Inventory Flow in Canadian Candy Bar Supply Chains

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ABSTRACT

This study examined the ages of candy bars to measure the inventory flow in their supply chains. It sampled 6888 candy bars at 8 retail chains made by 4 manufacturers over a 4 year period. The first objective of the study was exploratory: were there any significant differences in inventory turnover across retailers, manufacturers, or time periods? The second objective was explanatory: could those differences be explained by business events, factory location, market share, or pricing?

The analysis showed that there were substantial differences in inventory turnover, especially among the retailers. Unlike in previous research, these differences seemed independent of the particular retail sector. The analysis also found that significant changes in inventory ages coincided with major events at one manufacturer. Interestingly, locating factories close to their markets did not necessarily lead to faster flows. These findings have implications for firms operating in the increasingly integrated North American marketplace.

INTRODUCTION

This paper describes a field study of inventory in candy bar supply chains in Canada. The main performance measure is inventory age, i.e. the total amount of time elapsed since the bars left the production line. This measure of age is influenced not only by transportation choices, but also by other decisions made by manufacturers, distributors, and retailers. Lower ages indicate that the supply chain turns over its inventory faster and has a higher velocity; this implies fresher candy and potentially greater consumer satisfaction. It also implies lower holding costs for the firms.

The primary goal of this study was to explore whether there were any significant differences across retailers, manufacturers, or time periods for the ages of a common consumer packaged good. Supply chain management is much talked about in academia (e.g., Kouvelis et al, 2006; Sachan & Datta, 2005) and in industry (e.g., Hershey, 2009), and it is understood that leanness and efficiency are important attributes of a supply chain (Cattani & Mabert, 2009). But how well do actual supply chains perform in practice, especially relative to their competitors?

This question is particularly relevant given the ongoing "convergence" of retail competition. Retailers increasingly compete not just *within* their own sector, as in grocer versus grocer, but also *between* different sectors, as in grocer versus mass merchandiser. Previous research has shown that different sectors can have very different average turnover rates. For example, Gaur et al (2005) found while mass merchandise stores averaged just 4.45 inventory turns per year (equivalent to an average

inventory age of 82 days), drug stores had 5.26 turns (69 days), and food stores achieved 10.78 turns (34 days). But these studies used highly aggregated measures of inventory: for each sector they combined together all the products carried by all of the firms in all of their markets. Would the results look the same for firms competing in a single shared market area and a single shared product category?

The secondary goal of this study was explanatory. Assuming there were material differences in inventory velocities between firms or time periods, could these be linked to corporate events, the location of factories relative to their markets, manufacturers' market shares, or retail pricing?

To pursue these goals, the study analyzed the ages of 6888 candy bars on retail shelves in the city of Ottawa over a 4-year period. It found significant differences in inventory turnover among the firms studied, with Wal-Mart having the youngest and most consistent product ages among the 8 retailers and Cadbury performing best among the 4 manufacturers. It did not find any significant trend in inventory turnover for the industry overall, but trends were apparent at 3 of the retailers, and Hershey's product ages did change in concert with major events at that company. The observed differences between firms did not seem related to their retail sector, e.g. grocer versus drug store, nor to the closeness of factories to their markets. There was a slight tendency for older products to come from manufacturers with larger market shares and retailers with higher list prices.

These results are of interest because they demonstrate that there can be considerable differences in inventory velocities between competing firms, even for a mundane product like candy bars, and even within a single market region. The fact that cross-border supply chains apparently can perform quite well - or quite poorly - relative to domestic ones, should also interest operations managers as they plan their strategies for the North American marketplace.

The remainder of this paper proceeds as follows. The next sections provide an overview of candy manufacturing and retailing in Canada, and a description of the data that were collected. Analysis of these data begins by highlighting the differences in inventory turnover among the firms studied. Subsequent testing examines how these differences may have changed over time, and whether they can be explained by major events, market share, pricing, or factory location. This is followed by a discussion of how the results here support or differ from those of previous research, and what they imply for practitioners and researchers. The paper concludes with a summary of the study's main results, strengths, and weaknesses.

