

**Factors That Influence Price Recall Abilities of Consumers: A Case  
Study of the Nazarbayev University Campus**

by

Timur Amrenov

Darmen Gabitov

Adil Zhetpisbayev

Supervisor

Omer Baris

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## **Abstract**

We have found that people can either forget or recall the prices of the products they have just bought for various reasons and among them, there are a few unexpected factors. The number of products a person has just bought, their age, whether they always check the prices to be sure they get the best value, and if they plan before they shop - those are significant factors that impact the people's ability to successfully recall the prices. However, if we focus on locations, grocery stores, such as Ailin and ex-Vesna become significant, as the biggest number of people fail to recall the prices in these locations on the campus of Nazarbayev University. We have decided to focus on the campus of Nazarbayev University, where numerous stores, shops, and coffee shops are located, which all have different prices for similar or the same products. The demographics of the campus are also favorable, representing almost all age groups of adults. Particularly, the analysis will be focused on how widespread this phenomenon is; how the people at Nazarbayev University cope with it; what differences could be found between different demographic groups; and what effect the technologies are having on this problem. To conduct this research, we have collected data (300+ responses) to analyze the limited memory of consumers on the university campus, as well as to conclude if there is a correlation between demographic features and consumer behavior. The discussion of limited memory at Nazarbayev University campus is important since it may lead to the occurrence of price dispersion, and the different pricing for the same products across shops. This research will be beneficial to the research field, as it will contribute to the general literature concerned with consumer behavior since the campus presents a unique opportunity to study a variety of firms and consumer groups.

## **Introduction**

The economic theory assures that consumers are rational, meaning they make buying decisions with perfect information regarding the prices of goods (Kutlu, 2015). Specifically, the theory is based on the assumption that people can perfectly recall the prices of goods and that they can make their decisions on future purchases (Chen et al. 2010). However, in fact, as Wakefield and Inman (1993) continue, many consumers do not even recall the prices of the products they have just bought. In the field of economics, such behavior is referred to as limited memory. In general, limited memory refers to the fact that consumers do not have perfect recall about which seller offers the cheapest price for the good (Carvalho, 2009). Such a phenomenon could be explained by studies like the one by Bettman et al. (1979) that suggest that consumers tend to have cognitive limitations due to the complexity of the market. Precisely, they are often met with a lot of alternatives of products and services by different companies. In addition to that, it is important to mention the speed at which the market is constantly changing which also adds to this complexity (Bettman et al., 1979).

The main issue with limited memory is that it often leads to price dispersion (Carvalho, 2009). Price dispersion describes the situation when different firms set different prices for the same or similar products (Lach, 2002).

While limited memory and price dispersion exist across a variety of geographical locations and institutions, we will analyze limited memory consumers and price dispersion at the Nazarbayev University campus. Nazarbayev University Campus has a unique environment where consumers come from diverse backgrounds, including faculty, staff, students, and visitors with varying income levels and preferences. Moreover, we focused on the Campus because the off-campus alternatives are costly for consumers in terms of time and energy. The dynamics of price dispersion, if it is prevalent, may also be comparatively unique, considering the close proximity of sellers at the Campus. What it means is that there might be more to the discussion of consumer behavior than the mental inability to compare prices perfectly, since it is not an overwhelming task. Additionally, the research could potentially produce fruitful results due to the variety of stores located within the campus. For instance, campus has Magnum, ex-Vesna, the 24th Block, and Ailin as convenience stores; and a considerable number of coffee shops which include Daily Cup, Espresso Day, HP Cafe, and DrinkIt. Moreover, consumers, as was mentioned, are not homogenous, and research on the factors that affect the decision-making of particular groups may also give an insight into the heuristics of consumers depending on their income and preferences.

Overall, the major objective is to analyze when and how many consumers on campus can recall the prices of the goods they have just bought, which will significantly add material to the existing literature and discussion of limited memory as a phenomenon together with consumer behavior. Throughout the research, we will first analyze the extent of price dispersion within the campus stores/coffee shops. Then, collect data on whether people can recall the prices or not. After that, make inferences on whether the results are correlated with some of the variables like age, occupation, and payment method.

Therefore, our research question is:

- 1) How do different factors influence the ability of people to recall the prices of the products they have just bought?

The rest of this research paper will be divided into the following parts: literature review, research design, discussion, and conclusion. In the literature review, we overview the existing literature on the topic of price recall and price recognition. In the research design section, the methods used to acquire the data to work with will be presented and justified. In the discussion section, the interpretation and analysis of our findings, as well as possible correlations and explanations of them will be presented to the reader. Moreover, we will discuss what those data results mean in the context of existing literature and theories that will be analyzed in the following sections, as well as future practical applications in the research field. Then, we conclude with a summary and give the interpretation of the findings in a broader context, emphasizing their significance in relation to that field of study. It will also acknowledge the research's limitations, discussing any methodological constraints or factors that may have influenced the results.

### **Literature review**

Research indicates that consumers on average don't have accurate recollections of product prices, with variations based on factors such as demographic characteristics of consumers, product category, and consumers' own strategies. Numerous studies indicate that consumer price recall is often imprecise, with significant overestimation and underestimation of actual prices. According to the research on price recall of 51 food items by Loy et al. (2020), out of 715 participants only 14% of consumers accurately recalled prices within a  $\pm 5\%$  range. On average people were off by 34.5% in their estimates for the price of products. Overestimations occurred in 56% of recalls and underestimations in 36%. In Estelami and Lehmann's (2001) meta-analysis of 279 studies, the average deviation between recalled and actual prices (PAD) was around 14.2%, with large variation depending on study conditions.

There is no consensus on the best predictor of price recall ability in the population. It may appear that socio-demographic categories such as age, sex, and income could influence the memory of consumers due to cognitive, experiential, or behavioral differences. However, findings are mixed.

