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THE ECONOMICS OF NONLINEAR PRICING: EVIDENCE FROM AIRFARES AND GROCERY PRICES

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DISCUSSION PAPER 10.23

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Quantity discounts, characterised by unit prices falling as the quantity purchased rises, are a proliferate phenomenon that finds root in the economics of packaging. This paper reviews the key economic foundations of nonlinear pricing, introduces new pricing data and conducts an empirical investigation into airfares and grocery prices, which are shown to exhibit quantity discounts of an identical order of magnitude. The constancy of the quantity discount across distinct markets hints at the existence of a common force underlying the determination of prices.

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I. Introduction

Quantity discounts are widespread phenomena to be found in many markets, including the markets for groceries, illicit drugs, private school tuition, storage space and airline flights. As the quantity purchased increases, price increases less than proportionally. For example, a two-litre bottle of milk usually sells for less than twice the price of a one-litre carton. At the heart of this relationship is a dynamic tension between cost economies and price discrimination, with far-reaching implications for efficiency in goods and services markets.

The existence of quantity discounts can be attributed to several key reasons. Economies of scale in the production or retail of goods can be passed on to consumers in the form of discounts for bulk purchases. Alternatively, as in illicit drug markets, a risk premium might be charged for smaller package sizes that exposes a dealer to more individuals (Clements and Zhao 2009). Finally, quantity discounts could be explained by price discrimination, whereby the wholesaler or retailer exploits differences in the willingness-to-pay of different consumers.

This paper introduces new data on ticket prices for airline flights and on grocery prices, both of which are shown to exhibit quantity discounts of a near identical order of magnitude. Section II reviews the key economic foundations of nonlinear pricing. Section III introduces and employs an hedonic pricing model to estimate discounts in ticket prices for international flights from Perth, Australia. Section IV extends the application of this model to grocery prices in Australian supermarkets. Section V assesses the relationship between the size of the discount, the number of times the product can be divided and the markup charged for dividing products. Section VI concludes.

II. Nonlinear Pricing

Price Discrimination

There are several key explanations for the existence of quantity discounts. One explanation is price discrimination, where lower unit prices for larger quantities suggest that consumers of larger quantities have more elastic demand than consumers of smaller quantities. For example, suppose that there are just two classes of consumer: large and small. Producers maximise revenues by selling larger quantities at a lower price to the large-customer market, while also selling smaller quantities at a higher price to the small-customer market. In this way, the producer is able to exploit more consumer surplus than allowed under a single-price scheme. Effective price discrimination requires that the producer is able to segment the market and limit resale in order to reveal the consumer's maximum willingness-to-pay.

To illustrate the mechanics of price discrimination and the role of the price elasticity, consider the allocation of seats between one-way and return passengers on a given flight. Taking a one-way ticket as the base package size, we treat a return ticket as a larger package comprising two one-way components (outbound and inbound), so that if return is less than twice the price of one-way then quantity discounts exist. As a return ticket is a package twice the size of one-way, let the package size s equal one for one-way and two for return. For any given package size, define the unit price p'_s as the price of the ticket p_s divided by its size s, i.e. $p'_s = p_s/s$. Marginal revenue MR_s as a function of unit price and the price elasticity of demand η_s is therefore $MR_s = p'_s(1+[1/\eta_s])$, where $s = 1, 2$. Equalising the marginal revenues for one-way and return gives $p'_1[1+(1/\eta_1)] = p'_2[1+(1/\eta_2)]$ where p'_1 and η_1 are, respectively, the unit price and price elasticity of one-way; likewise for $s = 2$. Rearranging gives the ratio of the price elasticities:

$$\frac{\eta_1}{\eta_2} = \frac{(\eta_1+1)/(\eta_2+1)}{p'_2/p'_1}, \tag{1}$$

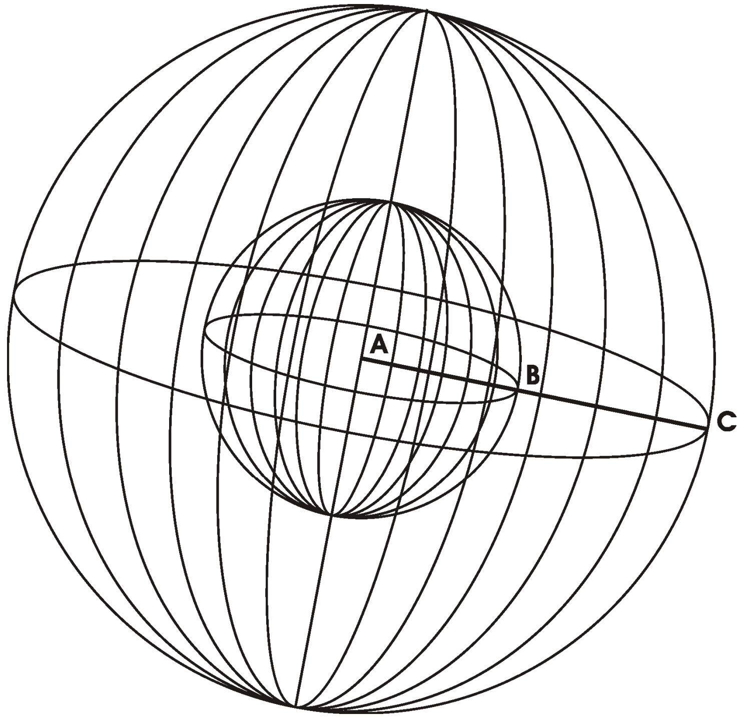
where $\eta_1, \eta_2 \leq 0$ and $p'_1, p'_2 \geq 0$. Thus, if the demand for one-way is less elastic than for return $\eta_1/\eta_2 < 1$ and airlines price discriminate, then unit one-way must be more expensive than unit return $p'_2/p'_1 < 1$, provided that the demand for one-way and return are both price elastic $\eta_1, \eta_2 < -1$. Equation (1) is a useful tool that yields key insights into the mechanics of price discrimination and the relationship between unit price and price elasticity.

Cost Economies

Another explanation for quantity discounts are economies of scale on the supply side. Lower unit costs in the production of larger package or pack sizes[1] may be passed on as discounts for larger purchases. This can include cost economies in the use of packaging material. For example, consider a hypothetical grocery product packaged in a sphere, where the volume of this sphere equates to the quantity of the product and the surface area reflects the amount of packaging material used. The volume of a sphere s and its surface area a defined as a function of its radius r are $s = (4/3)\pi r^3$ and $a = 4\pi r^2$, respectively, where $\pi \approx 3.142$. Thus, the volume of a sphere is proportional to r^3 while its surface area is proportional to r^2, showing that, for a given change in radius, the change in volume exceeds the change in surface area.

Fig. 1 illustrates the key nonlinear relationship between volume and surface area when moving from a smaller to a larger spherical package. Let the small sphere have a volume s_0 and a radius r_0, defined as the linear distance from point A to point B. Moving from the smaller to the larger package, we enlarge this sphere so that the volume expands to $s_1 = s_0 + \Delta s$ and the radius $r_1 = r_0 + \Delta r$ is now the linear distance between point A and point C. The change in surface area as a function of volume is therefore $\Delta a(s) = 4\pi(3/[4\pi])^{\frac{2}{3}}\left(s_1^{\frac{2}{3}} - s_0^{\frac{2}{3}}\right)$, so the surface area is nonlinear in s. Alternatively, the change in surface area with respect to a change in volume is

[1] *Package size* refers to the range of sizes for a given container, e.g. from small to large. *Pack size* incorporates multiples of containers usually packaged together, e.g. singles, doubles, half-dozens and dozens.



$$\Delta r = r_1 - r_0 = \mathrm{AC} - \mathrm{AB}$$
$$\Delta s = s_1 - s_0$$
$$\Delta a(s) = 4\pi\left(3/[4\pi]\right)^{\frac{2}{3}}\left(s_1^{\frac{2}{3}} - s_0^{\frac{2}{3}}\right)$$

FIG. 1 — Geometry of spheres

$$\frac{\mathrm{d}\,a(s)}{\mathrm{d}\,s} = ks^{-\frac{1}{3}}, \tag{2}$$

where k is a constant. Clearly, the amount (and cost) of packaging increases less than proportionally to an increase in product size. For instance, expanding the size of a spherical package by 100% will double the amount (and cost) of product, but the surface area, and hence the cost of packaging material, increases by only ~59%[2]. Such cost savings can be passed on as lower unit prices for larger packages.