CANDY MANUFACTURING AND RETAILING

Candy is not only a delight for the young and the young-at-heart, it is also big business. Retail sales of confectionery food in the USA totaled over $30 billion in 2009, of which an estimated 54% was spent on chocolate candy; the rest went to sugar candy and chewing gum. The chocolate category is even more popular in Canada, where it made up 69% of the country's $3.5 billion in 2009 confectionery sales (Euromonitor, 2009). Candy's popularity is related to its widespread availability: even vendors of office supplies and auto parts often sell candy near the checkout. Such commonality makes candy useful to study when comparing a diverse mix of retailers and suppliers.

The particular product studied herein is the everyday single-serving candy bar. The industry uses the term "everyday" to distinguish products sold year-round (78% of annual sales) from "seasonal"

ones sold only part of the year (22%), such as chocolate hearts for Valentine's Day (NCA, 2010). While an estimated 43% of Canadian confectionary food is sold from grocery stores, another 30% sells via convenience stores, 12% in health & beauty retailers, and 15% in other outlets (Euromonitor, 2009).

Candy bars have relatively long shelf lives, typically about one year. On the one hand, this means that their turnover lacks the urgency of more perishable goods such as dairy products. On the other hand, age will eventually degrade chocolate freshness, taste and quality, all of which are important criteria for consumers' chocolate purchase decisions (Lybeck et al, 2006). Thus, older products might reduce consumer satisfaction even if still within their "acceptable" shelf life.

This study covered the four largest chocolate candy manufacturers in Canada: Cadbury PLC (headquartered in the UK), The Hershey Company (USA), Mars Inc (USA), and Nestle SA (Switzerland). Together they supplied about 48% of Canadian sales. By comparison, the American market is dominated by Mars and Hershey, who each control 33% there (Euromonitor, 2009).

This study also included 8 major retail chains from 4 different sectors. Each chain was amongst the largest of its type in Canada, operated multiple outlets in Ottawa, and carried products from all 4 manufacturers. Wal-Mart Canada is the largest mass merchandiser in Canada, while Zellers is the discount division of the 2nd largest, Hudson's Bay Company. Mac's (along with Circle-K) is part of Alimentation Couche-Tard Inc, Canada's largest convenience store operator, while 7-Eleven Canada is 2nd. Loblaw Companies Ltd is the largest grocery retailer in Canada, and Metro Inc is 3rd. Shoppers Drug Mart Corp is the largest drug store operator, while Pharma Plus (along with Rexall) is part of Katz Group, the 4th largest (Euromonitor, 2009).

DATA COLLECTION

The first data were collected in July 2006 from retail stores in the city of Ottawa. Ottawa was chosen because the author was teaching there when the study began. As well, Ottawa is Canada's capital and 4th largest metropolitan region, with about 1 million people in the area, and so is a major market. In October 2006 and in February 2007 the same stores in Ottawa were visited again. This sequence was repeated for 4 years to accumulate 4x3 = 12 samples from July 2006 to February 2010.

A separate sample was also collected in October 2006 in Toronto, from stores belonging to the same 8 retail chains. Collecting a sample in another city enabled additional analysis to be done regarding factory locations. It also provided some assurance that the inventory ages in Ottawa were not wildly unusual. Toronto was chosen for this purpose because it is Canada's largest city, it has outlets of the same 8 retail chains, and it contains factories of 3 of the manufacturers.

For each sample a research assistant visited 3 stores from each of the 8 retail chains, for a total of 3x8 = 24 stores. In each store the assistant chose 2 single-serving packages from each of 3 flavors from each producer (e.g. 2 Hershey *Almond*, 2 Hershey *Oh Henry!*, and 2 Hershey *Reese Cups*) and recorded the production codes printed on the wrappers. For each product, the 1st code came from a bar at the front of its case, and the 2nd code came from a bar at the back. With 6 codes from each of the 4 producers, this totaled 6x4 = 24 codes per store and 24x24 = 576 codes per sample.

