Analysis of Consumer Buying Behavior: Price Discounts through Consumption Patterns of Instant Ramen[1]

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Abstract

This paper investigates the impacts of two indirect price discount channels (quantity discount and hypermarkets) on consumers by using the consumption data of instant ramen, which is attained from a consumer panel in Korea. The estimation results suggest that both effects are statistically significant; the decomposed discount effects of the multipack and the hypermarket are 10.7% and 4.3%, respectively. The savings benefit from the quantity discount channel is greater than that of the hypermarket channel. Hence, the implication of this paper is that the price gap between hypermarkets and small supermarkets can be reduced when the small supermarkets follow the strategy of the hypermarkets, i.e., giving quantity discounts.

Keywords: instant ramen, multipack, hypermarkets

JEL classification: D12, L81

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1 Introduction

Price discounts for food products can be implemented by consumer buying behaviors. First, consumers may enjoy cheaper products with a quantity discount such that the price per unit decreases as the amount sold increases. That is, if consumers, for example, purchase a large quantity of food at once (e.g., a large bottle of milk or a box of a dozen donuts), the discount rate per unit goes up. Second, the selection of a shopping venue can engender additional discount benefits. Usually, consumers can take advantage by making purchases at hypermarkets, because of not only the convenience but also the low price of goods. In that sense, this paper investigates empirically how consumption patterns can affect the unit price of food and also estimate consumers monetary benefits using one of the most popular foods in Korea instant ramen (hereafter "ramen").

The standard unit of ramen is one plastic bag; however, ramen is sold not only in individual units but also in a multipack (usually including 5 bags) or a box (including 20 or 30 bags). For instance, if the price of a single bag is 700 Korean won (KRW) and that of the multipack is 3,000 KRW at a small supermarket, the relative benefit of purchasing the multipack is 100 KRW per bag. In addition, consumers can also enjoy the discount benefits from purchasing ramen at a hypermarket. If consumers purchase a multipack at 2,800 KRW at a hypermarket, their benefit is 100 KRW from selecting the multipack plus an additional 40 KRW from buying at a hypermarket; i.e., savings of 140 KRW in total per bag. Thus, in this paper, we analyze the discount benefit implemented by these two channels and properly decompose it by each channel.

Quantity discount is a deal offered to buyers. It is a mechanism to increase the total revenue by increasing the amount sold while decreasing the price per product. This can be understood as follows: when consumers pre-purchase an anticipated consumption amount beforehand, they stockpile the future value of it (Hendel and Nevo (2006); Griffith *et al.* (2009)). Quantity discount can also be used to coordinate production policy and inventories (Monahan (1984); Lee and Rosenblatt (1986)), and more broadly, supply chains (Li and Liu (2006)). De-

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spite its popularity, the marketing and economic implications of quantity discount are still under debate (Dolan (1987); Dobson and Gerstner (2010)). Quantity discount should not be regarded as an obvious strategy because a quantity surcharge is quite prevalent in grocery shopping as well. Consumers may rely on primitive decision rules, such as the larger the better, inviting room for a quantity surcharge (Cude and Walker (1984)). Positive store pricing images and demand asymmetries can result in a quantity surcharge (Sprott *et al.* (2003)). Searching failure and false beliefs are other possibilities, which explain why items with large information and searching costs are often subject to a quantity surcharge (Binkley and Bejnarowicz (2003)). Therefore, ethical issues are involved in both quantity discounts and surcharges (Gupta and Rominger (1996)).

Hypermarkets can influence consumer benefits. Hypermarkets, such as Wal-Mart in the U.S., Tesco in the U.K., and E-Mart in Korea, provide cheaper products relative to small supermarkets (Basker and Noel (2009); Volpe III and Lavoie (2008)); hence, hypermarket users can get additional cost savings (Leibtag *et al.* (2010); Griffith *et al.* (2009)). Thus, restricting the entry and expansion of hypermarket chains can significantly decrease consumer surplus, particularly for lower income households (Hausman and Leibtag (2007)). Specifically, the debates about hypermarkets are instructive. In particular, Wal-Mart is regarded as being successful due to its efficiency and flexibility in meeting the customers needs (Boaz (1996); Bandow (1997)). Moreover, in the first year of entry, Wal-Mart creates 100 jobs and in the long run, an additional 50 jobs are made; however, 20 jobs disappear in the wholesale sector after Wal-Marts vertical integration (Basker (2005)). On the other hand, Wal-Mart can increase the rate of family poverty (Goetz and Swaminathan (2006)). According to Goetz and Swaminathan (2006), Wal-Mart destroyed 2.7% of retail jobs and 1.5% of retail earnings between 1987 and 1998. Even when hypermarkets lead job creation effects in the region, the loss of regional funds can be a serious problem. The profits of the hypermarket go to the firm not revert to the region (Vias (2004); Goetz and Swaminathan (2006)). Protests against Wal-Mart matter much less than the profits. Instead, Wal-Mart uses the protests strategically to foresee future issues.