More generally, suppose that the packaging cost is α dollars per cm^2 and the product cost is β dollars per cm^3, then the total cost of the product c, as a function of the radius r and size s, is $c(r,s) = \alpha(3/r)s + \beta s$. Since $r(s) = (3s/4\pi)^{\frac{1}{3}}$, the total cost expressed as a function of size is $c(s) = \alpha\left(3/[3/(4\pi)]^{\frac{1}{3}}\right)s^{\frac{2}{3}} + \beta s$. The elasticity of total cost with respect to size is therefore:

$$\frac{\mathrm{d}\,(\ln c)}{\mathrm{d}\,(\ln s)} = \gamma\frac{2}{3} + (1-\gamma), \tag{3}$$

[2] The nonlinear relationship between volume and surface area is not limited to spheres. For example, similar relationships exist for cubes and cylinders, which are close approximations of typical grocery package shapes.

where γ is a positive fraction reflecting the share of packaging cost in the total cost. As the elasticity of total cost is a weighted average of two-thirds and one, its value must be smaller than one, so total cost increases less than proportionally to product size — a relationship confirmed by the unit cost function:

$$\frac{c(s)}{s} = \alpha\left[\frac{3}{\left[3/(4\pi)\right]^{\frac{1}{3}}}\right]s^{-\frac{1}{3}} + \beta \,. \tag{4}$$

In many cases, economies of scale in physical packaging are too small to explain the size of prevailing discounts. Moreover, the thickness of the packaging material might increase as the size (and weight) of the package increases, partially offsetting any cost economies. However, it is useful to think of 'packaging' as referring to the sum of the value added at each step along a multistage supply chain. In addition to physical packaging, there can also be cost economies at different stages throughout the supply chain, including in transport, storage, advertising, retail and administration. For example, bulk freight shipments, the rental of storage space, advertising in a print catalogue, stacking shelves and processing at the checkout can all attract a lower per unit cost for larger package sizes than for smaller ones. The sum of all cost economies on the supply side can amount to significant cost savings for larger packages, passed on as quantity discounts.

We have heretofore examined quantity discounts from the producer's perspective, but a demand-side investigation is also warranted. Quantity discounts can also exist because consumers often have nonlinear costs. Consumers who buy larger packages may have greater transport and storage costs and hence demand lower unit prices as compensation. For example, the cost of carrying heavy grocery items and storing them in limited refrigerator space might be reflected in the discount for larger packages. Furthermore, consumers may also face a greater risk of wastage by purchasing larger package or, to a lesser extent, pack sizes (Fox and Melser 2007). For instance, a shopper who buys a large bottle of milk might run the risk of consuming only a portion before the remainder expires. Such costs devalue large packages for consumers.

Conversely, Gerstner and Hess (1987) suggest that bulk purchases entail fewer trips to the supermarket and less time spent shopping, thus reducing overall transport costs. This would suggest that there should in fact be surcharges for larger packages. Also, studies by food psychologists have shown that consumers who buy larger packages tend to cook and consume more than they would otherwise do so (Gittins 2010). This suggests that the risk of wastage is not nearly as great as it seems. Hence, the net impact of all cost economies on the relationship between price and package size is not explicitly clear.

Package Divisibility

Another explanation for quantity discounts stems from the divisibility of packages. If larger package sizes are exact integer multiples of smaller sizes, then quantity surcharges would ideally not occur as consumers can simply compose the larger size by buying several small packages[3]. Combined with a linear pricing scheme with no discounts or surcharges, the consumer's choice of package size for a given product then becomes an unfettered function of their consumption rates and storage and transport costs. Discounts for larger packages can therefore entice consumers to buy larger packages than under a linear pricing scheme. Moreover, high unit prices for smaller packages can act as a 'decoy' price that makes larger packages more attractive by appearing to offer significantly better value. This would reasonably assume that consumers are unsure about a product's true value without first comparing it to similar products (Ariely 2009).

Temptation and Self-Control

Another explanation for quantity discounts relates to temptation and self-control. Esteban, Miyagawa and Shum (2007) extend the work of Gul and Pesendorfer (2001) on *temptation preferences with self-control*. Firms can capitalise on consumer 'preference reversals' — where consumers actions systematically deviate from stated intentions — either by leading consumers into temptation or lowering utility costs incurred from self-control. For example, consider a car dealership. Some consumers know that upon entering the dealership and test-driving a range of models, they may be tempted to purchase a more expensive, higher quality model than originally intended. Some completely succumb to temptation and purchase the tempting model, while others buy the model originally intended, but have to exercise self-control in the process. Furthermore, some consumers partially succumb to temptation, compromising between the tempting model and their original intentions, perhaps by adding optional features to the model originally desired. Conversely, some consumers may instead be tempted 'downward' to be overly frugal and buy a cheaper, lower quality car. Those anticipating large self-control costs may choose not to enter the dealership at all.

Esteban et al. find that if all consumers succumb to temptation, the monopolist's optimal menu is a singleton. Conversely, if some consumers are tempted downward, the monopolist may offer a continuum of choices and impose self-control costs. This is because downward-tempted consumers prefer purchasing no bundle to purchasing the bundle offered in the singleton menu. The monopolist must then lower the price of the bundle in the singleton menu and price discriminate. Temptation and self-control preferences could explain quantity discounts if some consumers are tempted downward to purchase smaller packages than originally intended. Lower unit prices for larger packages might help alleviate large self-control costs. Offering a range of package sizes with different unit prices can be a form of price discrimination that attempts to extract commitment surplus.

[3] In reality, this is not always the case. Consider the following example of quantity surcharging despite the perfect divisibility of packages (Freakonomics 2010). *Nathan's*, a hot dog restaurant in Coney Island, New York, charges $1.99 for one hot dog, $3.99 for two and $5.99 for three. Here, the customer is charged one cent extra for every additional hot dog. The astute customer can therefore buy two bundles of one hot dog each at a total cost of $3.98, saving a penny. The existence of this pricing anomaly suggests that consumers: (a) incur disutility from carrying additional pennies; (b) value the utility cost or opportunity cost of correcting this anomaly at greater than a penny; or, most likely, (c) are unaware of the anomaly. The widespread prominence of prices ending in 99 cents suggests that this practice is effective in its goal of making products appear cheaper. It can also disguise the presence of quantity surcharges, which are a sign of price discrimination (Mills 2002).

Modelling Price and Package Size

The size and character of quantity discounts yield useful insights into the relationship between price and package size. Several approaches have been proposed to examine this price-size relationship (Telser 1978; Clements 2006). One approach to package pricing is suggested by Caulkins and Padman (1993). Let there exist a log-linear relationship between price and package size,

$$\ln p = \alpha + \beta \ln s, \tag{5}$$

where p is the price, s is the package size, α is an intercept and β is the size elasticity. The size elasticity reflects the percentage change in price in response to a percentage change in quantity. This implies that price as a function of size is

$$p(s) = as^{\beta}, \tag{6}$$

where $a = \exp(\alpha)$. Assume that a given product can be purchased in two package sizes, $s = 1$ and $s = n$, where n is larger than one by a factor of n. These packages have prices $p(1)$ and $p(n)$ respectively. Suppose we split the product of size n by a factor of n so that there are now n packages, each with size $s = 1$. The total revenue from these n packages is therefore $n \times p(1)$. Let the markup factor δ be the ratio of this revenue to the revenue from the larger package of size n, so that $\delta = n\left[p(1)/p(n)\right]$, or $n \times p(1) = \delta \times p(n)$. Also, let $\phi > 1$ be a conversion factor that converts the larger package s into the smaller one s/ϕ, so that $\phi = n$. We then have the following general relationship between prices, package sizes and the markup and conversion factors:

$$\phi \cdot p\left(\frac{s}{\phi}\right) = \delta \cdot p(s). \tag{7}$$

To derive an expression for the size elasticity β as a function of the markup and conversion factors δ and ϕ, we modify equation (6) so that $p(s/\phi) = a(s/\phi)^{\beta}$. Therefore equation (7) becomes $\phi \cdot a(s/\phi)^{\beta} = \delta \cdot as^{\beta}$, or $\phi^{1-\beta} = \delta$, implying that

$$\beta = 1 - \frac{\ln \delta}{\ln \phi}. \tag{8}$$

Here, the size elasticity β falls with the markup δ and rises with the conversion factor ϕ. If there is no markup then $\delta = 1$ and the size elasticity $\beta = 1$ so that price is proportional to package size and there are no quantity discounts. If $\delta > 1$ then price is less than proportional to package size and discounts prevail. The greater the conversion factor ϕ, the more a product can be divided and the higher the total profit. In equation (8), the conversion factor normalises by deflating the markup so that the size elasticity reflects a net effect. Equation (8) yields useful insights into the relationship between price and package size and the influence of the structural parameters δ and ϕ.

