Inflation Expectations of Households and the Upgrading Channel

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Abstract

This paper combines several administrative data and a survey experiment to evaluate the role of lifestyle changes in influencing inflation expectations. Using data from Nielsen's Homescan Panel, as well as a leading bank in Singapore, we first document that households are upgrading across categories and within categories of goods. We then use a survey experiment to show that price information of better-quality products will lead to higher inflation expectations. The effects on inflation expectations are smaller when the price information of both higher and lower quality products is made available, implying that increasing product variety of lower quality products reduced inflation expectations. Frequent shoppers tend to allocate more weight on higher quality goods when forming inflation expectations. These results suggest that exposure to better quality goods plays an important role in the formation of inflation expectations. Moreover, we map the personal shopping experience with our survey at the group level and find a positive relationship between the increase in quality of supermarket shopping and inflation expectations. Our findings highlight the relationship between personal experience, product variety and inflation expectations.

Keywords: Inflation Expectations, Personal Experience, Upgrading, Product Variety, Survey Experiment
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1. Introduction

Inflation expectations of households are crucial for the analysis of monetary policy and business cycles (Yellen (2016)). An increase in inflation expectation with a constant nominal interest rate will decrease the perception of real interest rate, inducing an increase in consumption. This is particularly relevant in a low interest rate environment (Bernanke (2020)). Recent studies have identified several factors that could influence inflation expectations of households. These include the priors and perceptions of inflation, shopping experience, media as well as understanding of economic policies (Coibion, Gorodnichenko, Kumar and Pedemonte (2018)).

In this paper, we focus on the personal experiences of households and study how changes in the lifestyle of households could influence inflation expectations through several administrative data and a survey experiment. Much work has identified consumers' personal experiences as a key driver for households' inflation expectations (Bruin, Klaauw and Topa (2011), Malmendier and Nagel (2015), D'Acunto, Malmendier, Ospina and Weber (2019)). We take a complementary approach to the existing work by focusing on a specific reason that drives inflation expectations: the upgrading channel. For the same product category, households could shift their spending to brands of higher quality. Consequently, this result in higher inflation expectations as households upgrade or aspire to upgrade to better quality goods.

Lifestyle changes, together with economic development for the past decades have contributed to changing baskets of goods for consumers. Moreover, items that were not previously available (such as smartphones) are now considered as necessities for many households. As standard of living increases for the median household, exposure to better quality goods could affect inflation rate and the formation of inflation expectations. Existing literature have documented the effect of quality change on household's inflation rate (Bils and Klenow (2001), Argente and Lee (2016), Kaplan and Schulhifer-Wohl (2017)). Our paper seeks to study the effect of quality change on household's inflation expectations, rather than actual inflation rate.

To test the upgrading channel, we use a unique combination of a proprietary credit card data from a leading bank in Singapore, Nielsen's Homescan Panel, as well as a survey experiment that we conducted. We first establish the presence of upgrading in Singapore through the study of household's choice of goods across different categories of goods. From the credit card data set, we find that households in the first quintile increased their spending in entertainment by 20 percent, while households in the second quintile increased their spending in watches and jewelry by 14 percent from 2011 to 2016. This suggests that *across categories* of goods, households upgrade themselves and purchase more luxury products.

We then focus on households' choice of brands within a specific category, supermarkets. Recent studies have highlighted the influence of grocery shopping on inflation expectations (D'Acunto, Malmendier, Ospina and Weber (2019)). We build on their work to show that changes in the quality of goods matters. Using Nielsen's Homescan Panel between 2016 to 2017, we introduce a Household Quality Index by tracking changes in the brands of goods purchased by households in Singapore. The index is created by grouping the brands for each category of goods into 10 different deciles based on the average price per weight. Similar to Jaimovich, Rebelo and Wong (2019), the underlying assumption is that consumers will be willing to pay more for similar products if they perceive the good to be of a higher quality. We then compute the monthly Household Quality Index by taking the average quality of all the goods purchased by individual households. Our results show that there is a strong inclination for households in Singapore to upgrade to better quality goods across time. Overall, there is an increase in the Household Quality Index by 3 percent, suggesting that households have moved from lower bins to higher bins in terms of quality of goods consumed. This increase in Household Quality Index is robust across all demographics.