Intuitively, age should affect price recall, as older consumers may have reduced cognitive and perceptual abilities. Gaston-Breton and Raghubir (2013) found that age

influences both motivation and ability to recall prices: while older consumers often have more motivation due to budget constraints, they also have less cognitive ability, especially in unfamiliar shopping contexts. This results in worse price recall overall, especially when prices are shown in an unfamiliar format like a new currency. Their study suggests that ability plays a more crucial role than motivation in determining price memory accuracy. On the other hand, studies by Rosa-Diaz (2002) and Kenning et al. (2007) found no significant relationship between age and price recall.

Another general that could be noticed is that lower income consumers should have better price recall, since they are more sensitive to prices. One research done in Spain found that low-income families have overall better knowledge of prices than middle or high-income ones (Rosa-Diaz, 2002). However, similar research conducted in Sweden found no evidence of such a negative correlation between income and price knowledge (Mägi & Julander, 2005). Same result is found in Kenning et al. (2007) research. Gaston-Breton and Raghurir (2013) make the conclusion that lower income consumers have worse price recall, due to the fact that consumers with higher income have better mobility and can be more knowledgeable about prices.

Gender is also important to discuss since cultural factors may shape socialization patterns, leading to gender-based differences in household responsibilities. Male or female may go shop more due to their role in the family, and therefore have better price recall. One research shows a difference in price knowledge between genders, with females having a significantly better ability to recall the prices of the goods (Rosa-Diaz, 2002). The authors suggest that, despite the possible decline of traditional family structures, women may still have greater price recognition due to their continued responsibility for household chores. A study by Estelami and Lehmann (2001), adds to this idea stating that women are more associated with being the “shoppers” within a household and therefore more knowledgeable regarding the prices of the products. However, the overall literature is not one-sided, as some of the studies identified a negative correlation. For instance, a study by Schmitt et al. (1988) suggested that sex type is not an important variable when it comes to estimating consumer behavior based on the memory test that the group has conducted. Kenning et al. (2007) have found no difference in price recall between genders either. These differences reflect how the impact of gender may be more situational than universal.

Non-demographic factors may also interfere with the data on price recall of consumers. The type of product itself is an important indicator on how people will recall the price of it. Some research is focused on groceries and essentials (Loy et al, 2020; Gaston-Breton and Raghurir, 2013; Estelami and Lehmann, 2001), while others are more niche things, like clothing (Kenning et al, 2007). That difference could be seen in the research of Estelami and Lehmann (2001), which highlighted that people recall essential goods, such as groceries, better. The adaptation-level theory suggests that repeated exposure to price information creates reference points, which help recall accuracy.

From the perspective of consumer behavior, Mazumdar and Monroe (1992) suggest that consumers who engage in frequent price comparisons across different stores tend to recall product prices more accurately and are more confident in their recall. In contrast, in-store comparisons alone show a weaker correlation with recall accuracy, implying that simply observing different prices within the same store does not significantly improve recall. Rosa-Diaz (2002) also points out that consumers' attitude towards checking prices is also an important determinant of the accuracy of price recall. In the discussion of the simple demographic factors that element is often neglected but we can suggest that younger or people with higher income could possibly have better ability to compare prices. In the context of our current research, we will explore the interplay between both demographic and non-demographic factors—a perspective that is rare in existing literature, as most studies tend to focus on just one of these elements.

## **Research Design**

This study investigates whether there is a correlation - and potentially a causal relationship - between consumers' price recall ability and their demographic and behavioral characteristics, specifically within the context of Nazarbayev University's campus. We aim to explore how factors such as age, income, gender, and shopping behavior influence a consumer's ability to remember prices of recently purchased products both individually and combined. In addition, we will cover indicators that are specific to the context of Nazarbayev University, which include the usage of either cash, card, or QR-system to buy

an item, whether they bought a singular item or several, and whether they live on Campus or not.

We assume that demographic variables might influence a consumer's ability to recall prices. Factors such as age, income, and gender can shape both memory capacity and attentiveness to pricing as it was discussed in the literature review. Therefore, our first hypothesis is:

**H1.** *Demographic variables —specifically age, income, and gender— have a statistically significant impact on consumers' ability to accurately recall the prices of recently purchased products.*

Beyond demographics, consumer behavior might play a key role in price recall. Individuals who are more engaged in the purchasing process, such as those who check prices, compare alternatives, or plan their shopping in advance, are expected to pay more attention to the pricing of goods. This aligns with Mazumdar and Monroe's (1992) findings discussed earlier. This leads to the following hypothesis:

**H2.** *Consumers who check prices regularly, compare prices across stores, prioritize and plan their purchases in advance are significantly more likely to recall product prices accurately than those who shop spontaneously or prioritize convenience.*

We also recognize that contextual variables could influence price recall. These include the time of day (which may affect cognitive focus), the number of items purchased (cognitive load), the payment method (e.g., mobile apps vs. cards), and store characteristics (e.g., store type). Excluding those factors from research might limit our understanding of the price memory and distort findings. Thus, our final hypothesis is:

**H3.** *Contextual factors — such as the number of items purchased, time of day, method of payment — have a statistically significant impact on consumers' ability to accurately recall prices.*

To check our hypotheses, we conducted offline face-to-face surveys with 300+ people. We conducted the survey in the morning, afternoon, and evening of working days and weekends, close to the places of focus – convenience stores, coffee shops, and cafes.

Precisely, among the stores, we covered Ailin located in Block 27, Magnum located in Block 22, the 24th Block located in Block 24, and ex-Vesna located in Block A1. As for coffee shops, we covered Daily Cup, Espresso Day, Health Project Cafe, and DrinkIT. Standing near the stores or coffee shops, we came up to a consumer who had just bought a product and introduced ourselves and our research. After describing short details of the questionnaire and its anonymity, we asked whether they had bought a single item or multiple items, as well as if they could recall the prices for those products. To categorize the respondents, we also asked about their method of payment – if they had used cash, card, or Kaspi QR/Mobile Payment, what their exact age was, the language that they used the most daily, and whether they lived on campus. Also, we tested the subject's memory capability with a surprise question. We asked what was the precise battery charge percentage on their phone to see whether their failure to recall the price of a product happened due to limited memory or disinterest.