Evidence from Drug Markets

Research into Australian marijuana prices, purchased in two package sizes, ounces and grams, has shown that marijuana is subject to substantive quantity discounts (Clements 2006). For marijuana leaf, heads and a combination of the two, prices were estimated to have a size elasticity β of around 0.75, implying that a 10% increase in package size produces a 7.5% increase in price or, alternatively, a 2.5% fall in the unit price. Similar estimates of the size elasticity were shown to hold for other illicit drugs, including heroin, methamphetamines and crack (Brown and Silverman 1974; Caulkins and Padman 1993). How well does this relationship between price and package size apply to other markets? The following sections extend this analysis to airfares and grocery prices.

III. Airfares

This section introduces airfare pricing data for international flights from Perth, Australia, and these prices are shown to have substantial quantity discounts. A sample of flights to 95 different destinations was collected for May 2010. For each destination, both the one-way and roundtrip prices were collected, yielding a total of $95 \times 2 = 190$ observations. The methodology of data collection is discussed in Appendix A. The prices are tabulated in Appendix B.

When considering airline ticket pricing, we treat a return ticket as a package comprising two distinct one-way components. We take a one-way trip as the base unit, so halving the price of a return ticket derives the equivalent one-way price. If, for a given route, the unit price of a return ticket equals the unit price of one-way, then linear pricing prevails. If, however, unit return is less than unit one-way, then quantity discounts occur. Fig. 2 plots unit return against unit one-way for the sample. As almost all points lie below the 45º ray, it is clear that quantity discounts abound: of the 95 observations collected, 93 have discounts. The average discount is approximately 26%, so the unit price of a return ticket is around 74% of the price of a one-way ticket. To what extent does package size influence the unit price?

The Discount Elasticity

Clements (2006) introduces the *discount elasticity* as a measure of the percentage change in unit price relative to a percentage change in package size. We now derive and estimate the discount elasticity for our sample of flights. Equation (5) gives the log-linear relationship between price and package size, where β is the size elasticity. To compare between products with different package sizes, it is preferable to express this relationship in terms of unit prices. Accordingly, let $p_i' = p_i / s_i$, where $i = 1 \ldots n$ types of the product, so that $s = 1$ for one-way and $s = 2$ for roundtrip for flights to a given destination *i*. Subtracting $\ln s$ from equation (5) gives the core relationship between unit price and package size:

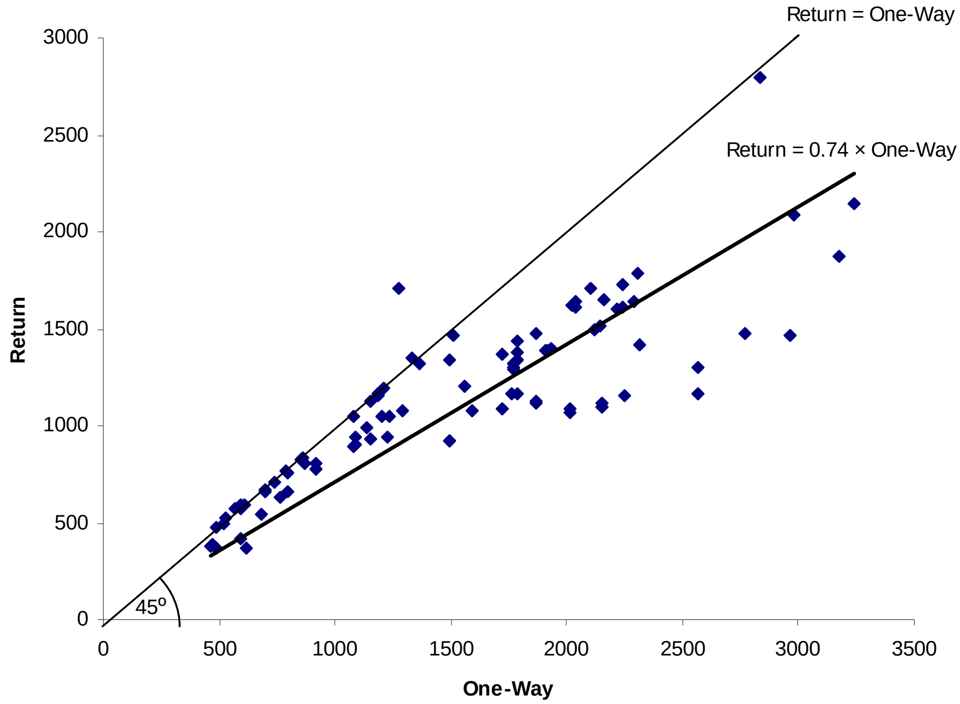


FIG. 2 — Unit prices: Return and one-way airfares ($A)

$$\ln p_i' = \alpha + \beta' \ln s_i \,, \tag{9}$$

where $\beta' = \beta - 1$ is the discount elasticity, which measures the responsiveness of a change in unit price relative to a change in size. If quantity discounts exist, then the size elasticity $\beta < 1$ and the discount elasticity $\beta' < 0$. By using unit prices, equation (9) both enables direct comparisons across package sizes and introduces the discount elasticity as a convenient measure of the quantity discount.

Taking equation (9) as a regression equation applied to airfare pricing, we treat a one-way trip to a given destination *i* as the base 'package size', while treating the return trip, which comprises two types of flight (outbound and inbound), as a larger package, so that $s = 1$ for one-way and $s = 2$ for roundtrip. Furthermore, it is useful to control for other variables, such as the geographic location of the destination, the airline flown and seasonal demand. Thus, we transform equation (9) into the following hedonic pricing equation:

$$\ln p_i' = \alpha + \beta' \ln s_i + \text{hemisphere, region, carrier and/or season dummies} + \varepsilon_i \,, \tag{10}$$

where ε_i is an error term. Equation (10) extends equation (9) by interacting with a mixed combination of dummy variables.

TABLE 1 Airline Pricing Equations

	Equation					
	(1)	(2)	(3)	(4)	(5)	(6)
Indep. Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Constant α	7.248 (.051)	7.410 (.053)	6.905 (.122)	7.273 (.094)	7.071 (.100)	6.693 (.149)
Log *s*, β'	–.365 (.098)	–.365 (.055)	–.365 (.071)	–.365 (.041)	–.365 (.097)	–.365 (.068)
<u>Dummy variables</u>						
Hemisphere:						
Southern	–.174 (.082)					
Region:						
Europe		–.114 (.060)		–.022 (.059)		
New Zealand		–.988 (.091)		–1.112 (.092)		
South America		.309 (.091)		.234 (.073)		
North America		.180 (.065)		.059 (.065)		
Asia		–.747 (.065)		–.483 (.067)		
Carrier:						
Air Canada			1.096 (.267)	.669 (.167)		1.146 (.256)
Air New Zealand			–.138 (.169)	.314 (.126)		.034 (.175)
Alitalia			.291 (.267)	–.054 (.160)		.141 (.260)
American Air.			.778 (.150)	.351 (.107)		.828 (.144)
British Airways			.478 (.182)	.125 (.113)		.328 (.182)
Cathay Pacific			.601 (.267)	.174 (.167)		.651 (.256)
Emirates			.607 (.134)	.216 (.090)		.583 (.132)
Garuda Indonesia			–.729 (.207)	–.614 (.121)		–.679 (.199)
Lufthansa			.567 (.141)	.222 (.091)		.417 (.144)
Malaysia Air.			–.068 (.136)	–.275 (.083)		–.156 (.134)
Royal Brunei Air.			–.564 (.267)	–.449 (.156)		–.514 (.256)
Singapore Air.			.118 (.133)	.002 (.079)		.109 (.127)
South African Air.			.578 (.182)	.210 (.123)		.428 (.182)
Qantas			.384 (.136)	.208 (.094)		.447 (.139)
Season:						
Peak					.044 (.108)	.162 (.097)
Shoulder					.261 (.106)	.363 (.096)
R^2	.089	.721	.562	.855	.122	.603
SEE	.469	.263	.338	.197	.462	.323
No. of obs.	190	190	190	190	190	190

NOTE: Regression equations are $\ln p_i' = \alpha + \beta' \ln s_i +$ hemisphere, region, carrier and/or season dummies $+ \varepsilon_i$. The *northern* hemisphere is the base for the hemisphere dummies, *Africa* is the base for the regional dummies, *Thai Airways* is the base for the airline carrier dummies and *off-peak* is the base for the season dummies.