As much as possible, the same 12 products were sampled in each store; see Table 1. If one of these was not carried, the assistant instead chose a bar of an alternative flavor or size. For example, Table 1 shows that 518 *Oh Henry!* regular flavor 62.5 g bars were sampled. For the other 576-518 = 58 times, a Hershey product of a different size (e.g. *Oh Henry!* 85 g king size) or flavor (e.g. *Glossette Raisins* 50 g) was substituted instead (shown as "other"). All products were the "regular" flavor and "single serving" size unless otherwise stated. Note that manufacturers adjusted some of their product sizes slightly (e.g., from 50 g to 48 g) during the course of the study; the sizes shown in Table 1 are those from 2010. As well, the source for Hershey products switched from Smith Falls, ON, to Hershey, PA, part way through the study.

Some samples had less than 576 bars each. One sample was short 2 because a store stocked a limited selection of candy; the assistant could not gather a full sample there, even after revisiting it. As well, 22 production codes were transcribed incorrectly and could not be deciphered. This reduced the number of usable production codes by 24, leaving a total of (576x12) - 24 = 6888 from Ottawa.

Each production code was then translated into a production date. The difference between this date of production and the date of data collection gave the age of the candy bar. Figure 1 shows the resulting distribution of ages. The mean age was 140.7 days, equivalent to 2.59 inventory turns per year. The median was 118 days, and the standard deviation was 90.4 days. Individual ages ranged from 6 to 891 days, with 2.9 % of the products being over a year old.

STATISTICAL ANALYSIS

Comparisons of Retailers & Manufacturers

The analysis begins by breaking down the overall data set to check for differences between firms. Table 2 displays the breakdown by manufacturer. Firms with younger products (lower mean and median ages) generally also had more consistent ones (smaller standard deviations and lower percentages of product over 1 year old). Cadbury was the best performer along both those dimensions. An ANOVA test of the differences in mean ages showed that these were statistically significant, with $p<0.001$. A Kruskal-Wallis test of the medians, Levene's test of standard deviations, and a Chi-squared test of proportions of product over 1 year old each gave significant results as well, all with $p < 0.001$. Calculations were done via Minitab statistics software using a statistical significance level of $\alpha = 0.05$, i.e. a 95% confidence level.

Table 3 shows the equivalent breakdown by retailer. The differences here were larger, and Wal-Mart had the youngest and most consistent ages. Tests of the overall differences in means, medians, standard deviations, and proportions of old product again were all significant, with $p < 0.001$ for each.

The next test evaluated the differences in mean ages across multiple dimensions at once using a fixed effects ANOVA model. This included 5 factors: retailer, store (nested within retailer), manufacturer, product (nested within manufacturer) and time period, along with their second-order interaction terms. This model gave a reasonably good fit to the data, with $R^2 = 46\%$. Each factor and interaction term was statistically significant with $p < 0.001$, except for the interactions of product with store, chain, or time period (some of the product flavors or sizes were not sampled everywhere or every

time). Removing each of the 5 factors in turn from the model revealed that all had similar impacts on mean product age as measured by the change in R^2 fit.

As a check on these results, this multifactor ANOVA was run again after transforming the data using techniques from Cardinal & Aitken (2006: Ch 3) to reduce skew, stabilize the variances, improve data independence, and generally make the test results more reliable. The transformed data gave the same general results as reported above for the raw data, so they are not repeated here.

Overall, these results indicate that inventory turnover differed significantly according to which firm made it and which firm sold it, and to some extent which individual product and store was involved. In other words, both levels of the supply chain materially influenced the chain's performance.

The fact that the manufacturer-retailer interaction was significant suggests that some firms coordinated their replenishment better with some partners than with others. For example, a particular retailer might trust one supplier enough to let them manage their own in-store stock (i.e., vendor managed inventory), but stick with traditional ordering methods with the others. Figure 2 displays an interaction plot of the average ages of these 32 manufacturer-retailer pairs. For example, Mars products at Wal-Mart were the youngest at 81 days old. However, the relative impact of this coordination effect was modest; removing that term from the ANOVA reduced the R^2 by only 3 points.