Then, to structure responses and later interpret them in an organized way, we divided the responses of the people into categories according to the respondents' age group, gender, and whether they had good or bad memory (the question about battery charge). In order to get an adequate size of the sample, we decided to collect 300 responses as our data.

After getting a sufficient number of responses, we encoded the responses into quantitative variables using statistical software, and after running and analyzing them, we created various graphs and charts. These figures represent the possible correlation and causation between the independent (demographic variables, consumer behavior ) and dependent variable, which is the consumer's price recall ability. Furthermore, we presented additional discussion and interpretation of these graphics, which can be found in the following sections.

## Research Findings & Discussion

### Figure 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of items	334	1.943	1.329	1	10
How freq do you shop?	334	5.305	.878	1	6
Spend effort to find best	334	3.03	.961	2	5
Always check prices	334	3.018	.914	1	5
Age	332	24.886	7.473	18	60
Product Price	277	870.83	482.355	100	4008
Date	334	23749.006	49.458	23673	23800
Hour	334	15.198	3.471	8	23
Card	334	.347	.477	0	1
Prioritize Convenience	333	.426	.495	0	1
Prioritize Price	333	.12	.326	0	1
Prioritize Quality	333	.294	.456	0	1
Prioritize Variety	333	.159	.366	0	1
Block24	333	.12	.326	0	1
Ailin	333	.12	.326	0	1
DailyCup	333	.132	.339	0	1
Drinkit	333	.12	.326	0	1
Espresso	333	.12	.326	0	1
Vesna	333	.144	.352	0	1
Hp	333	.12	.326	0	1
Magnum	333	.123	.329	0	1
Chose store: Convenience	333	.423	.495	0	1
Chose store: Habit	333	.177	.382	0	1

<b>Chose store: Price</b>	333	.066	.249	0	1
<b>Chose store: Quality</b>	333	.147	.355	0	1
<b>Chose store: Relationship</b>	333	.003	.055	0	1
<b>Chose store: Service</b>	333	.006	.077	0	1
<b>Chose store: Variety</b>	333	.177	.382	0	1
<b>Plans before shopping</b>	334	.308	.463	0	1
<b>Compares prices</b>	334	.24	.427	0	1
<b>Compared this time</b>	334	.087	.282	0	1
<b>Lives on campus</b>	334	.811	.392	0	1
<b>Faculty</b>	334	.144	.351	0	1
<b>Staff</b>	334	.018	.133	0	1
<b>Student</b>	334	.811	.392	0	1
<b>Visitor</b>	334	.027	.162	0	1
<b>English language</b>	333	.195	.397	0	1
<b>Kazakh language</b>	333	.18	.385	0	1
<b>Russian language</b>	333	.625	.485	0	1
<b>Female</b>	334	.446	.498	0	1
<b>Phone Recalls</b>	334	.392	.489	0	1
<b>Second Time</b>	334	.039	.194	0	1
<b>Final Recalls</b>	334	.551	.498	0	1
<b>Language</b>	333	2.429	.798	1	3
<b>Occupation</b>	334	1.386	.83	1	4
<b>Grocery</b>	334	.506	.501	0	1
<b>Income</b>	333	565915.92	634394.8	50000	2000000

We collected data from consumers at the Nazarbayev University Campus with a sample size of 334 people. We have collected 169 responses from grocery stores and 165

from coffee shops. The distribution among the stores or coffee shops was also somewhat equally represented, with every location with at least 40 responses acquired. Precisely, among coffee shops, Daily Cup has 45 people, while Drinkit, Espresso Day, and HP all have 40 responses. As for the grocery stores, Magnum has 41 people, Ex-Vesna has 48 people, and Ailin and 24th Block both have 40 responses. Overall, out of 334 respondents, 184 people perfectly recalled the prices of the products they had just bought either in coffee shops or regular stores on the campus. It is also important to note that out of 150 people, 93 initially claimed to remember the price; however, after double-checking, we found that the price they named was incorrect.

Regarding gender, we have an almost perfectly equal distribution of Male and Female populations, resulting in 53% and 47%, respectively. As for occupation, the distribution was not equal, yet it replicates the whole population of the university since 272 of our respondents are students, 47 are faculty, 6 are staff, and 9 are visitors. Lastly, income distribution was very diverse, with 17 people having an income from 0 to 50000 tenge per month, with 57 people having around 100000 tenge, with 55 people around 200000 tenge, with 54 people around 300000 tenge, with 83 having 500000 tenge, with 16 having 700000 tenge, and 51 people with over 2000000 tenge per month.

## **Individual Effects of Each Factor**

### **Demographic Variables**

Initially, we focused on the effect of demographic variables on our whole dataset. We specifically wanted to look at how income, age, accommodation on campus, occupation, preferred language, and gender affect the price recall rates of our respondents.

The first variable we focused on was our respondents' income, which had a significant negative effect on their price recall. Logistic regression has shown that the higher the income, the lower the ability to remember the price of the product the consumer has just bought.

### **Effect of Income on Price Recall**

In our analysis, we can see the significant effect of income with a negative coefficient on price recall; however, it is only significant at a 10% level. However, if we

exclude the responses of 9 visitors from the regression (whose income was misrepresentative of the NU Campus), then the effect would be strong even at the 5% level of significance with p-value of 0.040. Overall, this finding suggests that price recall is lower among higher-income respondents, especially among faculty members, whose income is considerably higher compared to students. When analyzed for income within the occupation groups like students or faculty, the variable was not significant, meaning that there is little variation in terms of income and price recall within the groups, but there is a strong correlation between the groups. Within our dataset, the distribution by income among students was in the range from 50 thousand tenge per month and 700 thousand tenge per month, while faculty members had 2 million tenge per month. This way, we found that the higher the income, the less likely the respondent would recall. This could be explained by the fact that people with higher salaries have low price sensitivity or price salience which is why they do not need to care much for prices. This result agrees with the general assumption that lower income consumers may be more sensitive to the prices, and therefore have a better recall. It aligns with the findings of Rosa-Diaz (2002) that suggest that consumers with a lower income have a significantly higher accuracy of price recall.