The estimates for six regression equations are presented in table 1. The estimate of β' for all equations is around –0.37, although the standard errors vary with the equation. Column 1 includes a southern hemisphere dummy, estimated with a negative coefficient, implying that on average flights to the southern hemisphere are cheaper than flights to the northern hemisphere. The geographical location of the destination of the outbound flight can account for much of the variation in the sample, reflected in the high goodness-of-fit R^2 of the equation in column 2. Estimates of the coefficients of carrier dummies are given in column 3. The strong goodness-of-fit of the equation in column 4 suggests that regional and carrier dummies together account for most of the variability in prices. For the equation in column 4, the estimated discount elasticity is –0.37 with a standard error of 0.04. Finally, whether a season is peak, shoulder or off-peak can account for some variation in price (columns 5-6). The discount elasticity of –0.37 implies that doubling the package size by transforming a one-way ticket into a return ticket produces a 37% fall in unit price.

Explaining Discounts

The estimate of $\beta' = -.37$ clearly indicates the presence of substantial quantity discounts for international airfares. What could explain such discounts? One possibility is that discounts reflect savings in administration costs. For example, lower unit prices for roundtrip tickets could reflect cost savings in the form of fewer entries recorded in an airline's computer system, or the use of a single booking reference. However, such cost economies are relatively nominal and unlikely to explain the size of the discounts observed. A second possibility is that airlines offer discounts in order to secure the roundtrip fare upfront. There is little evidence, however, to suggest that this policy forms the basis of fare pricing.

A third and more potent explanation is that airlines offer discounts in order to guarantee selling a seat on the return trip. Airlines use advanced probabilistic yield management techniques to price discriminate between different classes of traveller (see Belobaba 1987, 1989; Botimer and Belobaba 1999). This is done by allocating a fixed number of seats at different prices to each class of traveller. Airlines might then offer high-fare seats to one-way customers and low-fare seats to roundtrip customers in order to encourage the purchase of roundtrip tickets, securing seats on the return flight. Discounts may be larger if there are many choice substitutes available for the return trip, e.g. competing airlines or alternate transport options by land or sea (Brons et al. 2002).

Finally, quantity discounts in airfares could reflect price discrimination. Airlines may capitalise on differing price elasticities between, say, business travellers and leisure travellers. Leisure travellers, assumed to have free time and flexible travel schedules, and hence relatively elastic price elasticities of demand, are likely to plan their journey in advance, adjusting their travel dates to book the cheapest return tickets available. Conversely, business travellers with inflexible work schedules may have relatively inelastic price elasticities. For example, business travellers may need to fly on very short notice for a meeting or to conduct negotiations, with an uncertain date or time of return, and do not want their trip to be constrained by a return ticket. Booking separate one-way tickets affords the most flexibility to productivity-maximising travellers with high opportunity costs of time. Furthermore, business travellers may make multiple stops to different destinations, buying a string of one-way tickets with the return flight departing from elsewhere. In contrast, leisure travellers might buy a return ticket to a fixed destination, travelling on land to different locations before returning to the original destination. This could imply that the proportion of business travellers buying roundtrip tickets relative to one-way is not as great as for leisure travellers, thus encouraging airlines to offer discounts on return tickets.

Do roundtrip travellers have more elastic demand than one-way travellers? Recall equation (1), which gives the ratio of the price elasticities for one-way and roundtrip. Given our estimate that the price of a unit return ticket is approximately three-quarters of the price of unit one-way, i.e. $p'_2 / p'_1 = 0.74 \approx 3/4$, we derive expressions for the respective price elasticities, viz. $\eta_1 \approx 4\eta_2/(3-\eta_2)$ and $\eta_2 \approx 3\eta_1/(4+\eta_1)$. From these expressions, it can be determined that the demand for one-way is less elastic than for roundtrip, i.e. $\eta_1/\eta_2 < 1$. For example, if $\eta_2 = -1.5$ so that $\eta_1 = -6/4.5 = -1.\dot{3}$, then $\eta_1/\eta_2 = 0.\dot{8} < 1$ and one-way is relatively inelastic. This holds true provided that one-way and roundtrip are both price elastic, which implies that marginal revenue is greater than zero ($MR_s = p_s'(1+[1/\eta_s]) > 0 \;\forall\; \eta < -1$). This is not unreasonable given the airline policy of overbooking flights (Smith, Leimkuhler and Darrow 1992). Thus it appears that roundtrip travellers have more elastic demand than one-way travellers. Quantity discounts can reflect the exploitation of this difference in price elasticity.

IV. Groceries

We have shown that airfare pricing is subject to significant quantity discounts and that the discount elasticity, which measures the elasticity of unit price relative to package size, is around –0.37. In this section, we extend our analysis of quantity discounts to grocery pricing in Australian supermarkets.

A survey of the grocery prices of Australian supermarket giant Coles was conducted in September 2010, in which we collected a sample of 117 grocery products with a total of 53 different package sizes, yielding a total of 258 observations[4]. The sample can be divided into three broad categories: shelf groceries, frozen goods and refrigerated goods (dairy products). These broad categories can be sub-divided into a total of 23 distinct product groups, ranging from baking agents to cheese slices. The estimates of the parameters of our hedonic pricing model with product dummies are presented in table 2. The equation in column 1 is a regression of uncooled shelf groceries, yielding an estimated discount elasticity of –0.46. Frozen goods have almost no discounts, with an estimated discount elasticity of around –0.05 (column 2). The discount elasticity for dairy goods alone is around –0.39 (column 3). From these three estimates, it is apparent that the size of the quantity discount varies considerably with product category. The discount elasticity for the entire sample is –0.37 with a standard error of 0.04 (column 4), which implies that on average a 10% increase in package size leads to a 3.7% fall in unit price. The estimate of –0.37 for grocery products is also nearly identical to the elasticity estimated for airfares (section III).

Explaining Discounts

The results clearly indicate the presence of significant quantity discounts for supermarket groceries, although the size of the discount varies between products. What could account for this variation?

One explanation is that the size of the quantity discount is influenced, partly or wholly, by storage costs. Recall the geometric properties of packaging discussed in section II, where it was shown that the surface area of an object increases less than proportionally to its volume. For products that require cooling, larger packages have higher per-unit storage costs than smaller packages. This is because larger packages

[4] Details of the methodology used to collect grocery prices are provided in Appendix A. The prices are tabulated in Appendix B.