A personal interview survey with randomly selected individuals across Singapore was conducted from March to June 2019. Our sample is representative of the population in Singapore. We have 1036 individuals across all age groups (above 21 years old). On average, the next 12-months Inflation Expectation (pre-treatment) was 7.45% and past 12-months Inflation Perception (pre-treatment) was 8.57% which differ significantly from the actual inflation rate of 0.4% in 2018. The large gap of inflation expectations with reality is consistent with the Singapore Index of Inflation Expectations (Ghosh and Yu, 2011).

In studying inflation expectations and perceptions, we find that knowledge plays an important role. Households with financial literacy on inflation and with tertiary education report lower inflation expectations and perceptions. This is expected as these households are more informed about inflation and are in line with the literature on cognitive abilities (Armantier, Bruine de

Bruin, Topa, Van Der Klaauw, and Zafar (2015)). There is also suggestive evidence that both past experiences and expectations about the future matters. We find that females have higher inflation expectations and perceptions which is consistent with studies about how gender roles influenced women's outlook (D'Acunto, Malmendier and Weber (2019)). In addition, there is a strong correlation between the expected increase in spending and inflation expectations. This is not driven by the expected increase in income. Finally, households that stay in public housing report higher inflation expectations and perceptions. Upgrading from public housing to private housing is one of the aspirations of most Singaporeans (Tan (2015)) and highlights the importance of future goals in shaping inflation expectations.

To show how the upgrading channel has a causal impact on inflation expectations, we design a field experiment within our survey to evaluate how households react to different information about price changes (of different goods) in Singapore. We follow the experimental set-up used in studies such as Armantier, Nelson, Topa, Van Der Klaauw, and Zafar (2016), Cavallo, Cruces and Perez-Truglia (2017), as well as Coibion, Gorodnichenko and Weber (2019). By providing randomized information treatment about prices of different types of goods to a representative sample of households in Singapore, we seek to examine how it could influence their expectations. Specifically, we provided price changes of 2 different brands of ice-cream (Walls and Häagen-Dazs) in 2009 and 2019 in this survey experiment. While Häagen-Dazs is much more expensive (and arguably a better-quality good) vis-à-vis Walls, both prices have increased by around 20% during this time period. We provide the price of Walls in 2009 for all samples and vary the price information of higher and lower quality products in 2019 in three different treatment groups. For Treatment 1 (T1), we only provide the price of the lower quality product, Walls, in 2019. For Treatment 2 (T2), we only provide the price of the higher quality product, Häagen-Dazs, in 2019. For Treatment 3 (T3), we provide the price of both the lower and higher quality products, Walls and Häagen-Dazs, in 2019. The main difference between the treatment groups is the availability of price information from higher and lower quality products in 2019.

The experimental design is centered on how households react to different price changes. By comparing T2 with T1, we find that exposure of better-quality goods will lead to higher inflation expectations if the current price information of the lower quality goods is not available. When comparing T3 with T1, we also find that exposure of both higher and lower quality goods will lead to higher inflation expectations but in a smaller magnitude. Our comparison of T2 with T3 shows that if households are given current price information of both higher quality and lower quality good, the effect on inflation expectations is significantly lower. It implies that increasing product availability (of the lower quality product) will reduce inflation expectations. To quantify the extent that inflation expectations are affected by the price of higher quality product, we compute an upgrading parameter, alpha. This is defined as the ratio between the difference of T3 and T1, as well as T2 and T1. Our results show that households allocate 32 percent of weight on the price information of higher price product when forming their inflation expectations.

We present two pieces of evidence to test the hypothesis of the upgrading channel. Firstly, we find heterogeneity on how different households update their inflation expectations based on the information treatment. Frequent shoppers tend to form their inflation expectations by allocating more weight on the higher quality product when they are given current price information of both the higher quality and lower quality goods. As these groups of households are more likely to have a higher standard of living and have the largest propensity to upgrade to better quality goods, the heterogeneous updating suggests that personal experience (of consuming better-quality goods) is an important factor that affects inflation expectation. As they consume a better-quality product in their daily lives, they place more emphasis on it when forming their inflation expectations.