Since the ANOVA also indicated significant differences between time periods, the next step was to check for seasonal patterns or linear trends in the means and standard deviations of product ages. No statistically significant trend or seasonality was found for the industry overall, nor for any of the individual manufacturers. The retailers also lacked any significant seasonality, but 3 of them did display statistically significant trends; see Figure 3. For Zellers, linear regression indicated that its mean ages had increased by an average of 18 days per year (with $R^2 = 41\%$ and $p = 0.026$). Similarly at 7-Eleven, the mean ages increased by 16 days per year ($R^2 = 49\%$ and $p = 0.011$). At Shoppers it was the standard deviations that showed evidence of trend. It decreased by 10 days per year ($R^2 = 40\%$ and $p = 0.028$). Thus while inventory flow slowed down at Zellers and 7-Eleven, it became more consistent at Shoppers.

Hershey's Product Recall

Inventory ages could also change over time as a result of specific events. For example, in November 2006, Hershey's Canadian factory discovered that one of its raw materials was contaminated by bacteria. It consequently recalled products produced between 15 October and 10 November, and then closed for several weeks of cleaning (CBC, 2006). Between the recall and the closure, the plant lost about 50 calendar-days worth of production.

To examine the effect of this incident, the change in Hershey product ages between sample 2 (October 2006) and sample 3 (February 2007) was compared to that of the other producers. Over this interval, the average ages of Hershey products decreased by 41 days, from 158 to 117, whereas that of the other 3 producers combined increased by 11 days, from 117 to 128. A two-factor ANOVA test revealed that while neither the manufacturer ($p = 0.180$) nor the time period ($p = 0.504$) were themselves statistically significant, their interaction was ($p = 0.001$). That is, the *difference* in the changes was significant: relative to its competitors, Hershey's average age dropped by 52 days, roughly the lost

production time. Thus the recall had a beneficial aftereffect: Hershey refilled their Canadian distribution pipeline with younger products, evidently from their Canadian plant.

Hershey's Factory Consolidation

When this study began in 2006, each manufacturer had one chocolate factory located in Canada (see Table 1). For Mars, theirs was part of a North American network of factories that specialized by product. For example, they made their *Mars Bar* in Newmarket, ON (about 50 km north of Toronto), but their *Snickers* in Waco, TX, and *Twix* in Cleveland, TN. Consequently, moving products across the Canada-USA border was a regular part of their operations. By contrast, Cadbury, Hershey, and Nestle apparently supplied the Canadian market from their Canadian factories.

In 2007, however, Hershey announced its $629 million Global Supply Chain Transformation (GSCT) project to improve operating efficiency. This included closing their plant in Smith Falls, ON, (about 80 km from Ottawa) at the end of 2008 (Hershey, 2009). They thereafter supplied Canada from their factories near Hershey, PA.

To evaluate the GSCT's impact, changes in the product ages of Hershey relative to its competitors were again examined. Sample 8 was collected in October 2008, while the Canadian plant was winding down. Therefore, the 3 samples taken before that (5, 6, & 7) were used to represent the performance of the old Canadian supply chain, while the 3 samples taken afterward (9, 10, & 11) represented the new American sourcing.

Over this interval, the mean age for Hershey products increased by 61 days, from 134 to 195, whereas the mean for the other producers combined increased by only 9 days, from 133 to 142. A two-factor ANOVA test revealed that the impacts of manufacturer, year, and their interaction were each statistically significant, with $p<0.001$. In effect, Hershey's average ages were comparable to its competitors before the GSCT. But afterwards they increased relative both to Hershey's own past and to its competition. This change is visually apparent in the time series plot of Figure 4. It remains to be seen, however, whether this slowdown is permanent or merely a temporary setback.

Pricing & Market Share

In addition to major events like those discussed above, inventory flow could be affected by more routine business factors like market share. A relationship between manufacturer market share and inventory age could work in several ways. If a firm has a larger-than-average market share because it offers a wider range of products, then as noted by Cachon & Olivares (2010) this could result in more total inventory and slower flow for each product. Conversely, if the firm offers a limited range of products, but obtains a larger market share by enjoying greater-than-average demand for each one, then this should lead to less stock and faster flow.

Euromonitor (2009) contains estimated market shares for each year for each manufacturer; confectionery figures for the retailers were not available. Regression of product ages against the manufacturers' shares showed that the relationship was statistically significant ($p < 0.001$) and mildly positive. A 10% increase in manufacturer's market share came with an average age increase of 3 days.