TABLE 2 Grocery Pricing Equations

	Shelf Groceries	Frozen	Dairy	Shelf Groceries, Frozen & Dairy
	(1)	(2)	(3)	(4)
Independent Variable	Coefficient	Coefficient	Coefficient	Coefficient
Constant α	.735 (.126)	.864 (.193)	1.438 (.083)	1.436 (.098)
Log *s*, β'	–.455 (.067)	–.051 (.056)	–.387 (.049)	–.366 (.037)
Product dummies				
Shelf groceries:				
Baking agents	–.772 (.251)			–1.648 (.240)
Bread mixes	–.399 (.195)			–1.397 (.204)
Breadcrumbs	–1.090 (.180)			–1.953 (.188)
Cooking chocolate	.282 (.263)			–.470 (.231)
Dried fruits & nuts	.039 (.081)			–.779 (.119)
Biscuits	.001 (.187)			–.790 (.180)
Cereal				–.857 (.123)
Frozen:				
Carrots & corn		–1.500 (.146)		–1.446 (.170)
Mixed vegetables		–1.504 (.146)		–1.459 (.170)
Peas & beans		–1.674 (.142)		–1.630 (.159)
Other vegetables		–.977 (.191)		–1.168 (.234)
Convenience meals		–.850 (.151)		–.714 (.194)
Fish & seafood		–.404 (.148)		–.392 (.168)
Party snacks		–.697 (.176)		–.617 (.242)
Pies & pasties		–1.135 (.156)		–1.245 (.163)
Pastry		–1.612 (.173)		–1.384 (.247)
Poultry				.263 (.249)
Dairy - Cheese:				
Blocks & wedges			–.451 (.114)	–.482 (.119)
Cottage & cream			–.754 (.133)	–.778 (.149)
Gourmet & specialty			–.148 (.113)	–.162 (.130)
Grated			–.420 (.119)	–.443 (.132)
Slices			–.681 (.121)	–.709 (.130)
R^2	.654	.917	.726	.803
SEE	.348	.173	.250	.294
No. of observations	105	44	109	258

NOTE: Regression equation is $\ln p_i' = \alpha + \beta \ln s_i +$ product dummies $+ \varepsilon_i$. *Cereal* is the base for shelf groceries, *poultry* is the base for frozen products and *snack size* cheese is the base for both the dairy regression and the complete regression.

have less surface area per unit of volume available for the transfer of heat than do smaller packages. Thus, the time per unit needed to cool a given sized product decreases as its surface area increases (Ozisik 1968). For example, a pack of four small apple pies with a total weight of 500g cools to a given temperature more rapidly than a pack of a single large 500g apple pie. Consumers who place a higher value per unit on larger packages, due to savings in transportation or handling costs, will also pay a premium reflecting the additional storage costs borne by the retailer. Walden (2008), in an empirical survey of supermarket products, found that refrigerated and frozen goods have smaller discounts than goods that do not require cooling, attributing this to the aforementioned interaction between physical packaging and refrigeration. Our results are consistent with this relationship: our estimate of the discount elasticity for frozen goods (–0.05) is substantially lower than for refrigerated goods (–0.39), which in turn have a smaller elasticity than uncooled goods (–0.46).

This seems to suggest that the quantity discount diminishes as the amount of cooling required increases.

V. The Discount Elasticity and the Markup and Conversion Factors

Estimating the Markup

We can determine the markup factor given the conversion factor and our estimates of the discount elasticity. Recall equation (8), which expresses the size elasticity in terms of the markup and conversion factors. Transforming equation (8) into an expression for the discount elasticity, where the discount elasticity and size elasticity are related by $\beta' = \beta - 1$, gives $\beta' = -\ln\delta/\ln\phi$. For airlines, $\beta' = -.37$ and $\phi = 2$, so that the markup factor $\delta = \exp(0.37 \times \ln 2) = 1.29$, implying that there is a 29% markup in transforming a return ticket into two one-way tickets. Similarly for grocery prices, $\beta' = -.37$ and the average conversion factor $\phi = 2.51$, so that the average markup is $\delta = \exp(0.37 \times \ln 2.51) = 1.40$, or 40%, when dividing grocery products into smaller packages[5]. These estimates appear reasonable.

The Discount Elasticity and the Conversion Factor

We have in the preceding sections determined that airfares and grocery prices are subject to quantity discounts of a similar order of magnitude. The constancy of our estimate of the discount elasticity $\beta' = -0.37$ (or the size elasticity $\beta = 0.63$) is an intriguing result that could reflect the influence of core forces underlying the interaction between price and package size, holding true even across starkly different markets. However, our estimates differ notably from previous similar empirical studies. For example, recall from section II that marijuana prices are estimated to have a size elasticity of $\beta = 0.75$, which implies a discount elasticity of $\beta' = -0.25$. What could explain this discrepancy?

One possibility is that the price of smaller marijuana packages incorporates an additional risk premium to compensate for a dealer's exposure to more individuals (see Clements and Zhao 2009). Another possibility is that the discount elasticity is nonlinear in the conversion factor. Our analysis of airlines involves two package sizes, one-way and roundtrip, whereby in transforming a roundtrip ticket into a one-way ticket, we halve the package size, i.e. $\phi = 2$. Similarly, of the 141 conversion factors in our grocery sample, over half also have a conversion factor $\phi = 2$ and 71% have a conversion factor of two or smaller. On the other hand, the discount elasticity for marijuana prices is determined by converting ounces into grams, which means dividing the larger package by a factor of $\phi = 28$. The difference in the conversion factor could explain the discrepancy between the discount elasticity for airlines and groceries and the discount elasticity for marijuana. The discount elasticity could diminish as the conversion factor increases — a relationship that is not inconsistent with the predictions of our model. Clearly, the discount elasticity $\beta' = -\ln\delta/\ln\phi$ falls in absolute terms as the conversion factor rises, provided that the markup factor is

[5] More precise values than shown are used in the calculation of the markup factors.

either constant or increases less than proportionally to an increase in the conversion factor, i.e. $d\delta/d\phi < 1$. Our results could suggest that the size of the discount elasticity falls as the difference between the sizes of the product increases.

VI. Concluding Comments

Quantity discounts, characterised by unit prices declining as the quantity purchased increases, are puzzling phenomena to be found in a broad range of diverse markets. This paper has reviewed the key economic foundations of nonlinear pricing, introduced new pricing data and conducted an empirical investigation into airfares and grocery prices, which are shown to exhibit substantial quantity discounts. The discount elasticity β', which measures the percentage change in unit price relative to a percentage change in package size, is estimated to be around –0.37 for both airfares and grocery prices. This implies that a 10% increase in package size produces a 6.3% increase in price or, alternatively, a 3.7% fall in the unit price. These results are contrasted against those of the existing literature and it is suggested that the size of the discount elasticity could diminish as the difference between the sizes of the product increases. While there is notable dispersion in the distribution of the underlying elasticities for groceries, which can be attributed at least in part to differences in storage costs, the constancy of the discount elasticity across the two distinct markets considered in this paper is an intriguing pattern that could reflect the presence of key fundamental forces underscoring the relationship between price and package size, pervading across starkly different markets. This article has also served to highlight the central importance of the economics of packaging, and the inherent tension between cost economies and price discrimination, to the existence of discounts. The extent to which price discrimination accounts for the quantity discount yields insight into the degree of market power exerted by producers and the degree to which markets operate efficiently.

APPENDIX A

Methodology of Data Collection — Airfares

In compiling airfare data, certain limiting rules were adopted. All prices are for international economy flights from Perth, Australia, inclusive of taxes and surcharges. Taxes and surcharges are included because consumers price taxes and surcharges into their consumption decisions. The initial dataset includes one-way and roundtrip prices for 95 flights from Perth to various destinations worldwide. Data was collected over March and April 2010 for flights departing Perth on Monday 3 May returning on Monday 10 May or, when no flights were available, on the nearest available dates. For each destination, the airline offering the cheapest one-way economy ticket was chosen. The price of this ticket was then matched against the price of a return ticket with the same airline.

Low-cost carriers, such as Air Asia, Jetstar and Virgin Atlantic, have been excluded from the dataset because each leg of a trip with stopovers had to be booked separately, i.e. a flight is not available as one complete package. For example, a one-way Air Asia flight from Perth to London has to be booked separately for Perth to Kuala Lumpur and from Kuala Lumpur to London. Furthermore, there are often no quantity discounts with low-cost carriers.

Data was collected directly from airline websites as the fares quoted by travel websites are often problematic. There are many travel websites and 'online travel agencies' that conveniently search across databases or airline websites to find the lowest fares for given search parameters. Search parameters such as origin, destination, dates and fare class are inputted into these websites, which then quote corresponding fare prices offered by different airlines, ranked cheapest first. Initially, research data was sourced from several travel websites, including FlightCentre.com.au, Webjet.com.au and Expedia.com.au. There are also several metasearch sites — such as Kayak.com, Sidestep.com and Yahoo Farechase — that search across a multiplicity of travel websites. These metasearch sites are intended to call upon larger data sources to yield more robust search results.