Another demographic variable that showed significance on price recall rates was Faculty. Precisely, we have separated the occupation variable into 4 binary variables: Students, Staff, Faculty, and Visitors. We have found that when we check only for Faculty, it shows a significantly negative impact on price recall.

### **Effect of Payment Method on Price Recall**

In the questionnaire, we asked respondents a question regarding their method of payment: card, cash, or mobile application (QR) with a purpose to analyze and conclude its possible influence on price recall abilities. We found this effect, however, the extent of this influence is different in each group regarding the status on Campus. To start with, among students, card payment had a significant negative effect on price recall ability ( $\beta = -0.703$ ,  $p = 0.010$ ). This means that students who paid by card were less likely to remember the prices of their purchases compared to those students who paid via mobile application (QR). We can explain this result by pointing to the possibility that mobile payment apps create a higher degree of attentiveness, as users are actively looking at the total cost during the

transaction, while card payments can be made with little focus on the amount shown on the bank terminal. However, when we analyzed other groups regarding the status on Campus, this effect disappeared completely. For staff, despite the coefficient being technically large, the small sample size ( $N = 6$ ) prevents any possibility of statistically meaningful interpretation. As for faculty and visitors, the results turned out to be insignificant ( $p = 0.959$  and  $p = 0.765$ , respectively). This finding shows that the effect of payment method varies by status on Campus and is significant only among students. This result strengthens our previous argument: price recall is influenced not just by behavioral or cognitive factors but also by the consumer's socioeconomic context. Due to their greater sensitivity to price, students are more likely to carefully process the cost of a transaction - particularly when the payment method shows the amount of money involved. On the contrary, among higher-income groups such as faculty and staff, the payment method seems to hold no significance. This is likely due to the fact that price information is usually not prioritized, regardless of the means by which the transaction is finalized.

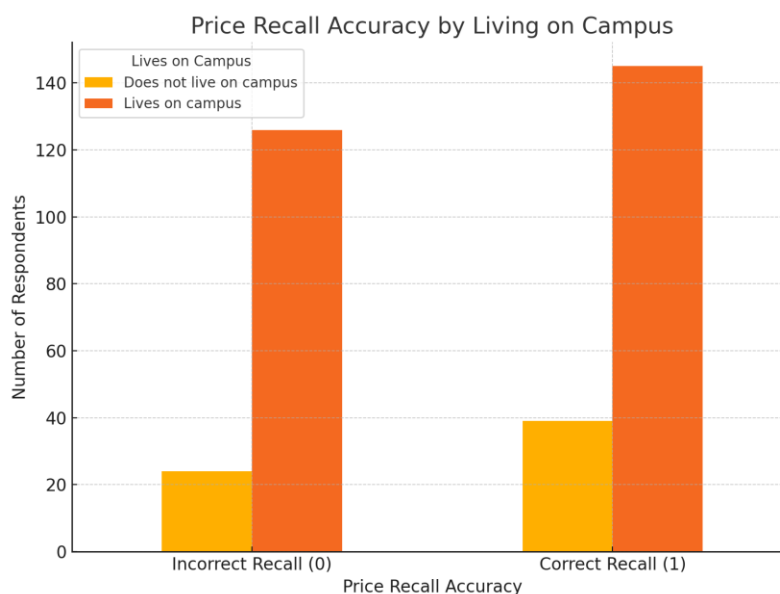
### **Effect of Faculty on Price Recall**

Overall, this finding suggests that Faculty, on average, are less likely to remember the prices of the products. But we need to consider that being Faculty in itself should not affect the recall abilities, instead, it is the association of Faculty with significantly higher incomes, age, and preferred language. Since, out of the demographic variables, only income is significant, we can say that Faculty variable is significant only due to association with higher salaries. This is also supported by the overlap effect when both variables are within the model, as both of them become insignificant.

In our dataset, Income, Higher Age, and Preferred English Language all describe one category of people, which are Faculty members. Precisely, in the context of Nazarbayev University, faculty members have considerably high salaries, they are mostly older than 30, and for them, the most convenient language is English. Therefore, there is a strong overlap between these variables, meaning that if all are added to the model, they are insignificant. For instance, *Age* and *English Language* do not show any significant results, but both are very close to being significant at a 10% level ( $p = 0.102$  and  $p = 0.126$  respectively). Such difference compared to income was probably due to the English-

speaking students who had better recall improving the recall among those who chose English as their main language. The effect of age was not as strong because of a very strong representation of students in the age category from 20 to 24, which is the majority of the sample. Other demographic factors like living on the territory of Campus were found to be insignificant.

**Figure 2. Price Recall among people living on and off Campus**



As Figure 4 shows, the result was insignificant due to the somewhat equal distribution of people recalling and not recalling the price despite the accommodation.

### Shopping Behavior Factors

The second group of variables that we are focusing on are the shopping behavior factors, which mostly demonstrate the attitudes and priorities of people towards shopping. Individually, among these factors, we found that spending effort to find the best price, checking the prices, and prioritizing price, quality, and convenience significantly impact the price recall of our respondents.