In sum, quantity discount is an important topic and is still an active

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research area. Our paper is important in that it investigates quantity discount in relation to the hypermarket issues, both which are highly relevant and significant topics to both practical managers and policy makers.

This paper exploits consumer panel data in 2010 collected by the Rural Development Administration (RDA) in Korea. This consumer panel data set is comprised of 995 household accounts written by housewives based on the information of receipts, which cover more than 800,000 consumption occasions of food purchases and include detailed information, such as price, quantity, brand, date, broad category of shopping venues, and various demographic information of each household (e.g., income and number of children). For our empirical analysis, this paper focuses on the data of ramen consumers (purchasing bag ramen and cup ramen) with detailed demographic information; hence, we exclude some households without full information of either income or the number of children. Thus, our final sample covers 17,999 purchasing occasions for 875 households.

Based on Griffith *et al.* (2009), we estimate the impacts of quantity discounts and hypermarkets. The estimation results suggest that both effects are statistically significant and the decomposed discount effects of the multipack and the hypermarket are, respectively, 10.7% (or 70.33 KRW per ramen) and 4.3% (or 28.26 KRW per ramen). The saving rates vary with respect to the income group or the number of children: The 3.00-3.99 million KRW monthly income group achieves the highest benefits from using the multipack (yearly 8.94 ramens) and the 4.00-4.99 million KRW income group from going to hypermarkets (yearly 1.86 ramens), which are similar to the results of Griffith *et al.s* (2009) upside down U-shape. Also, households with 3 children and more receive the highest benefits from using the multipack (yearly 9.70 ramens) and those of 2 children from going to hypermarkets (yearly 1.73 ramens).

To the best of our knowledge, this is the first paper to study the additional discount channels of food products in Korea. It contributes to the literature by investigating the discount benefits of Korean ramen consumers from the choices of multipacks and venues and demonstrating that the magnitude of the effects from the quantity discount channel is almost 2.5 times larger than that of the influences from the hypermar-

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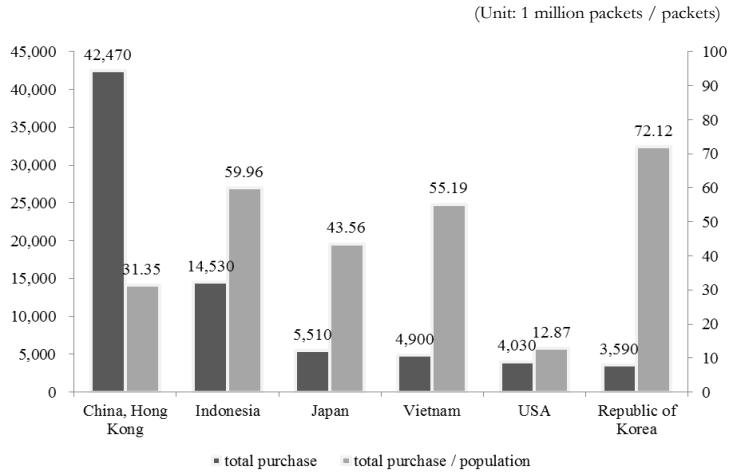
ket channels. As explained in Griffith *et al.* (2009), if larger sizes are offered and sold in several types of stores, the discount impacts from purchasing food in large packaging sizes are likely to be greater than those of choosing venues. Thus, our findings from the ramen products can be generalized to any other food products that are sold in large packs in many shopping places. Moreover, the implication of our paper can also be meaningful to policy makers: In general, hypermarkets provide cheaper products than small supermarkets; however, if most of the discount effects result from the quantity discount, small supermarkets may follow a similar discount strategy such that the gap of the discount benefits between hypermarkets and supermarkets can be reduced[5].

2 Industrial Background and Data Analysis

2.1 The Korean ramen industry

Figure 1: 2011 Ramen Consumption



Source: WINA, http://instantnoodles.org

[5]As we preliminarily checked up other food categories in the same data set, some processed foods in large sizes (e.g., milk and beer) are sold in small supermarkets. Thus, small supermarkets can provide more foods in large sizes.