However, there are several problems with the use of online travel agencies and metasearch sites. Firstly, there is a lack of consistency in the quoted fares between such sites. A search across Flight Centre, Webjet and Expedia does not always return the same prices and may even yield different airline rankings in order of affordability. Furthermore, the ticket prices quoted by these sites are almost always different (usually cheaper) to those quoted directly by airline websites. On occasion, the data is entirely unreliable. For example, a search with Flight Centre for a return flight from Perth to Lilongwe, Malawi priced a British Airways flight at around $4,454, inclusive of taxes of -$22,096. Given the highly disputable prices cited by travel agent websites, sourcing data directly from airline websites is a more reliable approach.

Other problems with the use of online travel agencies and metasearch sites emerge from the inadequacy of the information given by these sites. For example, when neither a single airline nor its codeshare partners fly the entire route from origin to destination, travel websites will then often 'mix and match' different airlines that do not have existing codeshare agreements. This is problematic for comparative analysis because the fare quoted does not represent a single cohesive package. For example, when airlines are mixed and matched, there is no streamlining of baggage and handling processes on flights with multiple stopovers. Some travel websites explicitly disclose when separate airlines have been combined, but others do not. For example, Flight Centre lists the total ticket price and the first airline flown along the route, but it does not disclose whether this airline has been combined with others to complete different legs of the journey. This has been confirmed by checking directly against individual airline websites, which explicitly state that they do not offer flights on the route in question. In our dataset, multiple airlines are not used unless airlines have already entered into a codeshare agreement. This lack of transparency is another reason why a direct search with airlines is preferred to using travel agent websites.

Another complication stems from the multiplicity of economy fare classes, which is not disclosed on travel agent websites. Different 'grades' of economy class, and sometimes business or first class, are offered, each with varying terms and conditions. For example, Qantas offers four grades within economy class: Red e-Deal, Super Saver, Flexi Saver and Fully Flexible. The restrictiveness or generosity of the economy ticket with regard to penalties for cancellation or date change, frequent flyer points earned, eligibility for upgrades, stopover allowances, payment deadlines etc. are contingent upon the grade purchased. Greater flexibility generally attracts a premium above the base ticket price, and so is an important variable to be controlled when comparing one-way with roundtrip prices. For example, for a return economy ticket from Perth to London, Qantas might offer Red e-Deal as the cheapest fare class for both outbound and inbound flights. However, for a one-way flight, the cheapest fare class might be Super Saver. In such a situation, we opted to use Super Saver as the basis for fare comparison across both one-way and roundtrip. In contrast, travel agent websites do not disclose the fare grade, citing only the cheapest price available regardless of ticket flexibility. As such, a manual search with individual airline websites, with full disclosure of all terms and conditions, was adopted in preference to travel agent websites.

Methodology of Data Collection — Grocery Prices

Grocery pricing data was collected in March and September from the *Shop Online* feature of the Coles supermarket website (coles.com.au). Coles Shop Online provides a comprehensive list of stock that can be delivered to the home. However, the prices offered online are at a premium to the prices listed on the shelf. As there is no explicit delivery fee, the premium charged presumably reflects a delivery surcharge, and is in the order of 7-9% of the shelf price. Also, as a postcode must be entered in order to access the Shop Online feature, the author selected 6151 for South Perth, Western Australia. Ideally, the choice of suburb would not impact on the prices offered, particularly as Coles has adopted a policy of charging uniform prices throughout Australia, regardless of geographical location. It is not clear, however, whether the choice of suburb impacts on the delivery surcharge incorporated into the prices offered online. Nonetheless, as the delivery surcharge is constant across all package sizes, it does not influence the size of the quantity discount measured.

APPENDIX B

TABLE A.1 Airfares from Perth, 2010

	Destination	Unit Price ($A)		Log Discount
		One Way	*Return*	
	(1)	(2)	(3)	(4)
	I. EUROPE			
1.	London	1088	944	-14.21
2.	Rome	1224	943	-26.00
3.	Paris	1140	986	-14.50
4.	Dublin	1207	1189	-1.45
5.	Frankfurt	1155	930	-21.68
6.	Amsterdam	1088	901	-18.89
7.	Athens	1078	895	-18.65
8.	Edinburgh	1201	1044	-13.93
9.	Manchester	1235	1046	-16.56
10.	Vienna	1495	926	-47.88
11.	Barcelona	1155	1122	-2.87
12.	Berlin	1868	1472	-23.84
13.	Bern	1787	1336	-29.09
14.	Bratislava	1725	1373	-22.84
15.	Bucharest	1768	1323	-28.99
16.	Budapest	1768	1323	-29.00
17.	Copenhagen	1187	1162	-2.06
18.	Helsinki	1725	1091	-45.79
19.	Lisbon	1769	1294	-31.24
20.	Luxembourg City	1763	1161	-41.76
21.	Madrid	1498	1338	-11.31
22.	Nicosia	1496	926	-47.99
23.	Prague	1292	1075	-18.47
24.	Riga	1918	1384	-32.62
25.	Sofia	1868	1123	-50.90
26.	Stockholm	1769	1298	-30.96
27.	Tallinn	1936	1402	-32.30
28.	Vilnius	1912	1392	-31.74
29.	Warsaw	1768	1300	-30.78
30.	Zurich	1187	1169	-1.53
	Mean			**-24.66**
	II. NEW ZEALAND			
31.	Auckland	490	471	-4.04
32.	Wellington	516	497	-3.80
33.	Christchurch	570	573	0.48
34.	Hamilton	531	525	-1.08
35.	Dunedin	595	589	-0.96
36.	Invercargill	592	576	-2.72
	Mean			**-2.02**
	III. SOUTH AMERICA			
37.	Buenos Aires	2121	1493	-35.13
38.	Rio de Janeiro	3175	1869	-52.97
39.	Santiago	2564	1164	-79.00
40.	Lima	2977	2087	-35.52
41.	Quito	2960	1463	-70.50
42.	Sao Paulo	1788	1382	-25.72
	Mean			**-49.81**
	IV. NORTH AMERICA			
43.	Honolulu	871	805	-7.87
44.	Los Angeles	1366	1319	-3.47
45.	New York	1510	1463	-3.13
46.	Miami	2310	1413	-49.18
47.	San Francisco	1335	1346	0.82
48.	Toronto	2769	1472	-63.20
49.	Vancouver	1785	1436	-21.75
50.	Mexico City	2565	1304	-67.60
51.	Chicago	2213	1599	-32.52
52.	Las Vegas	2142	1511	-34.90
53.	Edmonton	2105	1711	-20.75
54.	Ottawa	2023	1620	-22.20
55.	Victoria	3241	2145	-41.29
56.	Montgomery	2831	2796	-1.25
57.	Denver	2158	1648	-26.93
58.	Springfield	1272	1709	29.56
59.	Boston	2293	1643	-33.34
60.	Nashville	2245	1614	-33.00
61.	Austin	2039	1607	-23.78
	Mean			**-23.99**
	V. ASIA			
62.	Tokyo (Narita)	792	767	-3.15
63.	Hong Kong	702	674	-4.13
64.	Singapore	469	387	-19.10
65.	Taipei	797	762	-4.49
66.	Seoul	855	828	-3.17
67.	Manila	590	422	-33.52
68.	Bangkok	610	594	-2.66
69.	Yangon	697	659	-5.66
70.	Jakarta	485	372	-26.57
71.	Denpasar	485	372	-26.57
72.	Kuala Lumpur	463	379	-20.14
73.	Beijing	760	633	-18.29
74.	Kathmandu	860	832	-3.24
75.	Delhi	798	660	-19.02
76.	Istanbul	1187	1155	-2.72
77.	Islamabad	919	808	-12.83
78.	Damascus	1593	1076	-39.27
79.	Hanoi	742	709	-4.46
80.	Phnom Penh	680	548	-21.54
81.	Riyadh	1080	1047	-3.07
	Mean			**-13.68**
	VI. AFRICA			
82.	Johannesburg	922	778	-16.92
83.	Cape Town	922	778	-16.92
84.	Bloemfontein	2041	1637	-22.06
85.	Harare	2149	1101	-66.88
86.	Nairobi	2016	1068	-63.49
87.	Lilongwe	2149	1115	-65.59
88.	Cairo	1562	1203	-26.16
89.	Algiers	1868	1120	-51.11
90.	Luanda	2245	1732	-25.96
91.	Gaborone	1788	1165	-42.85
92.	Abidjan	2310	1786	-25.69
93.	Entebbe	2016	1085	-61.93