We examined the effect of spending effort to find the best price on price recall. Precisely, respondents were asked on a 5-point Likert scale towards the statement “I am ready to spend my time and effort to find the best price”. We found that the result is very significant with  $p=0.026$ , meaning that the more people are ready to spend effort, the better

the recall of the respondents. This is a logical conclusion considering that when people are actively searching and thinking about the best prices, they would be more likely to recall and to know them in general. It also proves the notion given by Mazumdar and Monroe (1992) and Rosa-Diaz (2002) that consumer behavior is one of the most important determinants of price recall between consumers. However, there is also a discrepancy, since such results were only significant for students, for faculty, staff and visitors the results were not significant. For the last two groups, we can not make any inferences since their representation within the sample is very low (6 and 9, respectively). However, when it comes to Faculty, it is logical to assume that buyers with such incomes would have low price sensitivities; hence, they do not need to engage in such methods as finding the best prices, which is why their recall is independent of the statement. The distribution in agreement with the statement was very stable, with 16 people disagreeing, 16 staying neutral, and 16 agreeing. This could be explained by the fact that for high-income respondents, the effort for prices is less popular and overall less impactful on actual recall. Additionally, we have found that this variable correlates more with men than women. When checked only for men, the p-value is 0.051, while when checked for women, the p-value is 0.246. We mostly believe that this is a random and a coincidental finding that does not replicate the actual situation, though we also consider that maybe overall female respondents were more likely to agree with our questions.

Another variable in consumer behavior that showed a significant effect on price recall consistently is the behavior of checking prices regularly. When we tested this variable across the entire sample, the results indicated a strong and statistically significant association between this variable and price recall abilities (Coefficient = 0.473,  $p = 0.000$ , 95% CI: [0.2268, 0.7194]). This indicates that consumers who actively check and track the prices of products are much more likely to recall the prices correctly. Nevertheless, subgroup analysis revealed a more detailed perspective. Upon gender-based division of the sample, the influence of price checking was found to be significant exclusively among male respondents (Coefficient = 0.666,  $p = 0.000$ , 95% CI: [0.3175, 1.0144]). In contrast, for female respondents, this effect is not statistically significant (Coefficient = 0.267,  $p = 0.139$ ). This shows that in the current dataset, the behavior of checking prices regularly is linked to better recall among men than among women. Further analysis across different

groups based on the status on Campus also revealed additional insights. For students, checking prices regularly continued to show high significance (Coefficient = 0.469,  $p = 0.001$ ), reinforcing the idea that within this respondent demographic, active price-conscious behavior is a significant factor in price recall. It is also noteworthy that for faculty, the effect was only marginally significant (Coefficient = 0.555,  $p = 0.105$ ), yet it suggests a potential trend. The results for staff and visitors were inconclusive because of very small sample sizes or perfect prediction cases, which resulted in omitted variables or models that could not be interpreted.

Additionally, we tested whether the significance of regularly checking the prices remained after controlling for other behavioral factors such as planning shopping beforehand and comparing prices between different brands. Even when controlling for those, checking prices regularly retained its statistical significance (Coefficient = 0.393,  $p = 0.003$ ), while the others remained statistically insignificant. This strengthens the finding that independent of other behavioral patterns, consumers who regularly check prices have significantly stronger price recall abilities. Interestingly, in the most complex model that included control variables such as spending effort to find the best price and value, planning shopping beforehand, checking prices regularly, and comparing prices between different brands, only checking prices regularly was statistically significant, demonstrating the strongest statistical effect. This supports the idea that direct price engagement (such as checking prices) is the most effective way to enhance price recall abilities, rather than relying on indirect behavioral attitudes or pre-shopping plans.

Up to this point, the analysis has yielded several noteworthy results, but one of the most significant relates to shop priorities: consumers' claims that they place greater importance on quality and price when making shopping choices. Logistic regression analysis of the complete sample indicates that `shop_price` and `shop_quality` are both significantly linked to improved price recall abilities. The coefficient of priority on price is 1.27 ( $p = 0.001$ ), while for priority on quality, it is 0.81 ( $p = 0.002$ ). The results indicate that those consumers who place a higher priority on price and quality when shopping are more inclined to recall the prices of their purchases. This corresponds with the intuition that consumers who pay more attention to value and product features are also more cognitively involved in the transaction, thereby improving price recall abilities. The

dynamics of these priorities, however, shift substantially across various gender and occupation subgroups. The effect intensifies and becomes more pronounced when only female respondents are analyzed. Among females, the coefficient of priority for price is 2.81 ( $p = 0.009$ ), and of priority for quality is 1.54 ( $p < 0.001$ ), indicating a highly significant effect on price recall ability. These effects are not only statistically sound, but they also show a magnitude that is considerably greater than that of the full sample. In contrast, for male respondents, the impact of priority on price is only marginally significant ( $p = 0.092$ ), and priority on quality is entirely insignificant ( $p = 0.796$ ). This indicates that men's price recall ability is less influenced by quality considerations and that the role of price prioritization is more limited compared to women.

Regressions specific to status on Campus show comparable features. For students, the importance of price and quality priorities is underscored by coefficients of 1.20 ( $p = 0.004$ ) for priority on price and 0.99 ( $p = 0.001$ ) for priority on quality. This suggests that students who are more aware of price and quality show superior price recall abilities. These findings are especially noteworthy considering that students typically function under stricter budget constraints and thus demonstrate greater price sensitivity, which may play a role in their alertness regarding product prices. However, the results for faculty members are significantly different. While the coefficient for priority on price is marginally significant ( $p = 0.098$ ), priority on quality is statistically insignificant ( $p = 0.835$ ). This reflects previous patterns, indicating that faculty's price recall may not be closely linked to shopping behavior or product assessment, but rather impacted by elements like income levels or heuristics derived from general value impressions instead of careful price observation. For staff and visitors, the regression results were either excluded due to collinearity or indicated no significance, primarily because of the small sample sizes in these subgroups. This limited statistical power hinders the ability to draw solid conclusions about these specific groups. As for looking at several variables at once, another intriguing pattern comes to light. A suppression effect becomes evident when priority on price and priority on quality are combined in a single model. With the inclusion of extra controls like priority on convenience or demographic factors, certain variables that were significant before may lose their significance and vice versa. For example, when priority on convenience and priority on price are both included in the model, priority on price

approaches significance ( $p = 0.077$ ), suggesting that some of the cognitive engagement linked to price may overlap with or be confused with convenience-oriented shopping. When priority on quality is included in the model, priority on price reestablishes its statistical significance ( $p = 0.013$ ), and priority on quality approaches significance ( $p = 0.054$ ). In this context, the effect of priority on convenience becomes completely insignificant ( $p = 0.559$ ). These results indicate that there may be a mediating or competitive relationship between these variables, where the explanatory power of one may conceal or enhance that of the other, depending on the structure of the model.