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We investigate the Korean ramen sector in order to analyze the effect of price discounts and consumer behavior. Ever since Samyang first produced ramen in 1963, ramen has been very popular with almost all Koreans. In 2011, the estimated level of Koreans ramen consumption was 72 ramens per capita. The World Instant Noodle Association (WINA) reports that in terms of per capita and total consumption, Korea is ranked first and sixth, respectively (Figure 1)[6].

Below, <Table 1> describes the ranks by total production in the food category for 2011. The data come from the Korean Food and Drug Administration (KFDA). Clearly, the ramen industry is significant in both production and consumption. The total revenue of bag ramen and cup ramen are 1.36 trillion KRW, which is the largest in the food category, and 0.57 trillion KRW, which is the 16th largest. The ramen sector is larger than the flour, sugar, etc. sectors, totaling 1.93 trillion KRW. Its production is 81.8% of total noodle production.

Table 1: 2011 Food Production Rankings[7]

Ranks	Category	Sub category	Total revenue (1,000 KRW)	Total production	Rankings by production
1	Noodles	Bag ramen	1,360,212,504	381,487	12
2	Soft drinks	Soft drinks	1,293,826,187	1,246,018	3
3	Breads and traditional cakes	Breads and others	1,165,213,206	499,754	6
4	Other foods	Flour	1,078,428,361	1,655,379	1
5	Other processed foods	Other processed foods	1,015,174,530	400,023	9
6	Snacks	Snacks	970,524,573	146,477	30
7	Sugar	White sugar	906,274,727	1,282,234	2
8	Breads and traditional cakes	Cakes	867,840,861	122,367	36
9	Cooked foods	Composite cooked foods	839,582,139	146,271	31
10	Soft drinks	Other soft drinks	839,405,464	692,629	4
⋮	⋮	⋮	⋮	⋮	⋮
15	Kimchi	Cabbage kimchi	654,306,012	327,028	16
16	Noodles	Cup ramen	569,812,166	107,884	39

Source: KFDA (2011)

[6]In 2011, the estimated annual consumption level of ramen was about 98.2 billion worldwide, among which the Chinese consumed almost half (about 42.9 billion). Indonesia and Japan followed China. Indias consumption has highly increased over the past 5 years.

[7]Total revenue is the sum of total production and profit per period, including

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In addition, there are other advantages in examining quantity discounting and corresponding consumer behaviors in the ramen sector. First, ramen is popular with almost all Korean consumers, easily allowing for a control of unobserved consumer characteristics. Second, ramen is more homogeneous than other foods in terms of quality and price. Third, since packaging is standardized, product characteristics are easily analyzable and classifiable[8].

2.2 Data

We obtain the household survey data for 2010 from the RDA in Korea. For our empirical analysis, this paper focuses on the data of ramen consumers with detailed demographic information. Hence, we exclude households without full information of either income or the number of children. Finally, we chose shopping cases of 17,999 ramen purchases for 875 households.

Table 2: Sample Household Characteristics

2A. Income (1 million KRW /month)

	Obs.	Share
< 2.00	1,820	10.11
2.00-2.99	4,929	27.38
3.00-3.99	5,511	30.62
4.00-4.99	3,042	16.90
≥ 5.00	2,697	14.98
Total	17,999	100

2B. Number of Children

	Obs.	Share
0	519	2.88
1	3,444	19.13
2	11,378	63.21
≥ 3	2,658	14.77
Total	17,999	100

2C. Shopping frequencies

Per week	Household	Share
< 1	35	4.00
1-1.99	224	25.60
2-2.99	335	38.29
3-3.99	199	22.74
≥ 4	82	9.37
Total	875	100

2D. Ramen purchase frequencies

Per month	Household	Share
> 1	496	56.69
≤ 1	379	43.31
Total	875	100

transfer, samples, nonmonetary compensation and internal consumption.

[8]As of August 2011, Nongshim is the leader in the ramen sector, whose market share is about 68%, followed by Samyang, Ottugi and Paldo (Source: AC-Nielson survey). The remaining players are negligible. Thus, product and brand effects can exist.