94.	Lusaka	2149	1097	-67.21
95.	Mauritius	2246	1159	-66.15
	Mean			**-44.21**
	Grand Mean			**-25.25**

NOTE: Log discount = 100 × logarithmic ratio

TABLE A.2 Grocery Prices, Coles, 2010

Product Type		Product	Obs.	Size (grams)	Price	Unit Price (per 100g)
(1)		(2)		(3)	(4)	(5)
Shelf Groceries						
Baking Agents	1.	McKenzie's Bicarbonate Soda	1.	500	2.04	0.41
			2.	1,000	3.84	0.38
Bread Mix	2.	Laucke Bread Mix White Crusty	3.	600	2.50	0.42
			4.	2,400	8.16	0.34
			5.	10,000	21.78	0.22
	3.	Laucke Bread Mix Wholemeal	6.	2,400	8.16	0.34
			7.	5,000	13.07	0.26
Breadcrumbs	4.	Anchor Breadcrumbs	8.	375	1.90	0.51
			9.	750	2.51	0.33
	5.	Coles Smart Buy Breadcrumbs	10.	500	1.36	0.27
			11.	1,000	1.94	0.19
Cooking Chocolate	6.	Cadbury Bournville Cocoa	12.	125	2.67	2.14
			13.	250	5.33	2.13
Dried Fruits & Nuts	7.	McKenzie's Coconut Desiccated	14.	250	2.01	0.80
			15.	500	3.60	0.72
	8.	Angas Park Prunes Pitted	16.	250	3.63	1.45
			17.	500	6.86	1.37
	9.	Coles Dates Pitted	18.	250	1.89	0.76
			19.	500	2.49	0.50
	10.	Coles Dried Mixed Fruit	20.	375	2.39	0.64
			21.	1,000	6.27	0.63
	11.	Coles Prunes Pitted	22.	250	2.78	1.11
			23.	500	5.28	1.06
	12.	Coles Sultanas Sun Dried	24.	375	2.62	0.70
			25.	500	3.26	0.65
	13.	Sunbeam Currants Sundried	26.	300	3.43	1.14
			27.	1,000	10.20	1.02
	14.	Sunbeam Mixed Fruit Dried	28.	375	3.98	1.06
			29.	1,000	7.90	0.79
	15.	Sunbeam Raisins Seeded	30.	375	4.31	1.15
			31.	1,000	10.78	1.08
	16.	Sunbeam Sultanas Sundried	32.	250	2.94	1.18
			33.	375	3.05	0.81
			34.	500	3.89	0.78
			35.	1,000	7.34	0.73
	17.	Sunsweet Prunes Pitted	36.	200	2.76	1.38
			37.	500	6.42	1.28
	18.	Trident Dates Pitted	38.	250	2.16	0.86
			39.	500	3.59	0.72
	19.	Lucky Almond Meal	40.	200	6.49	3.25
			41.	400	10.89	2.72
	20.	Lucky Almonds Natural	42.	110	4.13	3.75
			43.	350	8.16	2.33
			44.	500	10.89	2.18
	21.	Lucky Brazil Nuts	45.	150	4.13	2.75
			46.	350	8.16	2.33
	22.	Riverside All Australian Pecan Halves	47.	110	3.04	2.76
			48.	180	4.89	2.72
Biscuits	23.	Oreo Biscuits	49.	150	2.00	1.33
			50.	300	3.46	1.15
	24.	Unibic Sponge Finger Savoiardi Biscuits	51.	250	4.18	1.67
			52.	500	5.91	1.18
Cereal	25.	Carman's Muesli Original Fruit Free	53.	500	5.34	1.07
			54.	750	7.48	1.00
	26.	Coles Cereal Corn Flakes	55.	500	2.50	0.50
			56.	800	3.79	0.47

	27.	Coles Cereal Wheat Biscuits	57.	750	3.73	0.50
			58.	1,125	5.13	0.46
	28.	Kellogg's Cereal All Bran Original	59.	350	4.27	1.22
			60.	655	5.79	0.88
	29.	Kellogg's Cereal Corn Flakes	61.	280	2.92	1.04
			62.	460	3.73	0.81
			63.	775	6.21	0.80
	30.	Kellogg's Cereal Coco Pops	64.	450	5.59	1.24
			65.	735	8.03	1.09
	31.	Kellogg's Cereal Crunchy Nut Corn Flakes	66.	430	5.34	1.24
			67.	710	7.95	1.12
	32.	Kellogg's Cereal Just Right Original	68.	560	6.44	1.15
			69.	890	8.34	0.94
	33.	Kellogg's Cereal Nutri Grain	70.	345	5.34	1.55
			71.	560	6.62	1.18
			72.	805	8.55	1.06
	34.	Kellogg's Cereal Rice Bubbles	73.	300	4.38	1.46
			74.	490	5.61	1.14
	35.	Kellogg's Cereal Special K	75.	360	5.25	1.46
			76.	600	7.19	1.20
	36.	Kellogg's Cereal Sultana Bran	77.	500	5.81	1.16
			78.	820	7.35	0.90
	37.	Kellogg's Cereal Sultana Bran Buds	79.	340	5.34	1.57
			80.	600	8.55	1.43
	38.	Nestle Milo Cereal	81.	350	5.23	1.49
			82.	700	5.00	0.71
	39.	Norganic Crunchola Cereal Apple Blueberry	83.	450	6.41	1.42
			84.	750	9.62	1.28
	40.	Norganic Crunchola Cereal Apple Cinnamon	85.	450	6.41	1.42
			86.	750	9.62	1.28
	41.	Sanitarium Cereal Light N Tasty Berry	87.	620	6.09	0.98
			88.	900	8.55	0.95
	42.	Sanitarium Light N Tasty Macadamia & Honey	89.	115	1.49	1.30
			90.	620	6.09	0.98
			91.	900	8.55	0.95
	43.	Sanitarium Weet Bix	92.	375	2.77	0.74
			93.	750	4.91	0.65
			94.	1,000	5.56	0.56
	44.	Uncle Toby's Oats Quick	95.	500	3.73	0.75
			96.	1,000	6.28	0.63
	45.	Uncle Toby's Oats Traditional	97.	500	3.73	0.75
			98.	1,000	6.28	0.63
	46.	Uncle Toby's Plus Cereal Antioxidant Lift	99.	460	5.34	1.16
			100.	700	5.00	0.71
	47.	Uncle Toby's Plus Cereal Fibre Lift	101.	460	5.34	1.16
			102.	710	5.00	0.70
	48.	Uncle Toby's VitaBrits Cereal	103.	375	2.88	0.77
			104.	750	4.82	0.64
			105.	1,000	5.34	0.53
Frozen						
Carrots & Corn	49.	Birds Eye Corn Kernels Sweet Extra Juicy	106.	500	2.75	0.55
			107.	1,000	5.05	0.51
	50.	Coles Australian Corn Cobs	108.	600	2.99	0.50
			109.	1,000	4.16	0.42
	51.	Coles Australian Corn Kernels	110.	500	2.45	0.49
			111.	1,000	4.27	0.43
Mixed Vegetables	52.	Birds Eye Cntry Hvst Carrots, Caulifl. & Broccoli	112.	500	2.93	0.59
			113.	1,000	5.01	0.50
	53.	Coles Australian Carrots, Peas & Corn	114.	500	2.56	0.51
			115.	1,000	4.27	0.43
	54.	Coles Australian Mixed Vegetables	116.	500	2.23	0.45
			117.	1,000	4.16	0.42
Peas & Beans	55.	Birds Eye Peas	118.	500	2.18	0.44
			119.	1,000	4.19	0.42
	56.	Coles Australian Beans Sliced	120.	500	2.13	0.43
			121.	1,000	3.84	0.38
	57.	Coles Australian Peas	122.	500	1.92	0.38
			123.	1,000	3.14	0.31
	58.	McCain Peas Baby Frozen	124.	500	2.32	0.46
			125.	1,000	4.16	0.42
Other Vegetables	59.	Birds Eye Spinach Portions	126.	250	2.13	0.85
			127.	450	3.73	0.83
Convenience Meals	60.	Coles Lasagne Béchamel Beef	128.	400	4.80	1.20
			129.	1,000	6.82	0.68
	61.	McCain (Frozen Meal) Lasagne	130.	1,000	10.97	1.10

