax and therefore fundamentally regressive. Given South Africa's skewed income distribution, this raises both welfare and political feasibility concerns.

The free provision of flimsy plastic shopping bags in South Africa involved two market failures. Firstly, the plastic bags *did* have a market price, their marginal private cost (MPC), but the supermarkets providing them 'as a service to customers' hid that price, so that the bags were considered as 'free goods'. Secondly, the bags generated a negative externality, their marginal external cost (MEC). Since optimality requires that price equal marginal social cost, the price of bags would have to cover *both* the MPC and the MEC.

Fig. 1 is a stylised representation of the initial South African scenario in which bags appeared to be free to the consumer though the MPC was positive.¹⁵

When bags are distributed (effectively) gratis, the public demand Q_m . If retailers directly charge the private cost price for bags (i.e. $P_1 = MPC$) consumption falls to Q_1 . The optimal Pigouvian tax (t^*) is then the difference between P^* and P_1 , and equates DD with MSC.

A number of points suggest that bag pricing could successfully be used to constrain thin plastic bag use in South Africa: the product is identifiable, the bags are used in large quantities, the substitution possibilities are less polluting than thin plastic bags¹⁶ and the new charge operates within the existing administrative system.¹⁷ However, a low price elasticity of demand for the bags would constrain such a tax's effectiveness. This is further discussed in section 5.

South Africa has historically used direct regulation (command and control measures or standards) to manage environmental problems. The banning of plastic bags with a gauge under 30μ (24μ) is such a regulation. Standards offer simplicity and can achieve

¹⁵ Although there may be an element of oligopsony in the market between retailers and manufacturers, a constant-cost economy is assumed for illustrative purposes. The MPC curve is horizontal at P_1 (approximately 15c, this being the price paid by retailers for thin plastic bags).

¹⁶ E.g. Canvas, stronger plastic or reused bags.

¹⁷ Plastic bags are itemised separately like all other purchases resulting in low monitoring and enforcement costs. The initial administrative problems were promptly resolved.

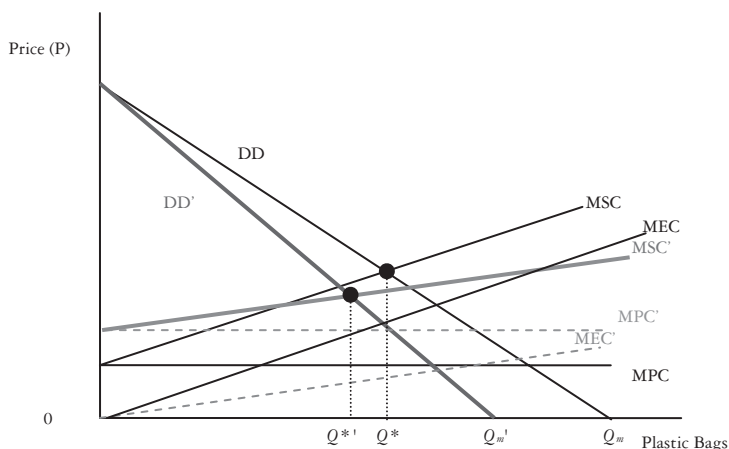


Figure 2. Regulation Approach: Increasing the Thickness of Plastic Bags

short-run results with comparative ease. However, like market-based tools, their results are suboptimal when market information is incomplete. Moreover, even with full information, efficiency requires that the penalty for contravention be optimal and enforcement strict. In addition, since each firm faces a different cost in adapting to new regulations a standards based approach causes 'static inefficiency' (O'Connor, 1999:92). Standards can also induce perverse outcomes (Cairncross, 1991, Da Motta, Huber and Ruitenbeek, 1999); if the percentage increase in plastic thickness is greater than the percentage decrease in bag usage, the amount of plastic used will increase.

Standards offer an important advantage however: where market based instruments fail, as when consumers are unresponsive to price signals, standards can generate real results albeit at a lower level of efficiency. Fig. 2 illustrates the impacts of changing bag thickness specifications.

The following changes are emphasized.

- The demand curve (DD) reflects consumer behaviour. Legislation to increase the gauge of plastic used in bags would pivot the demand curve inwards to DD'. If given away at zero price the number of bags consumed would drop from Q_m to Q_m' . Such thicker bags mean stronger packets, increasing packing efficiency and removing the need for double bagging. Their greater reuse potential further reduces the number of packets consumed.
- The cost of producing bags increases with the gauge of plastic used. Consequently the marginal private cost of bags shifts upwards (MPC').
- Heavier gauge packets reduce the negative externalities of plastic packets by increasing recycling and reuse, hence the slope of the MEC curve becomes shallower (MEC').
- Marginal social cost is the sum of MPC and MEC. The MSC curve therefore shifts upward, but its slope decreases (MSC').
- The heavier gauge of plastic used shifts the optimal use of packets to Q^* (where $MSC' = DD'$). Whether this involves an increase or a decrease in bag use depends on the relative magnitudes of the three key shifts illustrated:¹⁸ hypothetically it could lie to the left or to the right of the original equilibrium (Q^*).