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In the above, <Table 2> describes the sample household characteristics. The inverted U shape pattern of ramen purchases is presented in <Table 2A> in response to the monthly household income; ramen shopping is most frequent in the 3.00-3.99 million KRW monthly income household group. Moreover, <Table 2B> shows how the number of children in a household affects ramen purchases. According to the results, households with two children purchase ramen most frequently, 63.21% of the total sample. In <Table 2C> and < Table 2D>, the two compare the total shopping frequencies as well as ramen purchase frequencies. More than one third of 875 households shop 2-2.99 times per week. 496 households purchase at least one ramen per month, which is more than half of the sample.

Next, <Table 3> shows the patterns of ramen purchases. 251 households earn 3.00-3.99 million KRW per month, which is the largest segment, while the second largest segment (235 households) earns 2.00-2.99 million. The former group consumes the largest quantity of ramen, about 110 per year. Also, the higher the number of children, the more is the consumption of ramen. Consumption of ramen reaches about 120 per year for households with at least three children.

Table 3: Ramen Purchasing Patterns by Household

7A. Income (1 million KRW/month)

	< 2.00	2.00-2.99	3.00-3.99	4.00-4.99	≥ 5.00	Total
Annual purchases	82.67	96.357	110.3	98.669	94.896	98.865
Household	106	235	251	148	135	875

7B. Number of Children (person)

	0	1	2	≥ 3	Total
Annual purchases	50.739	83.436	104.68	120.44	98.865
Household	46	202	520	107	875

We compute the price of one ramen per purchase with the total spending in ramen divided by the sum of various package sizes multiplied by the number of ramens per package. The information about per prices, packaging, store types and brands is listed in <Table 4>. The store types are defined as follows: A hypermarket is a superstore combining a supermarket and a department store (e.g., E-mart). A su-

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per supermarket (SSM) is a supermarket with space between 1,000 and 3,000 square meters, which is smaller than a hypermarket and operated by large retailers (e.g., E-mart Everyday). A large supermarket is a locally owned supermarket, but with a similar space to the SSMs. A small supermarket is a small-sized local supermarket. Others consist of convenience stores, on-line shopping malls, thrift markets (opened on a regular basis in an apartment complex), and so forth.

The size of the total sample is 17,999 purchasing occasions. The shopping frequency for a bag of ramen is 12,550 (69.73%). Each household purchases about 2/3 of ramen as multipacks and about 1/3 from hypermarkets out of the total ramen consumption. The brand shares in our sample are 64.60% for Nongshim and 14.77% for Samyang.

Table 4: Summary Statistics

	Obs.	Mean	S.D.	Min	Max	t-test
Total Sample	17,999	657.32	153.57	263[a]	1,830	
(bag ramen, single and multipack)	12,550	617.15	122.14	267	1,820	
A. multipack dummies						*vs. unit*
Unit	5,484	755.74	184.14	267[a]	1,830	
Multipack	12,515	614.19	113.83	263[a]	1,750	-141.548***
B. Store type						*vs. Small supermarket*
Hypermarket	6,642	634.03	146.17	263[a]	1,830	-39.927***
SSM	2,450	654.50	150.93	270	1,800	-19.465***
Large supermarket	2,677	651.26	134.02	280	1,700	-22.706***
Small supermarket	5,171	673.96	146.24	270	1,800	
Others	1,059	743.93	228.14	290	1,800	69.963***
C. Brand						*vs. Others*
Nongshim	11,628	673.59	145.20	263[a]	1,830	25.049***
Samyang	2,658	598.38	121.76	267	1,800	-50.161***
Others	3,713	648.54	185.23	267[a]	1,820	

a. Round up to the first decimal

The sample average ramen price and that for a bag ramen are 658 KRW and 617 KRW, respectively. The lowest prices are for noodle-only products. Including the quantity discount, cup ramens are the most expensive. The quantity discount from purchasing a multipack is 141 KRW per unit. Hypermarkets offer a price at a discount of 41 KRW compared to small supermarkets. Further, brand effects exist: Nongshim charges 27 KRW more than the average, whereas Samyang charges