Table 2 shows the 4-year average market shares by manufacturer; note that Mars and Cadbury had the smallest shares and the lowest ages.

Retail price is another factor that arguably could affect inventory flow in several ways. Basic economics suggests that consumers would purchase less often where prices are higher: all else being equal, those products would sit on the shelf longer. Or the causation might be reversed: retailers who hold products longer incur higher holding costs, and might therefore set their prices higher. Consumers, however, might expect something quite different: if they are paying more for a product, then they might expect it to be a better (i.e. younger) one.

Retail list prices of the candy bars were recorded by the research assistants during their store visits. Regression of product age against these prices showed that the relationship was statistically significant ($p<0.001$) and mildly positive. A 10% increase in retail price came with an average age increase of 7 days. Table 3 shows the 4-year average list prices for each retailer. Wal-Mart had the youngest and cheapest bars on average, while Mac's were the oldest and most expensive.

Geographic Proximity

Geography can also influence supply chain performance. For example, there are trade-offs inherent in building factories close to customers versus close to suppliers, or near to competitors versus far from competitors (see e.g. Alcacer, 2006). Thus this sub-section explores geography's impact on inventory flow: does having factories closer to their markets lead to younger products? Obviously, the physical distance the product travels from factory to store will affect its age. But location could also impact age if extra paperwork is needed to ship across a border, or if a distant supplier is less responsive than a local one.

To evaluate this "closer is better" hypothesis, only the samples collected in fall 2006 from Ottawa and Toronto were used. The first comparison was country-versus-country; it considered whether the candy was produced in Canada (914 bars) or imported from the USA (222 bars). Table 4 shows the quantities and mean ages broken down by producer. Mars imported all but one candy bar type from the southern USA, yet their imports were marginally younger than their Canadian product. By contrast, Hershey and Nestle produced almost all their candy in Canada, and their few imports were quite old. An ANOVA test indicated that manufacturer, country, and their interaction were all significant, with $p < 0.001$. Thus it appears that the specific location of supplier facilities was relatively unimportant; what mattered more was how well the production & distribution system ran.

The second comparison was city-versus-city: bars produced in the city where they were sold presumably should tend to be younger than those produced elsewhere. This issue was addressed using the 914 Canadian-made bars, which came from factories around Toronto (Cadbury, Mars, & Nestle) or Ottawa (Hershey). Each of these was coded as "Near" if it was produced in the city where it retailed (e.g. produced in Toronto and sampled from Toronto), or "Far" if it was produced in the other city (e.g. produced in Toronto and sampled from Ottawa). Surprisingly, a t-test showed that the average age for the Near category, 144 days, was significantly *older* than the 123 day average for the Far category, with $p < 0.001$. This "backwards" result suggests that any delay due to the inter-city distance (only a day's drive by truck) was overshadowed by other location-related factors. For example, if stores in Ottawa had more demand and thus higher turnover than their counterparts in Toronto, then their bars would be

younger and would skew the "Far" category average. Alternatively, a factory's output might be routed through a warehouse, rather than going directly to the retailers; in that case, product ages might be affected more by the location of the warehouse than by the location of the factory.

DISCUSSION

It was interesting to find that the differences *between* retail sectors were rather modest: merchandisers had an average age of 127 days, food stores 140, drug stores 143, and convenience stores 153. The more pronounced differences were actually *within* sectors: for example, Wal-Mart's 97 day average versus Zellers' 157, or Shoppers at 128 days versus Pharma Plus at 158. This is quite different than the large differences between retail sectors reported by Gaur et al (2005). For example, they found that grocers turned their inventory 10.78/4.45 = 2.4 times faster than mass merchandisers did.

The discrepancy in results may be due to the scope of the studies. Gaur et al (2005) and Chen et al (2007) both examined total inventory aggregated across a firm's entire product mix, with the mixes differing greatly by retail sector. By contrast, the study of candy here targeted a single product category shared across all sectors. This suggests that much of the previously reported difference between industry sectors may have been related more to differences in product mix rather than in operating sophistication. For example, Chen et al (2007) reported that Wal-Mart had increased their inventory turnover throughout the 1990's. But they noted that this improvement coincided with the firm's increased emphasis on faster-turning food items.

