

Supplementary File 1: Calculating Tobacco Market Price Partitions

Discrepancies in the data provided by the tobacco companies required some alignments before analyses could proceed. For example, BAT prices submitted to the New Zealand Ministry of Health were actually prices for January in the following year (except for 2020, when the prices were for October), but were consistent with the Imperial and Philip Morris prices for the previous year. Philip Morris consistently provided between two and four prices for each year, as did Imperial in three years. Often, but not always, these prices changed (increased) over the return year. For these returns, we used the last price in the year; i.e., the price closest to the BAT price for January in the following year. For the small number of cases where BAT brand variants were delisted during a year and no retail price was provided, we assigned the same retail prices as a 20-stick pack of the same brand. In 2017, BAT reported the same prices as in 2016, which would seem to be an oversight. Consequently, we imputed BAT prices for 2017 by averaging the prices for 2016 and 2018.

Assigning the same retail price as the 20-stick pack to all pack sizes within that brand family enabled us to include the total sales volumes for these brands in our analyses. Our approach assumes that cigarette brands are ‘positioned’ in consumers’ minds in a particular price partition, or segment, regardless of pack size or the fact that unit stick prices vary by a few cents because of volume discounts. In other words, the fact that consumers could save a few cents per stick by buying a larger pack does not change a brand’s market ‘positioning’, which is determined by the price of its 20-pack relative to the price of a 20-pack of other brands.

This point is illustrated by the extract shown in Table 1, which comes from a table of factory-made tobacco brands by market segment reported in Scollo, *et al.* (2015). A similar table illustrating the same point is found in Scollo & Winstanley (2021). In studies by Scollo *et al.*,

and Gilmore *et al.*, the allocation of brands to partitions was based on comprehensive searches of trade publications to determine how the tobacco industry ‘positioned’ its brands. This information is not available in New Zealand, thus we based our price partitioning on the relative retail prices of 20-packs of each brand sold.

Supplementary File 1 Table 1: Australian factory-made cigarette brands by market segment and manufacturer: 2012-2014

Premium FMC	Mainstream FMC	Budget FMC
British American Tobacco Australia		
Benson & Hedges 20s, 25s	Winfield 20s, 22s	Holiday 20s, 22s, 25s, 30s, 40s, 50s
Cambridge 35s, 30s		Just Smokes 22s, 25s, 30s
Craven A 25s		Pall Mall 20s, 23s, 25s, 30s, 35s
Dunhill 20s, 25s		Stradbroke 40s
Kent 20s		
Rothmans 20, 25s		
Vogue 20s		
Wills 35s, 30s		
Imperial Tobacco		
Camel 20s, 25s	Escort 20s, 21s, 25s, 26s, 35s	Brandon 40s
Davidoff 20s		Horizon 20s, 21s, 30, 40s, 50s
More 20s		JPS 10s, 21s, 25s, 26s, 40s
Peter Stuyvesant 20s, 25s, 26s		Red Fortune Bamboo 20s
Philip Morris Ltd		
Alpine 25s	Longbeach 20s, 25s, 30s, 40s	Bond Street 20s, 26s
Marlboro 20s, 25s	Peter Jackson 20s, 25s, 30s	Choice 20s, 25s, 40s
		GT 40s

Source: Scollo, M., Zacher, M., Coomber, K., Bayly, M., & Wakefield, M. (2015). Changes in use of types of tobacco products by pack sizes and price segments, prices paid and consumption following the introduction of plain packaging in Australia. *Tobacco Control*, 24(Suppl 2), ii66-ii75.

We treated each normalised 20-pack brand price as an independent data point for the cluster analysis; theoretically, a brand could be allocated to any of the clusters produced, depending on its normalised price in a particular year relative to all other normalised prices. A given

brand could thus be allocated to different clusters in different years. These outcomes may have reflected deliberate pricing decisions made by the tobacco companies or simply ‘noise’ in the data. Consequently, assuming the latter had occurred in some cases, after cluster-analysing the normalised prices as described, we reviewed each cluster for each year to assess the face validity of the clustering result and re-allocated a small number of cases to correct what appeared to be marginal partition anomalies.

In 2010, we re-allocated GT to the Super Value partition even though its price was the same as two other brands in the Budget partition. This re-allocation was done because in each of the next five years GT was clustered into the Super Value partition. Similarly, Longbeach was re-allocated to the Super value partition in 2010 and 2011 because it was a Super Value brand for the following nine years, and Lucky Strike was re-allocated from the Everyday partition to the Premium partition in 2018 because it had been a premium brand for each of the previous eight years, and Davidoff was re-allocated from the Everyday to the Premium partition in 2011 and 2012 to be consistent with its positioning in 2010 and 2013. These minor re-allocations gave a more consistent brand pattern, but overall made relatively little difference to the composition of the calculated partitions.

We omitted the Vogue brand from the cluster analysis because its price was an extreme outlier, though we included it in the Premium partition after the rest of the analysis was completed.