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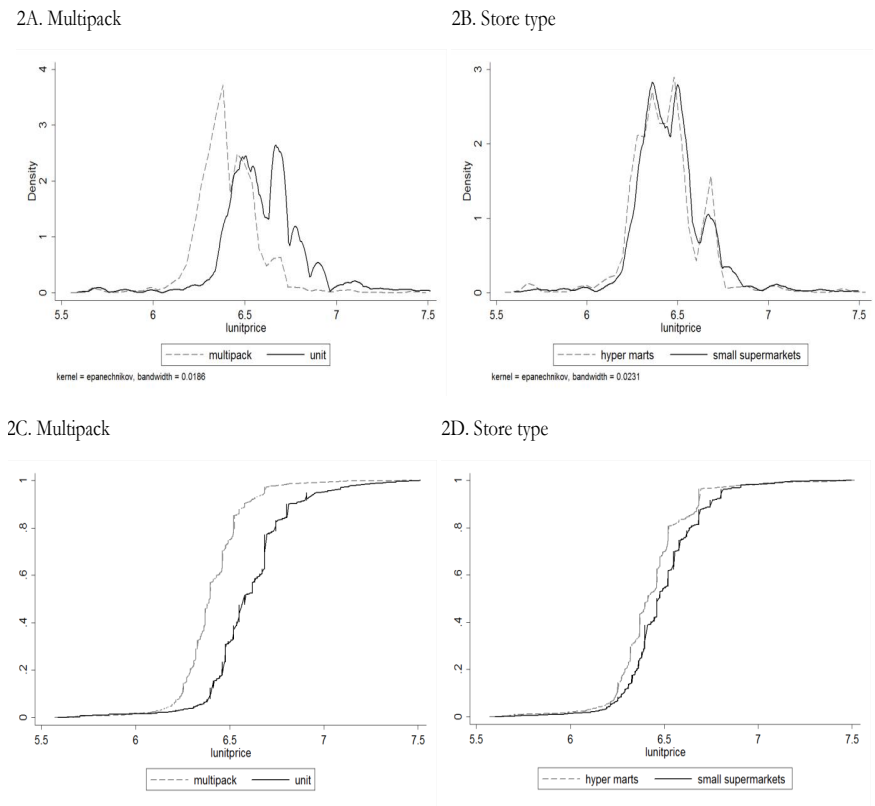
50 KRW less [9]. In relation, Griffith *et al.* (2009) ascribe the discount to large discount stores, which deal with multipacks and low-price products. Hence, the pure discount effect of the large discount stores is only 10 Pounds Sterling (GBP) per year[10]. Similarly, our Appendix suggests that store effects are small because most purchases for a multipack ramen occur in large stores.

Figure 2: Cumulative Distribution and Kernel Density Estimate of Log Unit Price



[9]This pattern can arise because Nongshim produces both bag ramen and cup ramen, while Samyang focuses on bag ramen.

[10]In contrast, Hausman and Leibtag (2007) and Leibtag et al. (2010) show that superstores like Wal-mart sell at a significantly lower price, at about 13-20% discount per product.

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Overall, <Figure 2> is based on <Table 4>, showing the probability and cumulative density functions of ramen per price depending on the packaging as well as on the stores. According to the results, <Figure 2A> and <Figure 2C> show that price per unit is lower in a multipack. Moreover, <Figure 2B> and <Figure 2D> show that hypermarkets sell at a lower price compared to small supermarkets although the difference is smaller than that in the case of multipack versus unit.

3 Methodology and Estimation Results

3.1 Model

We analyze the magnitude of discounting by packaging and store types. Our empirical model extends Griffith *et al.* (2009) as follows.

$$\ln p_{iht} = \alpha + \beta M_{iht} + \gamma S_{iht} + Cup_{iht} + \eta_i + \rho_h + \mu_t + \nu_t + \varepsilon_{iht} \quad (1)$$

$$i = \text{ramen product},\ h = \text{household},\ t = \text{shopping date}$$

p_{iht} is the price per unit that households pay. M_{iht} is the packaging dummy having one if a multipack and zero otherwise. S_{iht} is the store dummy in order to classify small supermarkets, large supermarkets, SSMs, hypermarkets and others. Cup_{iht} is 1 for cup ramens and 0 for bag ramens. We control unobserved heteroscedasticities by including the fixed effects: η_i for 180 products, ρ_h for 875 households, and μ_t and ν_t for months and weeks. The focal coefficients are β for the multipack discount and γ for the store effects.

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3.2 Multipack Discount Effects

In <Table 5>, the magnitude of multipack discounting is 11.8% or 77.56 KRW per ramen estimated upon column (1-3).