Future research might test this hypothesis by estimating retail inventory turnover in several distinct product categories, and then checking whether different weighted averages of those per-category results would explain the different aggregate inventory performance between sectors. This issue also highlights the need for analysts to ensure that the scope of their inventory measurements, aggregate versus focused, is appropriate for their objectives. Otherwise, their metrics may obscure a supply chain's actual behavior.

Regarding the time dimension, this candy study found that while inventory age did vary from period to period, there was no clear trend over time for the industry as a whole. Rather, as in Gaur et al (2005), Chen et al (2005), Chen et al (2007), and Cachon & Olivares (2010), the time series results varied by firm and industry, with a rather mixed record overall.

At Hershey, ages did change noticeably over time as the apparent side effect of a product recall and a factory rationalization. The latter event illustrated a classic textbook tradeoff curve, in that the desired increase in efficiency (greater factory utilization) came with a corresponding decrease in effectiveness (slower turnover). As for the recall, its beneficial impact on inventory ages is quite logical in hindsight, but not the kind of outcome that comes to mind when thinking about quality problems.

The Hershey results suggest that the methodology used in this paper might be useful for certain future studies where researchers want to examine operational changes inside a firm but lack access to a company's internal data. They may be able to instead use external measurements of inventory age to study those changes. As the recall example showed, the connection between internal cause and external effect sometimes can be remarkably close.

However, this study did not find a close connection between plant location and inventory age. The superior performance of American-based Wal-Mart compared to its Canadian competitors suggests that, for this operational metric, there was no "home court advantage" in retailing. On the manufacturing side, the fact that Mars had relatively fast flows demonstrates that it is certainly possible to create an effective trans-national supply chain. Conversely, the 45% older ages observed for Hershey after it started supplying Canadian stores from American plants demonstrates that such effectiveness is not automatic. Perhaps the lesson for managers here is that more complex distribution systems also take more time and effort to get right; they don't just "happen". For researchers, these results suggest an interesting question to explore in future work: what does Mars do differently that allows it to operate effectively in this cross-border context?

The economic relevance of the inventory measures in this study can be demonstrated by a simple extrapolation. The Canadian wholesale chocolate market is worth over one billion dollars per year. Arbitrarily assuming a 12% annual cost of capital, a conservative estimate for the daily cost of carrying that much inventory is 0.12 x 1000 / 365 = $0.33 million. If this study's average age of 141 days is reflective of the industry overall, then the total annual carrying cost is 141 x 0.33 = $46 million spread across all of the firms involved. If every company could instead match the 81 day average of Mars products at Wal-Mart, then the industry overall could save (141 - 81) x 0.33 = $20 million annually.

CONCLUSION

This study examined the flow of candy bar inventory in Canadian supply chains by sampling retail shelves in the city of Ottawa. It found significant differences in inventory turnover among the firms studied, with Wal-Mart performing best amongst the 8 retailers and Cadbury leading the 4 manufacturers. Interestingly, the performance differences did not seem related to the retailer's subsector (e.g. grocer versus druggist), nor to the distance between factories and markets. Changes in Hershey product ages did seem closely related to a product recall and a strategic reorganization at that firm.

The strengths and weaknesses of this research largely relate to its data set. Its focus on a single product category and market region allowed comparisons to be made across many types of retailers without the confounding caused by differing product mixes. It further allowed retailers and manufacturers to be included within a single study. Unfortunately, that concentrated focus also makes generalization of the results less straightforward.

Ideally, a future study on this topic would track products along each step of their distribution. This would reveal not only a product's total age, but also where it had spent that time: traveling on a truck, sitting in a warehouse, etc. This kind of data collection, however, would require cooperation from all members of the supply chain, something very difficult to obtain in a competitive industry.

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Table 1. Products sampled.