Secondly, to underscore the importance of household's actual shopping experiences, we map the Household Quality Index from the Nielsen Homescan Panel with our survey at the group level. We classify households into the same group if they have the same characteristics in the following dimensions: Household Income, Postal Code, Household Size, Race and Frequency of Shopping. We assume that households in Nielsen Homescan Panel and our survey are representative to the households in each group. We find that there is a positive relationship between the increase in Household Quality Index across time (defined as Upgrading Index) and inflation expectations. This suggests that households that have experienced upgrading in their lives indeed have higher inflation expectations.

The heterogeneous results also seek to address one common criticism of survey experiments: spurious reactions. It is possible that the information provision could result in respondents reporting numbers for spurious reasons, instead of inducing genuine learning. Nonetheless, if the reaction to the information was purely spurious, we should not expect to see households consider their personal experience in updating their inflation expectations. We also find that our results are robust if we just focus on the sub-sample of respondents who are financially literate in inflation. As we would expect this group of respondents to be less prone to spurious learning, our results are not consistent with spurious learning.

Our research contributes to several strands of literature. First, this paper seeks to contribute to the burgeoning literature on how economic agents form their inflation expectations. Coibion and Gorodnichenko (2012 and 2015) have documented the importance of informational rigidities in studying the inflation expectations of U.S. households and professional forecasters. Malmendier and Nagel (2015) found that individuals adapt their forecasts to new data, but inflation realized during their life-times had a larger influence on their decision making. Kumar, Afrouzi, Coibion and Gorodnichenko (2015) found that the shopping experience is a major source of information for the inflation expectations of managers in New Zealand. Using micro data for a representative U.S sample that matches their individual expectations, consumption bundles and prices, Kuchler and Zafar (2019) found that changes in local house prices influenced household's expectations about U.S.-wide real estate inflation. Our paper is most closely related to D'Acunto, Malmendier, Ospina and Weber (2019) which found that U.S. households' inflation expectations are shaped by the frequency and size of price changes they faced in grocery shopping.

Nonetheless, most papers focus on how changes in prices of goods influence individual's inflation expectations. Changing inflation expectations due to changing composition of goods by households is largely unexplored. Our paper highlights the relationship between personal experience, product variety and inflation expectation. We show that when the current price of the lower quality good is not available, households reported higher inflation expectations. Consequently, one plausible reason for the high inflation expectations could be due to changes in product variety. On one hand, lower quality (and less profitable products) have been replaced by retailers, leading to a fall in variety of some products. On the other hand, retailers have introduced new products (that are of better quality) in other categories of goods. Both events could contribute to an increase in inflation expectations. We show that increasing product availability (of the lower quality product) will reduce inflation expectations. Our findings imply that, to lower inflation expectations, policymakers could seek to increase the availability of goods at the lower end of the quality spectrum to provide households with more choices.

Understanding the relationship between upgrading channel and inflation expectation has potential policy implications. In the face of low nominal interest rates, there have been proposals for central bank to use inflation expectations as policy tools (Coibion, Gorodnichenko, Kumar and Pedemonte (2018)). Nonetheless, studies have shown that recent monetary policy tools that target household's expectations directly instead of the financial markets were less effective than the predictions of macroeconomic models. (Bachmann, Berg and Sims (2015), McKay, Nakamura and Steinsson (2016), Hagedorn, Luo, Manovskii, and Mitman (2018)). Here, we provide another reason to inattention and ineffectiveness of announcements as inflation expectations are driven by household's personal experiences to purchase better quality goods. Consequently, neglecting consumer's choice of goods in designing expectations-based policies could lead to an ineffective outcome. This would have implications on how central banks should communicate to the public (Coibion Gorodnichenko and Weber (2019)).