Table 5: Multipack Savings Rate

Dependent Variable: log of the unit price					
	(1) OLS			(2) WLS	
	(1-1)	(1-2)	(1-3)	(2-1)	(2-2)
Multipack	-0.160***	-0.118***	-0.118***	-0.112***	-0.118***
	(0.009)	(0.005)	(0.005)	(0.006)	(0.005)
R-sq.	0.195	0.690	0.731	0.738	0.730
Obs.	17,999	17,999	17,999	17,999	17,999
Conversion at the mean of unit price (=657.3174)	-105.17	-77.56	-77.56	-73.62	-77.56
Error type	cluster	cluster	cluster	cluster	cluster
Fixed effect	month week	month week product	month week product household	month week product household	month week product household
Weight				# of shopping	log of the expenditure of shopping

Notes: Multipack takes one if a household purchase multipack and zero otherwise. We obtain similar results using per price unit for dependent variables. We assume that error terms can vary with household type although assuming white standard errors does not change the results.

Our baseline fixed effects model in column (1-1) takes into account the seasonal sales discounting and events using month and week effects. Columns (1-2) and (1-3) additionally incorporate product and household fixed effects. Griffith *et al.* (2009) control the effects of household location in order to account for product effects. In comparison, our more rigorous approach controls the household effect. Columns (1-2) and (1-3) show that unobservable factors do not change our results as much. This means that income or child effects do not interfere with the effects of multipack discounting; all household segments uniformly obtain savings by buying multipacks. We also run the weighted least square (WLS) using the logarithm of the total expenditure as weights, which do not change our results as much.

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3.3 Multipack Discount Effects

<Table 6> shows whether large discount stores offer price discounts beyond multipack effects. (1-1) controls the company effects, including the top two players: Nongshim and Samyang. (2-1) controls more detailed product effects in order to account for unobserved product characteristics. (1-2) and (2-2) add the multipack effect to (1-1) and (2-1). And, (1-3) and (2-3) add the joint effect of a multipack and hypermarket to (1-2) and (2-2).

By comparing (1-1) and (1-2), interesting patterns are revealed. First, there are clear store effects. Hypermarkets, SSMs, and large supermarkets all offer lower prices relative to small supermarkets. Second, however, such price gaps between small supermarkets and hypermarkets or SSMs diminish by 1/3 1/2, once we include a multipack dummy. Such decreased store effects are proportional to the ratio of the multipack sales of each store[11]. The multipack effect is a 15% price discount, as shown in <Table 6>. There are also company effects: Nongshim brands charge about a 6% higher price, while Samyang brands charge 2% less than the average price. Interestingly, such brand effects are attributed to multipack effects; Samyang products are traded more in multipacks. If we additionally include the joint effect of a multipack and hypermarket in (1-3), the marginal price discount effect of hypermarkets relative to small supermarkets rises from 3.3% to 6.5%, but if the estimated joint effect of +3.5% is properly reflected, the actual price gap can be interpreted as only 3%. Actually, if single ramen bags are offered in hypermarkets, consumers also purchase single ramen bags. Also, as shown in Appendix A, even in other types of stores, multipacks are sold a lot. Thus, the correlation between hypermarkets and multipacks is not that high. In that sense, the consideration of the joint effect does not change the results.

Even after considering the product effects in columns (2-1) through (2-3), we still find that multipack dummies decrease the store effect. The multipack effect in (2-2) is 10.7%, which is only a 1.1% point difference from <Table 5> without any store effects. Hypermarkets offer a largest discount, a 4.3% lower price than that of the small supermarket. In monetary terms, the multipack effect has a 70.33 KRW discount,

[11] See Appendix A.

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while the hypermarket effect has a 28.26 KRW discount. And, similar to the findings in (1-3), since the joint effect of a multipack and hypermarket is +3.1%, the actual price gap between hypermarkets and small supermarkets is computed as only 3.6%.

Table 6: Large Discount Stores Discount Effect[12]