Manufacturer	Product	Size*	Factory Location	Quantity
Cadbury	*Caramilk*	52 g	Toronto, ON	536
	Mr. Big	60 g	Toronto, ON	508
	Wunderbar	58 g	Toronto, ON	446
	others	varies	varies	232
Mars	*Mars Bar*	58 g	Newmarket, ON	532
	Twix	57 g	Cleveland, TN	516
	Snickers	59 g	Waco, TX	496
	others	varies	varies	178
Hershey	*Reese Peanut Butter Cups*	51 g	Smith Falls, ON*	552
	Oh Henry!	62.5 g	Smith Falls, ON*	518
	Milk Chocolate with Almonds	43 g	Smith Falls, ON*	404
	others	varies	varies	246
Nestle	*Aero*	42 g	Toronto, ON	562
	Smarties	50 g	Toronto, ON	560
	Kit Kat	45 g	Toronto, ON	536
	others	varies	varies	66

Table 2. Manufacturers: candy bar ages in days, and average market share.

Company	Mean	Median	Standard Deviation	% 1 Year Old	Market Share
Cadbury	117	100	71	1.2%	13.5%
Mars	127	105	84	2.4%	4.1%
Hershey	155	129	102	3.7%	14.9%
Nestle	165	136	94	4.4%	16.2%

Table 3. Retailers: candy bar ages in days, and average list price.

Company	Mean	Median	Standard Deviation	% 1 Year Old	List Price
Wal-Mart	97	87	54	0.0%	$0.90
Shoppers	128	104	80	2.3%	$1.23
Loblaw	135	112	93	3.1%	$1.02
7-Eleven	140	125	73	0.7%	$1.28
Metro	145	123	86	2.2%	$1.02
Zellers	157	129	98	4.9%	$1.00
Pharma	158	136	91	4.3%	$1.14
Mac’s	167	132	117	6.0%	$1.23

Table 4. Domestic & imported candy bars from Ottawa & Toronto in fall 2006.

Company	Canadian Quantity	Canadian Mean Age	Imported Quantity	Imported Mean Age
Cadbury	282 bars	121 days	none	none
Mars	86 bars	127 days	202 bars	121 days
Hershey	262 bars	144 days	16 bars	250 days
Nestle	284 bars	134 days	4 bars	226 days