Our paper is also related to the literature that study the effect of quality change on inflation of households. We seek to complement the literature by studying inflation expectations. It has been documented that the quality of the goods and services consumed by households have increased with income (Jaimovich, Rebelo, Wong and Zhang (2019), Faber and Fally (2019), Baker, Baugh and Kueng (2019)). Using the US Consumer Expenditure Survey, Bils and Klenow (2001) showed that the US Bureau of Labour Statistics was unable to fully net out quality upgrading in estimating inflation. Hausman (2003) further documented that quality change and introduction of new goods could lead to biases in the Consumer Price Index, while Nakamura and Steinsson (2012) identified that a product replacement bias could lead to a low exchange rate passthrough. In terms of price changes experienced by households, Argente and Lee (2016) found that high-income households were able to substitute towards lower-quality foods, leading to lower inflation for the higher-income population during the Great Recession.

The remainder of the paper is organised as follows. Section 2 discusses the institutional background and administrative data. Section 3 presents the survey experiment design, while Section 4 discusses the relationship between inflation expectations and the upgrading channel. Section 5 concludes.

2. Institutional Background and Administrative Data

2.1 Institutional Background

Since 2013, the Economist Intelligence Unit's Worldwide Cost of Living has ranked Singapore as the world's most expensive city to live. Nonetheless, its citizens have enjoyed better standard of living and there has been a shift towards better quality goods. For instance, there has been an increase in the purchase of new luxury vehicles (such as Mercedes Benz and BMW) vis-à-vis regular cars (such as Nissan and Ford) from 2008 to 2018. (See Appendix Figure A1). There has also been an increase in the number of new retail outlets from abroad, which is well received locally. In April 2019, Shake Shack opened its first outlet in Singapore, with diners waiting in queues for hours to get their burger.

Following Broda and Weinstein (2010), we find that product turnover takes place within supermarkets in Singapore. We examine the total amount of unique choices made by households across all 79 categories of goods using Nielsen's Homescan Panel. On average, there is an increase in the variety of goods across time. Nonetheless, this is not consistent across all types of goods. While there has been an increase in the variety of biscuits, there is a fall in the variety of toilet paper purchased by households. (See Appendix Figure A2 for a snapshot of selected categories). This suggests that in some cases, products that were previously available to households could have been displaced. This forces them to change to alternative products.

It is plausible that lower quality (and less profitable products) have been replaced by retailers, leading to a fall in variety of some products. Moreover, retailers have introduced new (and better quality) products in other categories of goods. As shown by Jaravel (2018), an increase in demand for goods consumed by high-income households in the United States led to more new products in the segment. This led to an increase in product variety and a fall in prices for these goods (consumed by high-income households).

As its citizens enjoyed an increase in standard of living, media reports have indicated high inflation expectations and perceptions in this country. The departure of high inflation expectations and perceptions from reality has been documented by researchers in Singapore. Using a panel data of the Singapore Index of Inflation Expectations (Ghosh and Yu, 2011) between 2011 to 2017, Clark, Ghosh and Hanes (2018) highlighted that households' inflation expectations are systematically higher than professional forecasters and actual inflation rates in Singapore. In 2017, households' inflation expectations are 200 basis points higher than the expectation of professional forecasters. In reality, Singapore's inflation rate (based on changes in the Consumer Price Index) in 2017 and 2018 was 0.6% and 0.4% respectively.

2.2 Administrative data

There has been an increase in spending by households in Singapore across the years. According to the Household Expenditure Survey conducted by the Department of the Statistics in Singapore, the average monthly household expenditure had increased from SGD 3,352 (in the years 2002/2003) to SGD 4,906 (in the years 2017/2018). The increase in spending is consistent across all income quintiles, with a faster rate of increase among the lower income quintiles. Figure A3 (Panel A) presents the spending by income quintiles during this time period, while Figure A3 (Panel B) shows Singapore's inflation rate from 1998 to 2018. The increase in spending could be due to a myriad of reasons. This could be due to an increase in prices, increase in quantity of goods purchased, as well as choice of goods across and within categories of goods. To characterize upgrading in Singapore, we pool together different sources of information. Specifically, we make use of a proprietary dataset of Credit Card spending and Nielsen Homescan Panel Data to study changes in the patterns of consumption spending.