¹⁸ Fig. 2 above is purely heuristic.

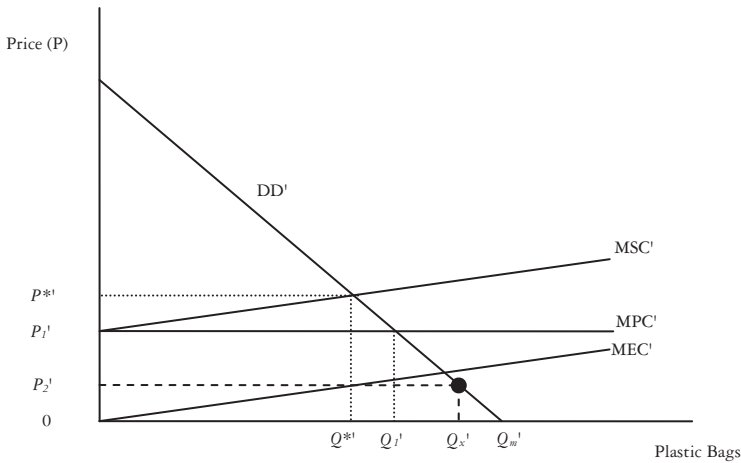


Figure 3. The South African Plastic Bag Legislation: A Combination of MSC Pricing and Standards

The current plastic bag policy combines regulatory and price measures. Such a 'mixed tool' can achieve 'policy objectives more efficiently than either [instrument] alone' (O'Connor, 1999:92). Fig. 3 shows the relevant curves once the thicker bags have been introduced. For the first three months of implementation, retailers charged consumers the full MPC of thicker bags (P_1') corresponding to a quantity at Q_1' . Only if the levy charged per bag ($2c$) were equal to the difference between P^{*1} and P_1' would it have constituted an optimal Pigouvian tax.

In August 2003 the consumer price decreased (P_2') due to a change in pricing structure.¹⁹ The new level of consumption (Q_x') was thus more than Q_1' (output level after the introduction of the pricing structure) and less than Q_m' (output level prior to the pricing mechanism).

3. METHODOLOGY

The effectiveness of South Africa's plastic bag regulations is assessed by addressing the following questions:

- (1) Have consumers been responsive to these changes in price and standards?
- (2) How different were consumer responses to the initial price introduction and to the second price change?
- (3) How important is income in determining price sensitivity?
- (4) Given the short term trends, what are the long term expectations of this policy?

In order to answer these questions four retailers were selected from the 'Retailers Plastic Bag Working Group':²⁰

These retailers have income based target markets and therefore proxy income groups: Firm 1 targets high income, Firm 2 middle-upper income, Firm 3 middle-lower income

¹⁹ See section 1 above.

²⁰ It did not encompass the full spectrum of SA retailers. Confidentiality prevents the retailers from being specified.

Table 1. Retailer information²¹

Retailer	Market Share ²²	LSM ²³
Firm 1	7%	7-10
Firm 2	36%	6-9
Firm 3	29%	3-8
Firm 4	1%	1-6

and Firm 4 lower income consumers (Annual Reports and personal communications with management). Although Firm 4 operates predominantly in rural areas and has only 1% of the formal market-share, its inclusion provides insight into the behaviour of lower income consumers.²⁴

(a) *Data Caveats and Manipulations*

Monthly plastic bag sales figures, supplemented by interviews, were obtained from each retailer. Firms 2, 3 and 4 had not kept records of bag consumption prior to the legislation.²⁵ The lack of complete data preceding May 2003 for these firms meant that their base values had to be extrapolated from broad estimates.²⁶ The three standard bag sizes currently in use are 8l, 12l and 24l (Appendix 1). The largest bag size dominated consumption both pre and post regulation (*pers. com.* 2004), thus only trends in the 24l bags are discussed. It is assumed that the relative proportion of varying sized bags used has remained constant.

Since bag use is primarily driven by retail sales, the numbers of bags used had to be corrected for monthly real retail trends before own price elasticities could be estimated. Individual retailer's sales being confidential, Statistics South Africa's (2004, 2005) monthly retail trade figures at constant prices provided the best available surrogate. This was supported by the relatively high and consistent correlation coefficients between these monthly retail sales and plastic bag sales between May 2003 and May 2004.²⁷

²¹ Statistics are from Annual Reports, *Business Report* (2004) and representatives from supermarket retailers.

²² These are approximate estimates of which formal supermarkets constitute 60-70% of the entire sector. The size of the informal sector is unknown.

²³ LSM – Living Standard Measure. It gives an idea of the consumer market, on a scale of 1-10 with 1 representing the lowest income consumers.