Another consistent and significant finding resulted in the analysis of shopping priorities, especially the role of convenience. The regression of the dependent variable of recalling the price on the independent variable priority on convenience for the entire sample yielded a coefficient of  $-0.75$  ( $p = 0.001$ ), signifying a considerable negative association. This means that people who indicated that they place a high priority on shopping convenience tend to have less accurate price recollections. This result underscores that a convenience-driven mindset may indicate lower attention to prices, potentially due to reduced effort in price comparison or diminished price sensitivity. The sample was further confirmed to exhibit this effect when it was segmented by gender. The coefficient among females was  $-1.43$  ( $p < 0.001$ ), indicating an even more pronounced negative correlation between priority on convenience and price recall. This implies that for the women in the sample, prioritizing convenience over other aspects of shopping leads to a significant reduction in price recall ability. Conversely, the same regression analysis for males produced a non-significant outcome (coefficient =  $-0.24$ ,  $p = 0.411$ ), suggesting that convenience does not significantly influence price recall abilities among men. These results suggest that the connection between shopping convenience and price attention differs by gender, with female respondents being the primary influence.

Further analysis by status on Campus shows that this significant effect is primarily driven by students. Among students, the coefficient for priority on convenience was  $-0.87$  ( $p = 0.001$ ), which also suggests a strong negative effect. However, among staff, faculty, and visitors, the coefficient is not significant, indicating that the convenience-priority factor primarily impacts students regarding their price recall behavior. It is noteworthy that when several priorities were included as control variables in the same model - for example,

priority on convenience, priority on price, and priority on quality - the coefficient for priority on convenience lost its significance ( $p = 0.559$ ). In contrast, the variables of priority on price ( $p = 0.013$ ) and priority on quality ( $p = 0.054$ ) became significant. This outcome demonstrates that the distinct influence of convenience decreases when other shopping preferences are taken into consideration. It also implies that individuals who place a high priority on convenience may differ in other underlying preferences (for instance, they might be less influenced by price or quality), complicating the task of isolating the convenience effect without accounting for other priorities.

### **Contextual Factors**

Another significant discovery based on our dataset relates to the variable of hour, which represents the time of day when the consumer made their purchase. The outcome of a logistic regression that includes only this variable indicates a significant negative influence on price recall ability (Coef =  $-0.0832$ ,  $p = 0.010$ ). This means that the later in the day a consumer makes a purchase, the less likely they are to remember the item's price. Cognitive fatigue might offer a possible explanation - shoppers later in the day could be less focused or mentally alert, which may decrease their attention to prices. Now, when we divided the analysis by gender, the results suggested some interesting insights. For example, the variable of hour is still statistically significant for males (Coef =  $-0.0794$ ,  $p = 0.065$ ), although at the 10% level. This suggests that men's ability to recall prices worsens throughout the day. Among females, the effect is less significant (Coef =  $-0.0882$ ,  $p = 0.076$ ) and slightly exceeds conventional significance thresholds, but remains suggestive. Therefore, the trend is evident among females as well, though it is somewhat less strong. In general, the negative correlation between time and price recall seems to be more evident in males compared with females. We may link it to variations in shopping patterns or energy levels during the day.

Further breakdown by status on Campus also reveals interesting dynamics. In the group of students, the effect continues to be statistically significant (Coef =  $-0.0829$ ,  $p = 0.020$ ), reinforcing the general finding that later purchase hours decrease the probability of successful price recall. As for staff and faculty, the effect is not statistically significant, which we may attribute to smaller sample sizes or differing behavioral patterns. Regarding

the impact on visitors, it is negative and insignificant (Coef = -0.358,  $p = 0.279$ ), likely due to low statistical power as there are only 9 respondents in that subgroup. The results indicate that the timing of a purchase is a more dependable predictor of recall for students, possibly due to their cognitive loads related to their schedules or the fluctuations in their attention spans throughout the day. In contrast, for faculty and staff, price recall seems to be less affected by time. This may be attributed to their lower sensitivity to price on average or their more stable levels of attention.

The variable of asking a second time, indicating whether the respondent was participating in the experiment for a second time, also shows no statistical significance ( $p = 0.634$ ). With a value of 0.276, the coefficient indicates a slight directional trend suggesting that repeated participation may lead to improved recall. However, this effect is probably attributable to chance. It seems that previous exposure to the experiment does not significantly improve price recall ability, probably due to the fact that price recall is difficult regardless of familiarity.

As for the variable of phone battery percentage, we took it into consideration to differentiate whether consumers' inability to recall prices was due to cognitive limitations (such as memory constraints) or merely a lack of attentiveness or interest in prices. This variable measured respondents' ability to recall the percentage of their mobile phone battery charge, which is a straightforward and neutral detail that served as an indicator of general memory function. However, the results of the regression analysis show that there is no statistically significant correlation between phone battery percentage recalls and price recall accuracy ( $p = 0.388$ ).