The brands allocated to each price partition are shown in Table 2. In the table, the colour shading of retail prices denotes the price partition for each brand, and the colour of each

brand name highlights the manufacturer. Thus, for example, in 2017, Winfield Select (from BAT) was categorised as a Budget brand, not an Everyday brand. Missing values indicate that the brand was not sold in New Zealand in that year.

Supplementary File 1 Table 2: Cigarette market partitions 2010-2020

Partition	Actual Recommended Retail Price of 20 Pack										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Super Value											
Longbeach	10.20	12.00	13.50	14.50	16.00	18.20	20.00	22.00	24.50	27.50	29.20
GT	10.00	11.80	13.00	14.00	15.50	17.50					
West				14.50	15.80	18.20	20.00	22.00	24.50	27.50	29.90
JPS Full Taste		11.80	13.00	14.90	16.50	18.70	20.40	23.00			
Choice						17.50	19.50	21.50	23.90	26.90	28.90
Eight-90	8.90										
Fortune Bamboo		11.30	13.40								
Classic		11.80									
Chesterfield										25.50	28.40
Marlboro Crafted											28.90
Rothmans London											28.90
Rothmans Royals										25.50	29.90
Budget											
JPS	10.00	12.00	13.80	15.60	17.00	19.50	21.00	23.00	26.00	29.50	33.50
Horizon	11.50	12.60	14.40	16.20	18.60	20.90	22.90	24.50	23.90	26.90	28.90
John Brandon	11.20	12.50	13.60	15.40	17.00						
Peter Jackson	10.50	12.00	13.80	15.60							
Club					17.90	19.50	22.00	24.80	27.50	30.90	30.90
Rothmans					18.20	20.20	22.50	25.20	27.90	28.50	31.90
Pall Mall Amber	10.00	14.50									
JPS Long								23.00	25.00	28.50	29.50
Horizon Mellow								25.00			
Winfield Select								26.30	26.90	29.90	29.50

Everyday											
Pall Mall Baseline	12.00	13.80	15.60	16.00	19.20	21.60	23.90	26.90	29.90	33.50	33.90
Freedom	12.00	13.60	14.90	15.50	18.90	21.30	24.50				
Pall Mall	12.50	14.50	15.60	17.80	20.20	22.10	24.50	28.00	31.50	35.00	35.50
Camel		14.30	15.90	17.80	18.80	21.40	24.00	26.50	28.90	32.00	35.90
Holiday	12.60	14.40	16.20	18.00	20.90	22.80	25.00	28.00	29.90	33.50	33.90
JPS Superkings	12.90	13.90	15.90	15.60	17.00	19.50	21.60	23.80			
Marlboro	13.00	14.30	15.90	17.50	19.30	21.50	23.90	26.30	28.90	32.30	35.90
Peter Stuyvesant	13.00	14.20	15.90	17.80	19.20	22.20	23.90	26.30	28.90	32.00	35.90
Freedom Black	11.80						23.90	26.90	29.90	33.50	
Freedom Red			15.40	16.00							
Pall Mall Baseline Extra Kings				16.00	19.50	21.90	24.20	26.90	28.90	33.50	
Holiday Escape	12.00	13.80	15.40	15.00	18.20	20.20					
Holiday Supers			16.20	18.00	21.20	23.00	25.50	28.00	29.90		
Premium											
Winfield	13.50	15.30	17.20	18.40	21.50	23.90	26.30	29.20	32.00	35.00	35.90
Benson & Hedges	14.20	15.90	17.80	19.00	22.20	24.50	26.90	29.50	32.00	35.50	35.90
Dunhill	14.50	16.00	17.90	19.20	22.50	24.60	26.90	29.50	32.00	35.50	35.90
Rothmans Kingsize /Premium	14.50	16.50	18.40	19.90	22.90	25.00	27.50	30.30	33.00	36.50	36.90
Lucky Strike	14.20	16.20	18.20	19.70	22.90	25.90	28.50	28.50	28.50		
State Express 555	14.50	16.50	18.40	19.90	22.90	25.20					
Vogue	17.60	19.70	21.60	23.20	26.00	28.00					
Kent	14.40	16.40	18.20	19.70	22.90						
Topaz	14.50	16.50	18.40	19.90							
Cameo	14.50	16.50	18.40	19.90							
Davidoff	14.00	15.00	16.50	18.50							
Sportsman	13.70	15.50	17.20	18.40							
Pacific No. 1	13.40	15.50									

Imperial Tobacco brands

Philip Morris International brands

British American Tobacco brands

Improvements to Data Collection

While we believe the data provided by tobacco companies have enabled important insights, we have also identified anomalies that complicated our analyses and that policy agencies could address by stipulating tobacco companies provide data in a specified format. We suggest the following improvements would facilitate use of these data to monitor industry practices and changes in the tobacco market structure.

- Standardising the format could be simplified by providing tobacco companies with a template that requires data to be provided from the beginning of each calendar year.
- Where more than one price has applied in a given calendar year, the template would allow the date (or dates) of post 01 January price changes and separate entry of all products released after the price change.
- The template would be electronic, thus greatly facilitating use of the data (and reducing the need for data entry and verification, as currently occurs when data are provided in PDF files).
- Where brands are delisted, the date on which they were no longer released should be supplied.