Dependent Variable: log of unit price						
	(1) Company & Store			(2) Brand & Store		
	(1-1)	(1-2)	(1-3)	(2-1)	(2-2)	(2-1)
Multipack		-0.150***	-0.158***		-0.107***	-0.112***
		(0.008)	(0.009)		(0.006)	(0.005)
Multipack · Hypermarket			0.035***			0.031***
			(0.012)			(0.008)
Hypermarket	-0.116***	-0.090***	-0.117***	-0.094***	-0.076***	-0.099***
	(0.012)	(0.012)	(0.016)	(0.009)	(0.008)	(0.011)
SSM	-0.079***	-0.070***	-0.069***	-0.065***	-0.059***	-0.057***
	(0.013)	(0.012)	(0.012)	(0.009)	(0.009)	(0.009)
Large supermarket	-0.087***	-0.082***	-0.080***	-0.054***	-0.051***	-0.050***
	(0.012)	(0.011)	(0.011)	(0.009)	(0.008)	(0.008)
Small supermarket	-0.054***	-0.057***	-0.055***	-0.031***	-0.033***	-0.032***
	(0.012)	(0.011)	(0.011)	(0.009)	(0.008)	(0.008)
Nongshim	0.058***	0.059***	0.059***			
	(0.006)	(0.006)	(0.006)			
Samyang	-0.022***	-0.012	-0.012			
	(0.008)	(0.007)	(0.007)			
R-sq.	0.287	0.330	0.331	0.718	0.737	0.737
Obs.	17,999	17,999	17,999	17,999	17,999	17,999
Conversion at the mean of unit price (= 657.3174)						
Multipack		-98.60	-103.86		-70.33	-73.62
Hypermarket	-40.75	-21.69	-40.75	-41.41	-28.26	-44.04
Multipack · Hypermarket			+23.01			+20.38
Error type	cluster(id)	cluster(id)	cluster(id)	cluster(id)	cluster(id)	cluster(id)
Fixed effect	month	month	month	month	month	month
	week	week	week	week	week	week
	household	household	household	product	product	product
				household	household	household

Note: The estimated discount offered by store types do not vary whether we control for multipack and product effect or not.

In addition, when considering for bag ramens only, the multipack discount is getting even larger, 12% or 71.62 KRW; however, the hypermarket discount becomes smaller at 3% or 19.76 KRW. This analysis considers that bag ramens are far more popular than cup ramens and furthermore, a multipack includes five ramens.

[12]Large discount stores sell private label (PL) products; however, it is negligible (less than 1%) and therefore, the products can be controlled with product fixed effects.

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4 Saving Benefits by Consumer Characteristics

We find that household characteristics are not related with the magnitude of a discount. Thus, the total expenditure and behavioral shopping pattern determine how much a household saves in purchasing ramens.

Griffith *et al.* (2009), we use a household-level savings measure in order to compute savings in each customer group. We compute the household-level savings measure upon the weighted savings rate, which is the multipack discount (β) and the hypermarket discount (γ), multiplied by the household specific expenditure weight. The household specific expenditure weight is the ramen expenditure per discount channel divided by total ramen expenditure. Discount channels denote multipack and store types.

$$SavingRate_h^{DC} = w_h^{DC}[1 - exp(\theta)], \quad \theta = \beta, \gamma \tag{2-1}$$

$$w_h^{DC} = \frac{\sum_t (Discount\ Channel_{iht} = 1) expenditure_{ht}}{\sum_t expenditure_{ht}} \tag{2-2}$$

$$\begin{aligned} Saving_h^{DC} &= Quant \times SavingRate_h^{DC} \\ &= Quant \times w_h^{DC}[1 - exp(\theta)], \quad \theta = \beta, \gamma \end{aligned} \tag{2-3}$$

DC means a discount channel: multipack and stores. $SavingRate_h^{DC}$ is the savings rate of each discount channel multiplied by the ratio of the discount channel purchase over total ramen purchase. $Saving_h^{DC}$ is $SavingRate_h^{DC}$ multiplied by annual ramen purchases of each household, resulting in the annual savings per household.

In <Figure 3>, the discount that each household group enjoys per ramen is presented. 82% out of 875 households purchase multipack ramens, saving 8.5% for each unit of ramen purchase. 40% use hypermarkets, saving 1.7% over small supermarket prices. Savings rates do not vary with household incomes, although the 4.00-4.99 million KRW group enjoys larger savings than those in the less than 2 million KRW

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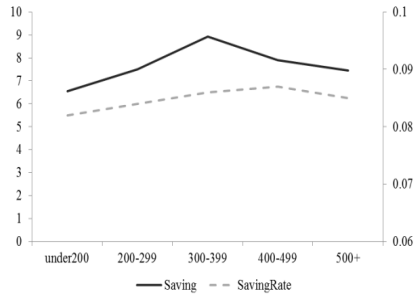
group because the former group purchases more multipack deals and use hypermarkets more. The 3.00-3.99 million KRW income group saves most with the multipack deals: 8.94 ramens per year. The 4.00-4.99 million KRW income group saves most by using hypermarkets: 1.86 ramens per year. These results correspond to the inverted U shape of Griffith *et al.* (2009).