Figure 3. Finalized Regression

	(1)	(2)	(3)	(4)
	Demographics	Shopping Behavior	Contextual Factors	Locations
Income	-0.000000 346	-0.000000205	0.000000142	0.000000235
	(0.000000380)	(0.000000407)	(0.000000439)	(0.000000667)
Female	-0.0272	-0.0232	-0.140	-0.171
	(0.226)	(0.243)	(0.261)	(0.276)
Age	0.00273	-0.00214	0.0221	0.0259
	(0.0322)	(0.0343)	(0.0366)	(0.0402)
Lives on Campus	-0.273	-0.305	-0.0580	0.0482
	(0.295)	(0.320)	(0.344)	(0.369)
Time and Effort		0.0360	0.0331	0.0178
		(0.132)	(0.141)	(0.146)
Check Prices		0.391***	0.545***	0.570***
		(0.143)	(0.157)	(0.166)
Plans Before		0.264	0.461	0.494
		(0.278)	(0.307)	(0.327)
Compare Prices		0.306	0.0346	0.107
		(0.314)	(0.338)	(0.355)
Price Priority		0.911*	1.231**	1.149**
		(0.473)	(0.522)	(0.553)
Quality Priority		0.546	0.629	0.388
		(0.363)	(0.392)	(0.439)

Convenience Priority	-0.190 (0.333)	-0.0777 (0.361)	-0.108 (0.373)
Number of Items		-0.609*** (0.127)	-0.613*** (0.136)
second_time		0.189 (0.640)	0.182 (0.662)
Hour		-0.0178 (0.0380)	0.00119 (0.0426)
Card		-0.647** (0.284)	-0.655** (0.292)
Phone Charge		0.0785 (0.265)	0.0680 (0.278)
24th Block			-0.780 (0.610)
Ailin			-1.480** (0.648)
Magnum			-0.518 (0.608)
Ex-Vesna			-1.132 (0.993)
Daily Cup			-0.551 (0.569)
Drinkit			-1.129** (0.557)
Espresso day			-1.249** (0.559)

<b>Constant</b>	0.551	-0.999	-0.881	-0.473
	(0.722)	(0.929)	(1.156)	(1.308)
<b>Observations</b>	331	330	330	329

In the finalized regression, we can see that overall, all of the demographic variables become insignificant when controlled for each other. There could be an overlap effect between income and age since both of them predict the same group of people. When age is removed from the regression, the income becomes significant at a 10% level of significance with a p-value of 0.070. Gender and accommodation on campus were insignificant initially and now in the complete model as well. The effect of demographic variables further becomes less significant when other variables are added. Therefore, it could be concluded that for the whole sample, we reject the hypothesis that demographic variables play a significant role on price recall, instead, we should focus on other hypotheses.

Assessing the shopping behavior of our respondents, we may notice how most of the proactive behaviors are insignificant compared to checking the prices to make sure they get the best value and prioritizing prices while shopping. Regarding the first, we had a statement “I always check prices to make sure I get the best value for the money I spend”, and we asked the respondents how much they agreed with the statement. The regression shows that even within the final models, the variables stay significant, suggesting that agreement with the statement strongly correlates with better price recall abilities of our consumers. The same goes for prioritizing the price, which stayed significant for the finalized model. Though not every proactive behavior stayed significant, we may conclude that overall constantly thinking about prices or prioritization of those lead to better recall, which means that we accept the second hypothesis.

Among the contextual factors, we may see that the number of items remains significant throughout all of the models, meaning that purchasing multiple products had an enormous impact on the price recall abilities of our consumers. The same goes for the Card variable, which holds that people using cards are worse at price recall. Other contextual factors were not significant, and therefore, we can say that the hypothesis about contextual factors is partially correct.

The last model focused on the locations themselves and here we can see interesting results as some of the locations remain significant. Precisely, we may notice that shopping at Ailin, Espresso Day, and Drinkit considerably reduces the chances of recall among our respondents. The issue with Ailin that we noticed is that at the time of our data collection this store did not have price tags for the majority of the products. This is why we suspect that people were not exposed to prices very much, hence why the recall is poorer. The issue with Espresso Day is that most of our responses were collected in the evenings when people are more fatigued, which explains the poorer recall. Additionally, Espresso Day has discounts in the evenings when prices change to more complex price tags, which is why the recall is worse. Lastly, the surprising finding is that Drinkit also has a worse recall. The reason why it is very surprising is that everyone shops at this coffee shop using their mobile app where people are constantly exposed to prices. However, our regression shows that people have worse recall within this coffee shop, which is probably an accidental result.

## **Recommendations**

In this research, we have researched and analyzed limited memory on the Campus of Nazarbayev University. We have found that, first of all, it exists, and it does so in various degrees across different demographic groups, which we categorized by age, gender, income level, status on Campus, and the language that they used the most on a daily basis. The first instinct could be a policy that sets one price for the product in every grocery store or coffee shop but this action would actually bring more harm to the purchasing ability of consumers and the economy as a result. To explain it simply, people with higher income levels buying a product at a higher price (due to not enough effort or limited memory) give the opportunity to the people with lower income levels to buy the same product for a lower price, balancing out in the end. If, for example, we recommended price regulation to set one price for the product, this price would have to be higher than the price that the people with lower income are buying the product now. This action, as a result, would deprive those people of an opportunity to buy that product. Thus, our recommendation is to leave the prices as they are now, without any price regulation or other policies, as the current condition of the market lets people with all income levels buy the product. In the end, the welfare trade-off remains in the economy, letting it maintain its present condition and develop further.