²⁴ Because of these differences retailer information cannot be aggregated.

²⁵ Pre-May 2003 plastic bags were not considered a commodity and thus most retailers did not keep records of consumption trends.

²⁶ Firm 2: Immediately following the regulations, plastic bag usage dropped by 80% (*pers com.*, 2004). By reverse extrapolation this gives a monthly average of 20 million bags. The company's largest volume bags were the most popular prior to and following the legislation. Firm 3: Historically, 600 million bags were consumed per annum (*pers com.*, 2004). Their largest volume bag (16l) constituted 70% of all bags distributed, representing 35 million large bags per month. Firm 4: The data were provided as 'Plastic Bag Sales in Rands.' These were converted to physical units using the respective prices. Bag usage dropped initially by 60% (*Pers com.*, 2004), thus prior to the legislation Firm 4 had a base level average of about 2 million bags per month assuming all plastic bags consumed are the largest. Firm 4's data also extends until July 2004.

²⁷ 0.63, 0.57 and 0.63 for Firms 1, 2 and 3 respectively. Firm 4's coefficient was lower (0.48). Firm 4's consumers had an established convention of buying good quality bags at the store. and reusing them. This reuse may explain the lower coefficient.

Over this period Firm 2, Firm 3 and Firm 4 also increased their largest bag sizes (from 18*l*, 16*l* and 18*l* respectively) to 24*l*. Firm 1's bags were 24*l* already. As the carrying capacity of the bags had increased, some of the decline in plastic bag usage may have resulted from these larger bag sizes. To correct for this, a conservative 'lower limit' estimate was calculated for these firms.²⁸

(b) Estimating Price Elasticity of Demand

Since bag supply has never been a constraint, price elasticity of demand (η) could be estimated directly from plastic bag sales.

Plastic bag consumption falls into three initial phases.

Phase 0: the pre-legislation base period – 8 μ bags issued at zero price.

Phase 1: new 24 μ plastic bags cost 46c each (May 2003 to July 2003).

Phase 2: 24 μ bags cost 17c each (August 2003 to June 2004).²⁹

Arc elasticity³⁰ allows the calculation of η with a zero base value and ensures the calculated elasticity is not influenced by the direction of price change. The initial legislation introduced two new elements: bag prices rose and bag quality was improved (as thickness rose to 24 μ). This presented an identification problem – the unique impacts of price and quality changes could not be separated because they occurred simultaneously. However, the second price change presented no such problem and did show a clear short term relationship between price and quantity demanded.

4. DATA DESCRIPTION

Fig. 4 indicates short term trends in plastic bag consumption using actual, de-seasonalised and lower limit (volume corrected) plastic bag sales for each retailer. The dashed lines indicate the May and August price changes. Overall, phase 1 exhibits a substantial fall in bags used from consumption in phase 0; however, following the August price decrease bag sales gradually increase.

There are a few anomalies in the time series. Firm 1's sales were relatively high in May 2003 despite the commencement of the regulations. It must be reiterated that Firm 1 was the only retailer to keep previous consumption records.³¹ Thus plastic bag consumption prior to the 9th May, when bags were still free, is also captured in the May observation. Additional calculations for Firm 1 are therefore shown excluding May 2003.³² Firm 4 shows a distinctive peak in response to the second price change. This firm had always sold heavy gauge alternatives to flimsy 8 μ packets. The new legislation effectively provided a significantly cheaper, good quality substitute for the firm's heavy gauge bags.

²⁸ Base values were multiplied by 18/24 (Firm 2 and 4) and 16/24 (Firm 3).

²⁹ In June 2004 a third phase commenced when the price of 24*l* bags increased to 21c. Unfortunately only firm 2 has provided a usable data set that covers the impacts of this price change. Its implications are covered in section 5.

³⁰
$$\eta = \left(\frac{P_1 + P_2}{Q_1 + Q_2} \right) \cdot \frac{\Delta Q}{\Delta P}$$

³¹ Firm 1's bag consumption prior to May 2003 cannot be displayed for confidentiality reasons.

³² Calculations excluding May 2003 for the other retailers were not significantly different from the presented figures.