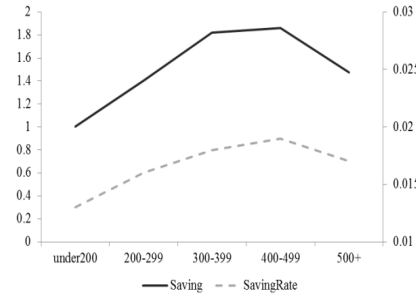
Figure 3: Discount Rate and Savings by Household Characteristics

A. Income, multipack effect



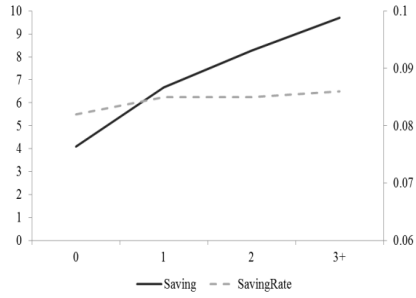
	< 2.00	2.00-2.99	3.00-3.99	4.00-4.99	≥ 5.00	Total
Saving Rate	0.082	0.084	0.086	0.087	0.085	0.085
Saving	6.539	7.500	8.935	7.907	7.443	7.855

B. Income, hypermarket effect



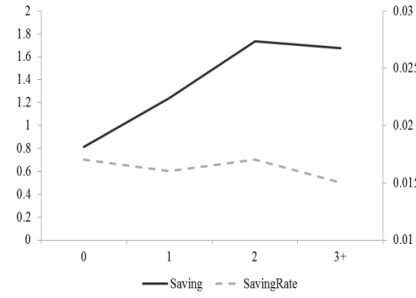
	< 2.00	2.00-2.99	3.00-3.99	400-499	≥ 500	Total
Saving Rate	0.013	0.016	0.018	0.019	0.017	0.017
Saving	1.002	1.403	1.821	1.861	1.475	1.563

C. Children, multipack effect



	0	1	2	≥ 3	Total
Saving Rate	0.082	0.085	0.085	0.086	0.085
Saving	4.084	6.675	8.269	9.695	7.855

D. Children, hypermarket effect



	0	1	2	≥ 3	Total
Saving Rate	0.017	0.016	0.017	0.015	0.017
Saving	0.812	1.238	1.733	1.673	1.563

Note: Saving unit is one ramen.

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The number of children does not affect the savings of a multipack; yet, there is an effect based on store types. When a household has two children, the frequency of going to the hypermarkets increases, but decreases afterwards. According to <Table 3>, purchasing ramen increases with the number of children in the household. Thus, multipack savings should increase with the number of children as well, reaching 9.70 ramens for those with at least three children. Households with two children save most by using hypermarkets, at around 1.73 ramens per year.

5 Concluding Remarks

This paper investigates empirically how consumption patterns can affect the unit price of food and improve consumer welfare by using the consumption data of ramen, which is attained from a consumer panel in 2010 collected by the RDA in Korea. The estimation results based on Griffith *et al.* (2009) suggest that the impacts of the quantity discount and hypermarkets are, respectively, 10.7% and 4.3%. The savings rates vary with respect to the income group or the number of children: The income group of 3.00-3.99 million KRW obtains the highest benefits from purchasing a multipack and that of 4.00-4.99 million KRW received the highest benefits from shopping at hypermarkets. Moreover, households with 3 children and more obtain the highest benefits from purchasing a multipack and that of 2 children from shopping at hypermarkets.

The present paper contributes to the literature by investigating the additional discount channels using the Korean data of ramen consumers; further, it shows that most of the effects result from the quantity discount channel rather than the hypermarket channel. This implies that the price gap between hypermarkets and supermarkets can be reduced when small supermarkets mimic the strategy of the hypermarkets, i.e., giving quantity discounts. This implication can be meaningful not only to researchers but also to policy makers who are concerned about balancing welfare among different markets.

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Appendix

A. The relationship between multipack and shopping venue

Table A1: Both bag and cup ramens for various types of multipacks (2 and more)

Shopping venue	Single bag	Multipack	Total
Hypermarket	1,225	5,619	6,844
SSM	836	1,708	2,544
Large supermarket	945	1,786	2,731
Small supermarket	2,218	3,121	5,339
Others	574	568	1,142
Total	5,798	12,802	18,600

Table A2: Bag ramens for multipack of 5 bags

Shopping venue	Single bag	Multipack	Total
Hypermarket	274	1,521	1,795
SSM	144	4,489	4,633
Large supermarket	337	1,605	1,942
Small supermarket	1,010	2,895	3,905
Others	200	468	668
Total	1,965	10,978	12,943

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