			131.	2,000	14.97	0.75
Fish & Seafood	62.	Birds Eye Fish Fingers	132.	375	5.34	1.42
			133.	1,000	9.63	0.96
	63.	Coles Fish Fillets Crumbed	134.	425	7.27	1.71
			135.	1,000	14.97	1.50
	64.	Coles Fish Fillets Crumbed Lemon	136.	425	7.27	1.71
			137.	1,000	14.97	1.50
Party Snacks	65.	Patties Party Pies	138.	560	6.11	1.09
			139.	1,120	11.64	1.04
Pies & Pasties	66.	Coles Smart Buy Meat Pie	140.	150	0.75	0.50
			141.	450	2.66	0.59
	67.	Four'N Twenty Traditional Meat Pies	142.	700	7.04	1.01
			143.	1,050	8.75	0.83
	68.	Scotts Meat Pie	144.	150	1.09	0.73
			145.	900	6.29	0.70
Pastry	69.	Pampas Puff Pastry	146.	1,000	4.00	0.40
			147.	1,600	6.94	0.43
Poultry	70.	Steggles Turkey Breast Roast Frozen	148.	1,000	20.92	2.09
			149.	2,000	41.18	2.06
Dairy - Cheese						
Blocks & Wedges	71.	Bega So Light Vintage Cheese 25% Reduced Fat	150.	250	5.19	2.08
			151.	500	7.91	1.58
	72.	Bega Strong & Bitey Cheese Vintage	152.	250	5.19	2.08
			153.	500	7.80	1.56
	73.	Bega Tasty Cheese	154.	250	4.78	1.91
			155.	500	7.54	1.51
			156.	750	10.69	1.43
			157.	1,000	12.14	1.21
	74.	Capel Choice Mild Cheddar Cheese	158.	250	4.01	1.60
			159.	500	7.16	1.43
			160.	1,000	12.19	1.22
	75.	Capel Choice Tasty Cheddar Cheese	161.	250	4.01	1.60
			162.	500	7.16	1.43
			163.	1,000	12.19	1.22
	76.	Coles Cheese Block Vintage	164.	250	4.27	1.71
			165.	500	7.48	1.50
	77.	Coles Cheese Tasty	166.	250	4.06	1.62
			167.	500	6.73	1.35
			168.	1,000	11.01	1.10
	78.	Coles Cheese Tasty Extra	169.	250	4.06	1.62
			170.	500	6.73	1.35
	79.	Coles Cheese Tasty Lite	171.	250	4.06	1.62
			172.	500	6.73	1.35
			173.	1,000	11.01	1.10
	80.	Coles Colby Cheese	174.	250	4.06	1.62
			175.	500	6.73	1.35
	81.	Coles Smart Buy Tasty Cheese Block	176.	500	5.13	1.03
			177.	1,000	8.89	0.89
	82.	Coon Tasty Cheese	178.	250	4.48	1.79
			179.	500	7.37	1.47
	83.	Coon Tasty Cheese Light	180.	250	4.48	1.79
			181.	500	7.37	1.47
	84.	Mainland Cheese Extra Tasty Special Reserve	182.	200	4.87	2.44
			183.	400	7.54	1.89
	85.	Mainland Colby Cheese	184.	250	4.87	1.95
			185.	500	7.54	1.51
			186.	1,000	12.23	1.22
	86.	Mainland Tasty Cheese	187.	250	4.87	1.95
			188.	500	7.54	1.51
			189.	1,000	12.23	1.22
	87.	Mainland Vintage Cheese	190.	250	5.23	2.09
			191.	500	8.01	1.60
	88.	Watsonia Cheese Cheddar Matured	192.	250	4.07	1.63
			193.	500	7.28	1.46
			194.	1,000	12.54	1.25
	89.	Watsonia Cheese Cheddar Semi Matured	195.	250	4.07	1.63
			196.	500	7.28	1.46
			197.	1,000	12.54	1.25
Cottage & Cream	90.	Bulla Cottage Cheese Plain Low Fat	198.	200	2.77	1.39
			199.	500	5.34	1.07
	91.	Coles Cottage Cheese Lite	200.	200	1.91	0.96
			201.	500	4.59	0.92
	92.	Kraft Philadelphia Cream Cheese	202.	250	4.26	1.70
			203.	500	8.01	1.60
	93.	Weight Watchers Cottage Cheese	204.	250	3.35	1.34

			205.	500	5.98	1.20
Gourmet & Specialty	94.	Aussie Gold Camembert Cheese	206.	125	4.48	3.58
			207.	250	7.48	2.99
	95.	Jindi Brie Cheese	208.	125	5.34	4.27
			209.	200	9.62	4.81
	96.	South Cape Cheese Brie	210.	110	4.80	4.36
			211.	200	8.55	4.28
	97.	Tasman Heritage Brie	212.	125	4.70	3.76
			213.	140	6.09	4.35
			214.	250	10.15	4.06
	98.	Perfect Italiano Ricotta Cheese Light	215.	250	3.19	1.28
			216.	500	5.34	1.07
	99.	Perfect Italiano Ricotta Cheese Smooth	217.	250	3.19	1.28
			218.	500	5.34	1.07
Grated	100.	Coles Cheese Shredded Mozzarella	219.	250	4.38	1.75
			220.	500	6.40	1.28
	101.	Coon Tasty Cheese Shredded	221.	250	4.62	1.85
			222.	500	6.94	1.39
	102.	Mainland Mozzarella Cheese Grated	223.	250	5.16	2.06
			224.	500	6.41	1.28
	103.	Mainland Tasty Cheese Grated	225.	250	5.16	2.06
			226.	500	7.76	1.55
	104.	Mainland Tasty Cheese Grated Light	227.	250	5.16	2.06
			228.	500	7.76	1.55
	105.	Perfect Italiano Mozzarella Cheese Grated	229.	250	5.23	2.09
			230.	500	6.55	1.31
	106.	Perfect Italiano Parmesan Cheese Shredded	231.	125	3.95	3.16
			232.	250	5.23	2.09
Slices	107.	Bega Natural Cheese Slices Tasty	233.	250	5.34	2.14
			234.	500	8.76	1.75
	108.	Bega Super Cheese Slices Individ. Wrapped	235.	250	3.30	1.32
			236.	500	6.41	1.28
	109.	Bega Super Slim Cheese Slices Individ. Wrapped	237.	250	3.30	1.32
			238.	500	6.41	1.28
	110.	Coon Tasty Cheese Slices	239.	250	5.17	2.07
			240.	500	9.19	1.84
			241.	750	11.76	1.57
	111.	Kraft Singles Cheese Slices 97% Fat Free	242.	205	3.20	1.56
			243.	410	2.84	0.69
	112.	Kraft Singles Cheese Slices Light	244.	250	3.20	1.28
			245.	500	2.84	0.57
			246.	750	8.43	1.12
	113.	Kraft Singles Cheese Slices Original	247.	250	3.20	1.28
			248.	500	2.84	0.57
			249.	750	8.43	1.12
Snack Size	114.	Bega Cheese Stringers	250.	80	2.89	3.61
			251.	160	5.34	3.34
			252.	240	7.49	3.12
	115.	Bel Mini Cheese Babybel	253.	100	4.27	4.27
			254.	200	8.12	4.06
	116.	Mainland On The Go Spcl Res. & Water Crackers	255.	50	2.44	4.88
			256.	120	5.34	4.45
	117.	Mainland On The Go Tasty & Water Crackers	257.	50	2.44	4.88
			258.	120	5.34	4.45

SOURCE: Coles.com.au

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