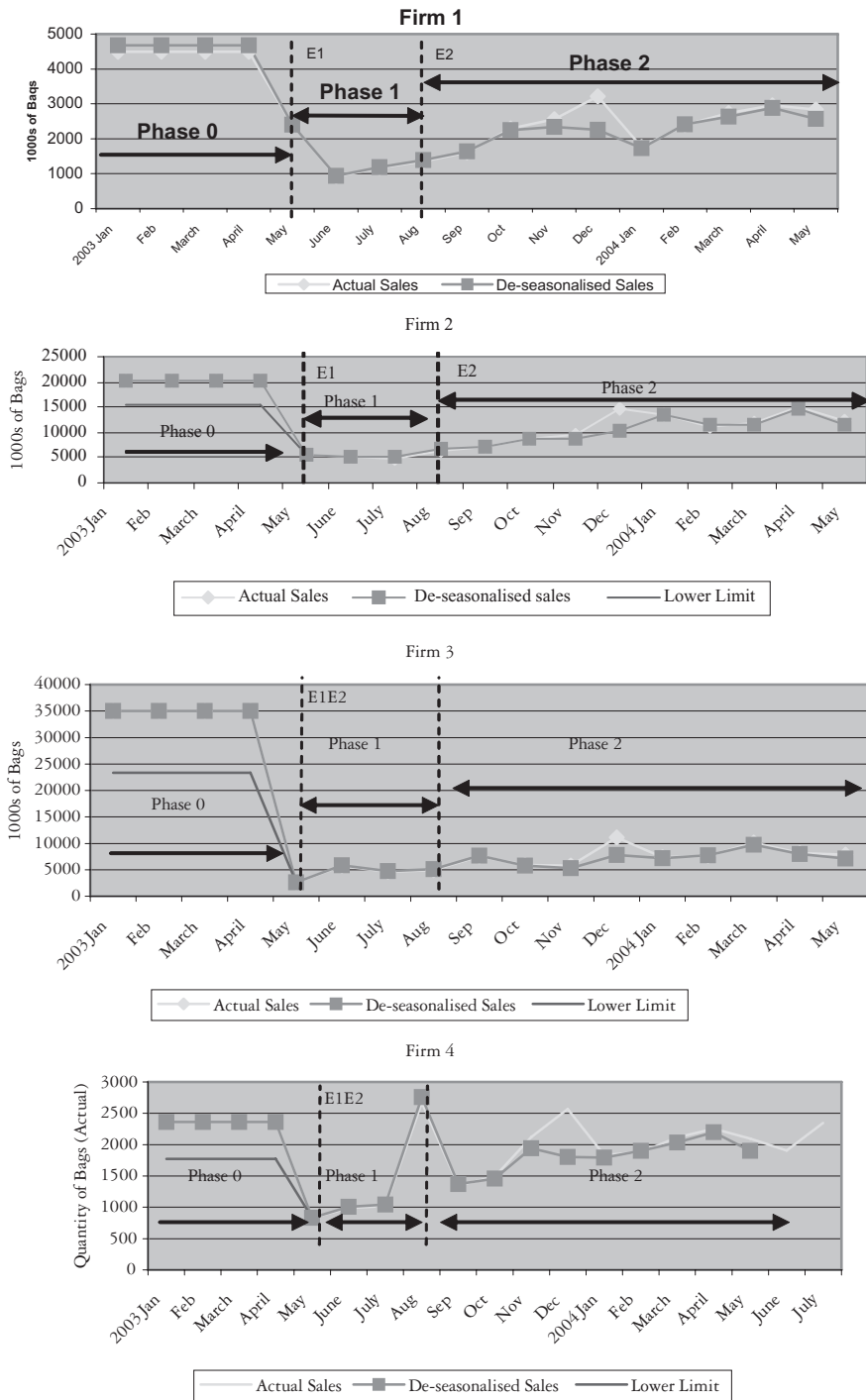


Figure 4. Plastic bag use by four major retailers, January 2003-May 2004 (Firm 4 till July 2004)

Table 2. Percentage decrease in plastic bags issued relative to pre-legislation levels

	Price change 0-46c gauge change to 24 μ		Price change 0-17c gauge change to 24 μ	
	Actual	Corrected for bag size (LL)	Actual	Corrected for bag size (LL)
Firm 1	-67.70%	na	-52.78%	na
excl. May03	-77.21%	na	na	na
Firm 2	-74.07%	-65.43%	-49.16%	-32.21%
Firm 3	-87.44%	-81.17%	-79.61%	-69.42%
Firm 4	-60.00%	-45.82%	-18.96%	8.06%

Table 3. De-seasonalised absolute arc elasticities of demand (24l bags)

	Market Share ³³	Price change 46-17c
Firm 1	7%	0.41
excl. May 2003		0.76
Firm 2	36%	0.70
Firm 3	29%	0.52
Firm 4	1%	0.72

5. DATA ANALYSIS

Since the second price change in August 2003 all retailers have shown gradually increasing sales of plastic packets. While Firms 1-3 are still issuing fewer bags than they were prior to the legislation's introduction, Firm 4's plastic bag use was already approaching its original levels by mid-2004. As mentioned above, however, this firm was already offering heavy-duty bags for sale at the time, and has a low income target market.

Table 2 presents the percentage decrease in plastic bag consumption for each retailer relative to consumption in the base period when bags were free.

The above table quantitatively demonstrates the decline in plastic bag consumption in response to the price changes. In phase 1 the drop in sales is noteworthy with Firm 3 (middle to lower income) displaying the largest percentage decrease.