Figure 1. Histogram for all 6888 candy bar ages from Ottawa

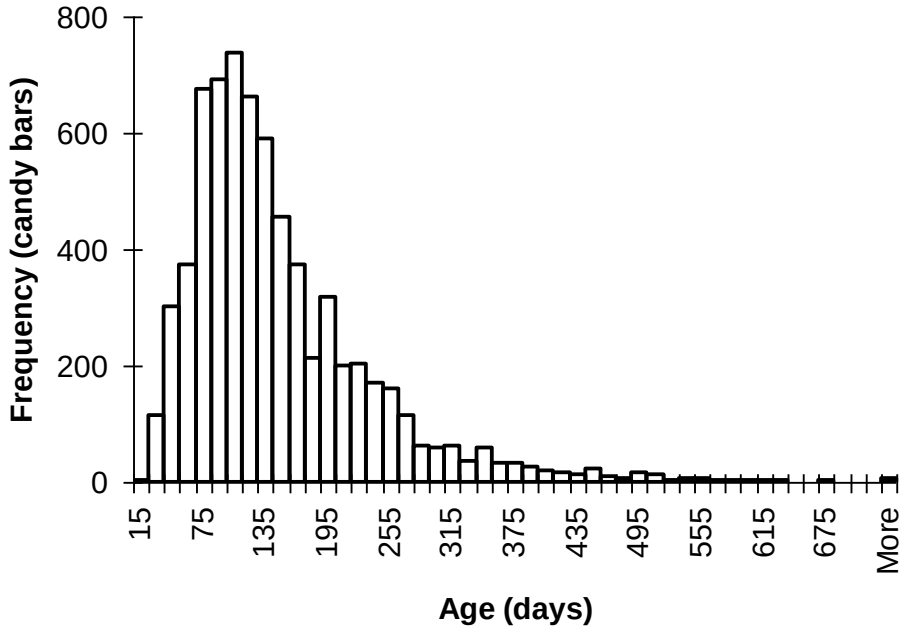

Figure 2. Interaction plot comparing average ages by retailer & manufacturer

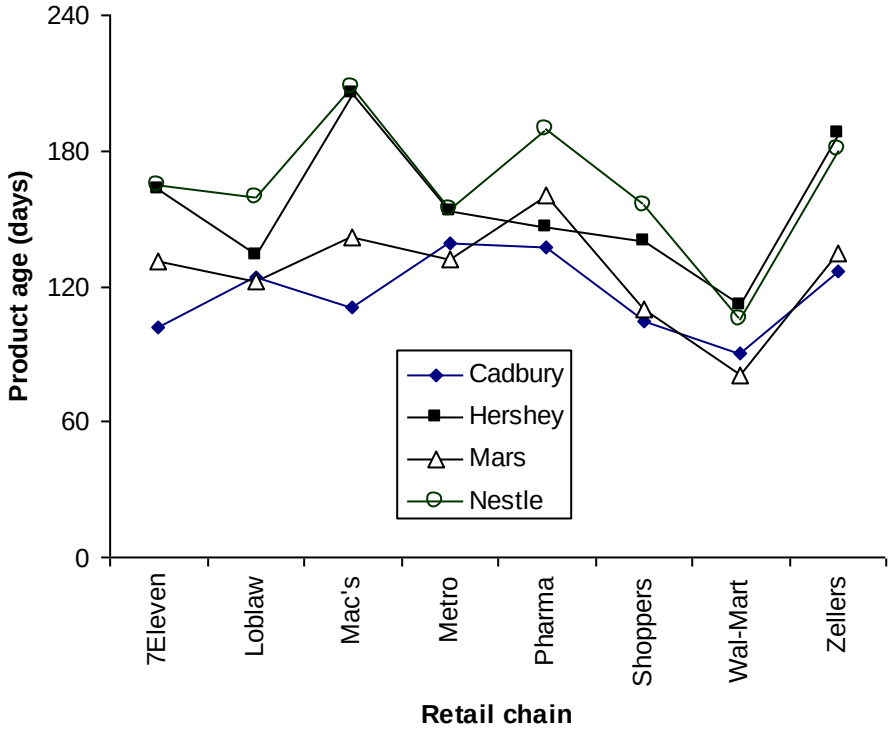

Figure 3. Plots of Zellers mean, 7-Eleven mean, and Shoppers standard deviation.

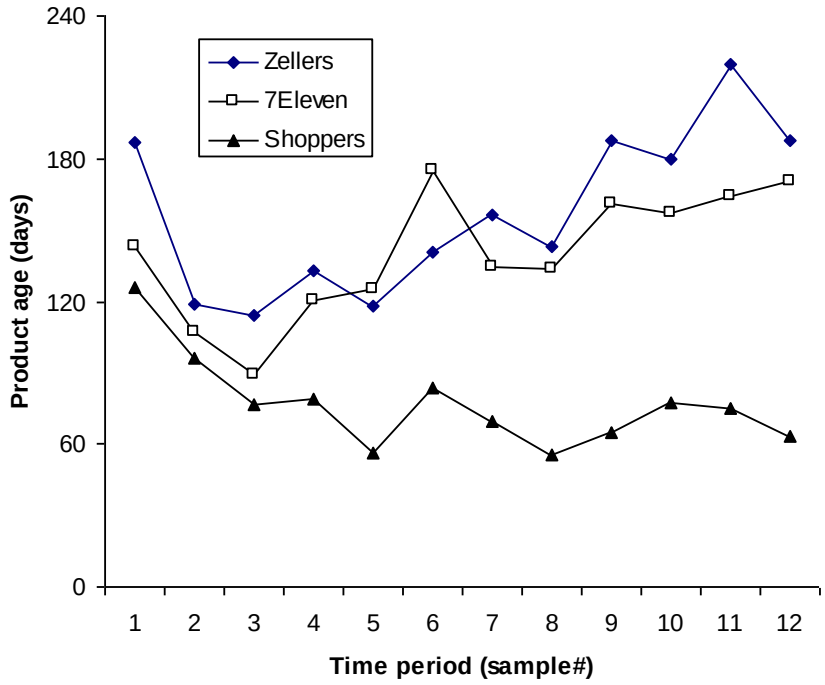

Figure 4. Plot of Hershey product average age compared with that of Cadbury, Mars, & Nestle ("CMN") combined; the vertical scale is amplified to show detail.