## **Limitations**

As in many research papers, there are some limitations to our research, too. The first limitation exists in the fact that the research itself focused on the Campus only. Even though the Campus provides different demographic variables, which makes it suitable for research, it does not reach the diversity level of a bigger research location. So, whether the results can be applied to the broader area - city, for example, is a debatable issue. Another limitation is the guessing probability of respondents during the questionnaire. The guessing probability refers to the respondents saying the right price of the product but not through recalling, only with guessing. We view recalling and guessing the price as different methods of answering the question, where the latter infiltrates into the responses and may affect the findings of the paper. Moreover, this research did not cover external factors such as inflation in the country, a possible change in the salary of individual consumers, and

seasonal variations. For instance, inflation, which means a change in the price of the product, could affect the recall ability in both positive and negative ways. Since the price increases, consumers may recall it better as it becomes more costly for them to purchase that product. On the other hand, if there is a recent change in the price, consumers may not memorize it solidly, lowering their price recall ability. The change in the salary of a consumer, in turn, could also affect the price recall ability in both ways. If the salary increases, it becomes less costly for the consumer to buy this product, which can impact the price recall ability negatively. Similarly, if the salary decreases, purchasing the product becomes more costly for the consumer, putting more pressure on them and thus, influencing their price recall ability in a positive way. Seasonal variations, in turn, mean shifts in the trend of buying different products in different periods of time. For example, during summer, cold beverages become more popular among consumers, and those seasonal variations create more complexity to the research. These aforementioned limitations pose a challenge and opportunity for further research in this field of study. In the future, solving and operating these limitations can add up to a deeper analysis of this topic.

### **Conclusion**

This study has focused on the investigation of the effect of numerous variables on the price recall abilities of consumers of Nazarbayev University in the grocery stores and coffee shops located on Campus territory. Our findings illustrate that price recall is dependent on many factors including demographic, shopping behavior patterns and contextual factors. However, when we added all of our variables in the final model, we find that demographic variables are not very significant compared to shopping behavior and contextual variables. The whole focus has shifted to these variables and their effect on the price recall ability. Overall, the study finds that the perfect recaller of prices is someone with lower purchasing power compared to Faculty, who actively engages in checking the prices of the products, shopping with the QR System/Mobile App, preferably shopping at places with price tags or overall more exposure to them. These insights significantly enhance the broader literature on consumer behavior by demonstrating how real-world

environments - such as a university campus - provide unique opportunities to observe and comprehend price recall abilities and price dispersion.

These findings have practical implications in addition to their academic value. Store owners and marketers may be encouraged to adopt more transparent and consistent pricing strategies if they understand that consumers often forget prices. For consumers and policymakers, acknowledging the cognitive limits in everyday transactions underscores the significance of tools such as digital receipts or price comparison apps to aid in making better-informed purchasing decisions. Finally, although our data set was strong, future studies could be enhanced by longitudinal research or experiments that clarify causality with greater precision. To investigate whether digital settings lessen or heighten price memory limitations, the scope could also include off-campus or online purchases. This research paper provides valuable insights into consumer behavior within a specific context and opens up new opportunities and directions for further investigation into how limited memory influences market dynamics.

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## Appendix

### Questionnaire

Dear Participant,

Thank you for participating in our survey on price recall on campus. Your insights will help us to understand the shopping behavior among students. Remember that this survey is:

- 1) Anonymous
- 2) Your data will not identify you
- 3) The results of this survey will be published at the library of the Nazarbayev University
- 4) You can withdraw at any time during the survey
- 5) You can object to answer certain questions if you feel uncomfortable

Where are we? (shops)

- *Ailin*
- *Magnum*
- *Ex Vesna*
- *24th Block*

Where are we? (coffee shops)

- *Daily Cup*
- *Drinkit*
- *HP*
- *Espresso Day*

1. How many items did you buy? (approximate)

- *Your answer*

2. You paid with what?

- *Card*
- *Cash*

- *QR/Mobile app*

3. Could you recall the exact price of a particular item?

- *Yes*
- *No*

(If yes) What's the item? (Full name of the product)

- *Your answer*

(If yes) What's the price?

- *Your answer*

(If yes, check later) Was the respondent right?

- *Yes*
- *No*
- *Other: \_\_\_\_\_*

The original price was

- *Your answer*

What do you prioritize in the shop selection?

- *Quality*
- *Price*
- *Convenience*
- *Variety*
- *Other: \_\_\_\_\_*

How frequently do you shop on campus? (on average)

- *Multiple times a day*
- *Once a day*
- *Multiple times a wekk*

- *Once a week*
- *Once a month*
- *Never, only on this occasion*

Where do you shop most frequently? (Shops)

- *Magnum*
- *Ailin*
- *Ex-Vesna*
- *24th Block*

Where do you shop most frequently? (Cofee shops)

- *Daily Cup*
- *Drinkit*
- *Tapioka*
- *HP*
- *Espresso Day*

Why do you prefer this shop?

- *Quality of products*
- *Variety of products*
- *Convenience*
- *Habit*
- *Price*
- *Other: \_\_\_\_\_*

Do you plan before shopping on Campus?

- *Yes*
- *No*

(If yes) At campus, I compare prices in multiple places.

- *Yes*
- *No*

I'm ready to spend my time and effort to find the best price.

- *Strongly disagree*
- *Disagree*
- *Neutral*
- *Agree*
- *Strongly agree*

I always check prices at the grocery store to be sure I get the best value for the money I spend.

- *Strongly disagree*
- *Disagree*
- *Neutral*
- *Agree*
- *Strongly agree*

I compared prices between brands/coffee shops this time.

- *Yes*
- *No*

Do you currently live on campus?

- *Yes*
- *No*

Who are you?

- *Student*
- *Staff*
- *Faculty*
- *Visitor*

How old are you?

- Your answer

What language do you use most?

- *Russian*
- *Kazakh*
- *English*

Gender

- *Male*
- *Female*
- *Other*

What's your income?

- *0 - 50 000 KZT*
- *50 000 - 100 000 KZT*
- *100 001 - 200 000 KZT*
- *200 001 - 300 000 KZT*
- *300 001 - 500 000 KZT*
- *More than 500 000 KZT*
- *Prefer not to say*

Can you recall the exact percentage of charge that you have on your phone right now without looking at your phone? (margin of error 5%)

- *No*
- *Remembers within Margin*
- *Remembers exactly*

It was the second time asking

- *Yes*

-  
**Dear Participant,**

Thank you for taking the time to complete this survey and contribute to the knowledge of consumer behavior on campus. Your responses will be analyzed to identify patterns and trends among the consumers.