While local plastic bag manufactures may have been heavily impacted by the legislation, these effects were moderated by the August 2003 price decrease. As Table 3 below shows, however, consumer responses to this price fall were price inelastic..

The Table presents de-seasonalised price elasticities revealed by consumption changes immediately after the price fall from 46c to 17c on 24 μ gauge 24l bags.

The general trend is captured by Firms 2 and 3 which together represent 65% of South African supermarket turnover. Firm 3 which represents middle to lower income consumers shows the smallest price elasticity of demand. However, the initial reduction in plastic bag consumption was the most severe for Firm 2 (81.1%) when the price change (0-46c) was phased in.

The effects of the May and August legislative and price changes are illustrated below (Fig. 5), with S_1 , S_2 and S_3 representing plastic bag sales (in '000s of bags) prior to the legislation, after the first legislative change, and after the second legislative change respectively. S_1^* is the quantity of bags used prior to legislation adjusted for change in bag volume. The dashed line indicates the May price/bag thickness change after correction for any change in the volumes of the packets issued. It must be stressed that these diagrams

³³ These are estimates of the firms' shares in the supermarket retail sector (supermarkets constitute 60-70% of all formal retailing). The size of the informal sector is unknown.

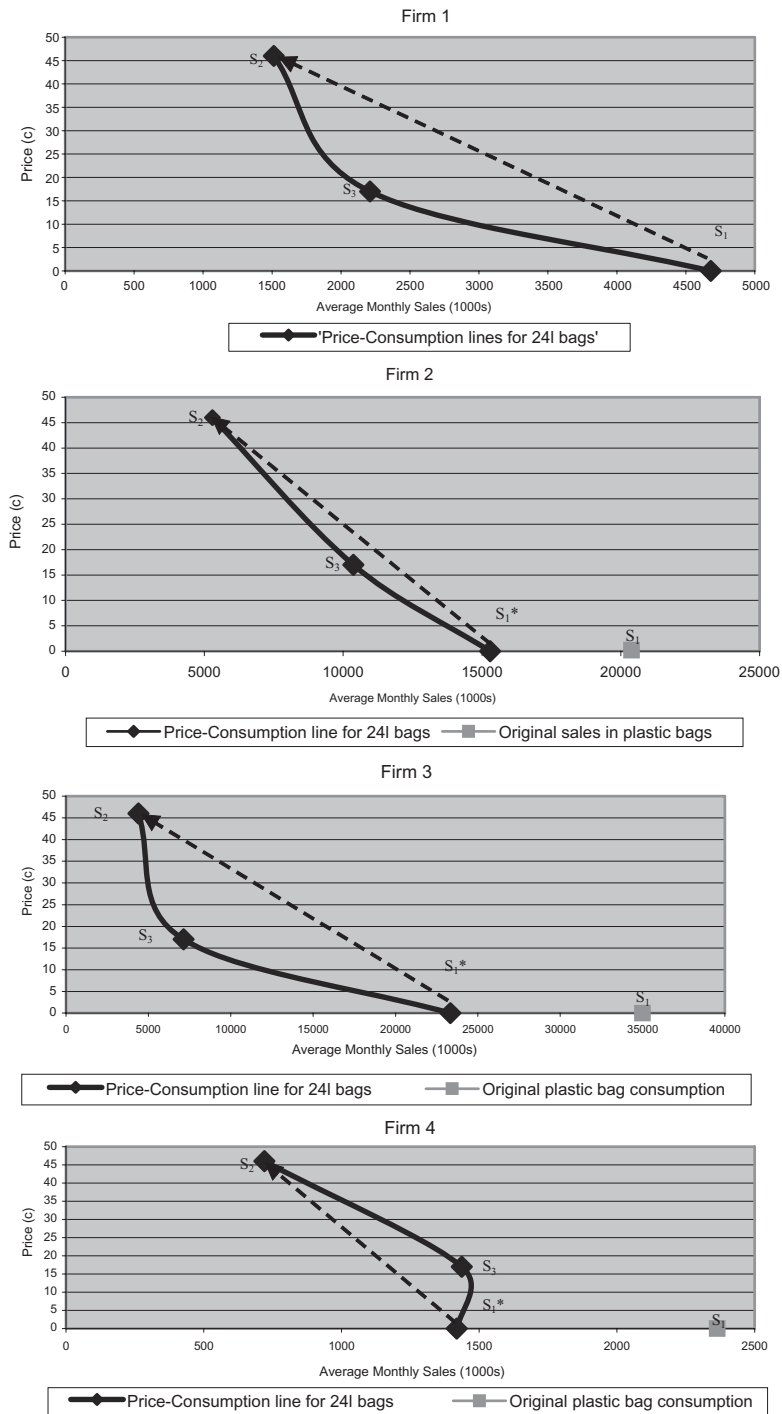


Figure 5. De-seasonalised Plastic Bag Price-Consumption Schedules for 24 litre packets (including correction for changes in bag capacity)

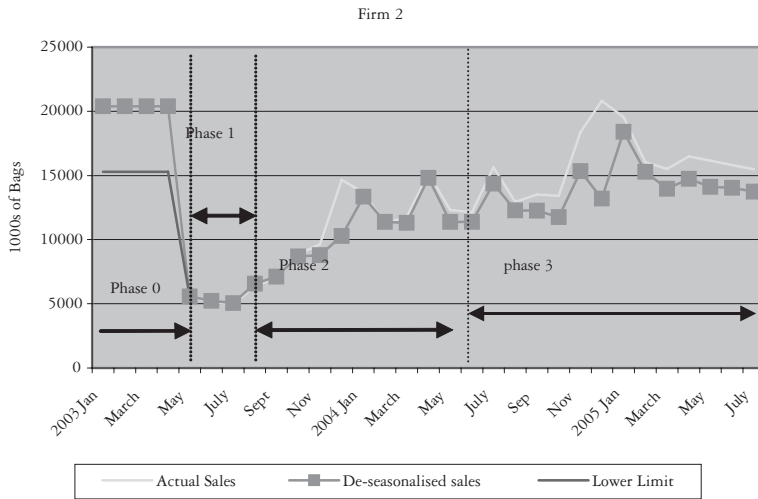


Figure 6. Updated plastic bag use Firm 2, January 2003-July 2005

are not true demand curves; they show only two price changes, the first of which incorporated adjustments due to changes in bag size and quality. Both events involved a change in consumer awareness.

Consumer reactions to the sale of bags at firm 4 differed from the reactions at firms 1, 2 and 3 (which previously distributed flimsy bags gratis). This may reflect initial consumer resistance to paying for a previously 'free' item; alternatively it may reflect the effect of improved bag quality. Firm 4's lower sensitivity to the initial price/quality regulation can be attributed to the prior availability of heavy duty substitute bags (priced at 35c and 90c) – the 46c price of the new regulated bags was very competitive with the heavy gauge alternatives already available. The low elasticity may also reflect the limited ability of low-income customers (who carry their own shopping by hand) to *reduce* their use of packets when only one or two bags are used per transaction (Bland, *pers com*, 2004). By contrast, firm 4 shoppers showed the greatest price sensitivity to the subsequent price fall from 46c to 17c. At this lower price the *regulated* plastic bags were considerably cheaper than their substitutes and this was reflected in greater sales of the new specification bags.

Subsequent to these short run effects, consumer responses continued to change. Particularly significant was the steady rise in consumption of plastic packets. Fig. 6 below illustrates the number of 24l bags issued weekly by firm 2 – one of the major supermarket chains – for the period May 2003 until July 2005. It is clear that in the two years following the initial changes in price and bag quality, and the subsequent fall in bag price, the number of bags issued has steadily risen.

The questions posed at the beginning of section 3 can now be answered:

- (1) The initial (May, 2003) price rise combined regulation and price effects, while the second (August, 2003) change involved price alone. Public reactions to both indicated that these policies do affect use of plastic bags in the short term.
- (2) The initial response by most consumers (Firms 2 and 3) to the *introduction* of the legislation was the most significant. A common argument is that price elasticity is greater in the long run than in the short run since consumers take time to adjust their spending

patterns after a price change. South Africa's plastic bag experience suggested the opposite: the initial 'price shock' had the greatest impact. Even after allowing for changing bag size and quality, it is clear that as the public became accustomed to the charge, its effectiveness declined.

(3) The 'income effect' initially appeared minimal although low income consumers at firm 4 did substitute towards the new bags when they became available at 17c. The availability of substitutes, and consumers' behavioural adjustments to the policy change over a significant period of time, were more powerful determinants of demand. In real terms, the cost of plastic bags (as a percentage of shopping expenditure) was low and had generally been built into retail prices as a hidden item. Effectively the new legislation transformed the cost of bags from being an 'add-in' item to being an 'add-on' one. The new regulations did raise the real cost per bag, but the bags were now re-usable, and being stronger, fewer were needed. One of the arguments against the regulation was that it would constitute a regressive tax – disproportionately hurting the poor. The reusability of the bags, the availability of options, and the possibility that the new bags are in some cases more useful or cheaper than the old ones, suggest that this regressivity is a non-issue.

(4) While the short term impact of the legislation led to a significant reduction in plastic bag consumption, the longer term trend observed from Figure 6 indicates that bag consumption has almost returned to original levels. There is, however, a general consensus that the litter problem associated with plastic bags has been reduced. Further research into reuse and recycling rates is needed. The new price gives value to bags; together with increased thickness this raises the likelihood of reuse.³⁴ The regulations concerning thickness and printing also support recycling. It remains to be seen how these two areas of the plastic bag life cycle have been affected.

6. CONCLUSION

Micro-economists are accustomed to argue that the price elasticity of demand for a given price change rises with time, *i.e.* that it is greater in the long run than in the short run. The longer the time period, it is argued, the more substitution opportunities arise. Our analysis has suggested that this sort of logic can result in serious mis-estimation of the negative effects flowing from environmental legislation. Where a price change is small relative to household disposable income, initial reactions may be significant as consumers resist the new higher price, but as they become accustomed to it, the impact on consumption declines. As theory suggests, cheap goods are typically price inelastic.

This analysis has shown that plastic bag consumption and plastic bag litter did indeed decline sharply in response to the combination of price and regulation in the initial 2003 legislation. Thereafter they rose steadily. Two reasons suggest themselves. Firstly the price charged was dropped from 46c to 17c, and secondly, consumers became accustomed to paying for the bags. The steady rise in bag usage over the intervening period suggests that this may be a significant issue, and that the August 2003 drop in price may have been unduly steep. Certainly the negative impacts of the regulations on the plastic packaging industry have not been as profound as initial concerns suggested.

³⁴ This may not necessarily be in the form of shopping bags. For example, individuals may conclude that purchasing plastic bags is more cost-effective than buying bin liners.

The cognitive shift that occurred amongst consumers may have been the most important feature of the legislation. Economic value is now attached to plastic bags. Hopefully this change in attitude will persist and shift consumers' environmental consciousness.

The Wilson and Smit (2002) study specified that if bag consumption decreased by more than 50%, the plastic bag manufacturing industry would be harmed. As we have shown, the percentage decrease in plastic bag sales relative to original consumption levels was initially high (falling by 60% to 90% in the first phase). In phase 2, however, the number of bags distributed was less severely affected, with reductions varying between 20% and 80% of original consumption levels. Over a longer time horizon (May 2003-July 2005), and allowing for the change in size of the packets issued, the fall in the quantity of bags demanded at the country's biggest retail chain was between 15% and 20%. Clearly the initial concerns that the legislation would permanently harm the plastic packaging industry were seriously overstated.

The standard-based tool of increasing bag thickness facilitates reuse and recycling but does not impact on the perceived value of the bags. The price instrument on the other hand facilitates the change from bags being a liability to being a general asset. The pricing tool is clearly limited by the long run price inelasticity of demand for goods that make up a small share of household expenditure. The implication for policy is that if plastic bag litter is still deemed a problem, the price increase would have to be considerable to induce a noteworthy change in consumption. Alternatively, the reuse and recycling avenues need to be promoted.

APPENDIX 1 SUMMARY OF THE MEMORANDUM OF AGREEMENT

On the 26th September 2002 the 'Memorandum of Agreement' was signed by DEAT (Department of Environmental Affairs and Tourism), organised labour represented by the Congress of South African Trade Unions (COSATU) and the National Council of Trade Unions, and organised business represented by the Chemical and Allied Industries Association, Plastics Federation of South Africa, Plastic Recyclers Employers Organisation and the Retailers Plastic Bag Working Group. Plastic bags were defined as those acquired at the point of purchase. Thin plastic bags used in primary packaging, such as for bread and fruit, were not included in this definition. The following key principles were agreed upon:

a) Thickness

Plastic bags would have a minimum thickness of 30 μ with a 20% margin of tolerance for five years (thus 24 μ). Refuse bags would also require a minimum amount of recycled material. The exact percentage and definition of 'recycled content' was not specified.

b) Printing on plastic Bags

The ink to plastic ratio affects the recyclable potential of the bags. Printing on 50% of the bag would be allowed; however, where the ink was problematic for recycling purposes, only 25% of the surface area would be for printing.

c) Disclosure and Transparency

The full cost of plastic bags would be passed on to the consumer. Prices of general goods would decrease accordingly. Major retailers would supply three standard plastic bag sizes.

d) Levy

A levy would be imposed on the manufacturers, but with the understanding that it would be disclosed and recovered from the consumer. This levy would go towards funding the section 21 company. The initial levy was set at 2c per bag.

e) Section 21 Company

This company would be a 'Proudly South African' member and would support the government by promoting the reduction of plastic bag litter such as by developing markets for recycled material. It would undertake research concerning plastic bags and encourage educational campaigns. It would also be responsible for managing the levy.

f) Promotion of Job Creation

For a five year period, retailers and manufacturers would not reduce labour because of the regulation. The establishment of the section 21 Company would generate from 2000-4000 jobs in the formal and informal sectors.

g) Prevention of Illegal Imports

Imported plastic bags would be subject to domestic regulations, whilst exporters could continue to manufacture thin plastic bags as before.

APPENDIX 2
RELEVANT LEGISLATION AND EVENTS PRECEEDING AND RELATING
TO THE PLASTIC BAG POLICY

Date	Name	Relevant points
1989	Environment Conservation Act (Act 73 of 1989)	Provided for: <ul style="list-style-type: none"> • Prohibition of littering • Waste management at disposal sites • Penalties for involvement in activities that have a negative environmental affect. • Control over imports and exports of wastes and related material
1993	White Paper: Policy on a National Environmental Management System for SA	<ul style="list-style-type: none"> • Uphold principles of re-use, recycling and recovery of re-usable packaging materials. • Encourage the creation of profitable facilities for the use, re-use and recycling of urban solid waste. • Establish guidelines for evaluating packaging material.
1996	Constitution (Act No. 108): Bill of Rights (chapter 2 section 24)	Everyone has the right to: <ul style="list-style-type: none"> • A protected environment for present and future generations Reasonable legislative measures that: <ul style="list-style-type: none"> • Prevent pollution and ecological degradation • Ensure sustainable development
May 2000	White Paper on Integrated Pollution and Waste Management for South Africa	Proposed: <ul style="list-style-type: none"> • Pollution prevention and waste minimisation policies • Involvement of all sectors of society • 'Duty- of-core' principle – the institution which generates waste is responsible for its management and disposal thereafter. • Establishing a National Waste Management Strategy to translate policy into practice.

APPENDIX 2 *Continued*

Date	Name	Relevant points
19 May 2000	Proposed Regulations (1 st Draft)	<ul style="list-style-type: none"> • Banned thin 'carry bags' • Effective: <ul style="list-style-type: none"> ◦ 1 Jan 2001: Minimum thickness = 30 μ ◦ 1 June 2002: Minimum thickness = 80 μ • Penalty fine up to R100 000
23 October 2001	Proposed Regulations (2 nd Draft)	<ul style="list-style-type: none"> • 'Plastic bags' – included bread bags, flat bags and carrier bags. • Effective: 1 June 2002
9 May 2002	(Amended) Regulations under section 24(d) of Environment Conservation Act. Plastic Carrier bags and Plastic Flat bags	<ul style="list-style-type: none"> • inclusion of refuse bags in regulations • Commencement date: 9 May 2003 • Minimum thickness: <ul style="list-style-type: none"> ◦ 80 μ (with printing) ◦ 30 μ (without printing) • Penalty of fine no more than R100 000 and/or imprisonment no more than 10 years.
September 2002	Memorandum of Agreement between DEAT and Organised Labour and Organised Business. (See Appendix 1 for more detail)	<ul style="list-style-type: none"> • Referred to plastic bags at point of purchase, i.e. secondary packaging Main elements included: <ul style="list-style-type: none"> • Minimum thickness <ul style="list-style-type: none"> ◦ 30 μ with 20% tolerance for 5 years • Specification of ink-type and surface coverage • Transparency of costs of bags (first mention of a charge on bags) • Development of market for recycled material • Promotion of job creation • Establishment of a section 21 company • Mandatory levy • Prevention of illegal imports
9 April 2003	Repeal of Regulations.	<ul style="list-style-type: none"> • Cancelled Plastic Bag Regulations published May 9 2002
9 May 2003	Regulations under section 24(d) of Environmental Conservation Act. Plastic Carrier Bags and Plastic Flat Bags	<ul style="list-style-type: none"> • Regulations commenced. • Prohibition of certain plastic bags according to 'Compulsory Specification of Plastic Carrier Bags and Flat Bags'. • Penalty to offenders: fine and/or imprisonment. • Separate charging of plastic bags is <i>not covered</i> in the legislation.
May 2003		<ul style="list-style-type: none"> • <i>Retailers</i> charge for plastic bags: <ul style="list-style-type: none"> ◦ (3 sizes), 24l plastic bag is charged 46c each (cost price + VAT + 2 cent levy)
20 June 2003	Compulsory Specification for Plastic Carrier bags and Flat Bags	<p>Required:</p> <ul style="list-style-type: none"> • Plastic wall thickness greater than 24 μ • Printing and ink specifications <p>Applied to:</p> <ul style="list-style-type: none"> • Domestic and imported plastic bags for use in RSA, not exports • Not bread bags, refuse bags, bin-liners or household plastic bags.
August 2003		<p>Retailers decreased cost of bags from 46c to 17c (per 24l bag)</p> <ul style="list-style-type: none"> • Manufacturers cut cost price of bags • Retailers further subsidised bags
February 2004	Environment Conservation Amendment Act 2003	<p>Enabled minister of Environmental Affairs and Tourism to make regulations regarding:</p> <ul style="list-style-type: none"> • compulsory charges and other related financial measures • control, sale, distribution etc of products that have a detrimental effect on the environment.
June 2004	Customs and Excise Act, 1964. Amendments of Schedule No. 1(No.1/3/2)	<ul style="list-style-type: none"> • Levy set at 3c per bag
June 2004		<ul style="list-style-type: none"> • Price of bags increased: 24l bag = 21c

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