2.2.1 Proprietary dataset of Credit Card spending

Firstly, we use a unique, proprietary dataset obtained from the leading bank in Singapore. The bank has more than four million customers in Singapore, which is approximately 80 percent of the population in Singapore. Our data sample contains a random representative sample of more than 180,000 unique individuals during 2 time periods: 2011 and 2016. For each individual in our sample, we have transaction level information about their credit card spending involving the date, amount spent, as well as merchant name and merchant category.

We present changes in household's choice of goods *across categories* using transaction level data from the leading bank in Singapore. Table I reports the annual credit card spending of goods by households in 5 categories: restaurants, apparel, department stores, entertainment, as well as watches and jewelry. We divide the households into 5 different quintiles (based on their annual spending).

<Insert Table I>

Across categories of goods, we observe that the increase in annual credit card spending differs across quintiles. For luxury goods such as watches and jewelry, the increase in spending is sharpest in the 2nd Quintile (14.1%), followed by 3rd Quintile (12.4%), 1st Quintile (8.1%), 4th Quintile (7.6%), before the 5th Quintile (6.4%). For entertainment, the increase in spending is sharpest in the 1st Quintile (20.6%), followed by 2nd Quintile (12.3%), 3rd Quintile (3.2%), 5th Quintile (-1.7%), before the 4th Quintile (-3.1%).

In comparison, for restaurants, households in Quintile 5 (16.7%) experienced the largest increase in spending, followed by Quintile 4 (14.4%), Quintile 3 (5.3%), Quintile 2 (-7%), Quintile 1 (-20.3%). For apparel, the increase in spending is largest in the 4th Quintile (16.7%), followed by 3rd Quintile (14.4%), 2nd Quintile (9.4%), 5th Quintile (5.5%), before the 1st Quintile (-2.7%).

From the statistics described above, there is evidence to suggest that households in different consumption quintiles change their consumption basket of goods across categories. For households in the lower quintiles, there is an increase in their spending towards more luxury products, such as watches and jewelry, as well as entertainment. For households in the higher quintiles, there is an increase in their spending in apparel and restaurants.

2.2.2 Nielsen Homescan Panel data

To study consumer’s choice of grocery goods in detail, we use transaction level data from Nielsen Homescan panel, which tracks the household purchases of all grocery goods from all retail outlets in Singapore. Using a barcode scanning device, households in the panel electronically record their purchases of all grocery goods (fresh and packaged). The Nielsen Homescan panel has large coverage and is demographically and geographically representative of Singaporean households.

Our data sample contains daily transactions of 900 households from 2016 to 2017. These households span across 25 districts in Singapore, which is approximately 90 percent of all the districts in Singapore. We also have a rich set of demographics of each grocery buyer such as their race, household size, household income and age group. Table II shows basic descriptive statistics of households in the Nielsen Homescan panel.

<Insert Table II>

Majority of the households (72%) have around 1 to 4 members, and the respondents are spread across different income levels. In terms of racial composition, 80% of the respondents are Chinese, 11% are Malays and 9% are Indians/Others. In terms of the age, 42% of the respondents are senior (more than 55 years old). This is followed by respondents in the age group of 45 to 54 years old (34%) and 35 to 44 years old (20%). 82% of the respondents stay in public housing provided by the Housing Development Board (HDB). This is representative of the Singapore population.

For each transaction, we have information of the shop name, category and brand of goods, as well as price, weight and quantity of the goods purchased. Shops include supermarkets such as NTUC FairPrice (Singapore's largest supermarket) and department stores such as Takashimaya. There are 78 categories of goods. They include food items such as beer, chocolate, ice-cream, as well as personal care products such as shampoo and tissue packs. For each category of good, we can identify the brand of goods. For instance, in the ice cream category, there are 40 brands (such as Ben's and Jerry, Magnolia, Wall and Häagen-Dazs).

In this paper, we make use of the brand of goods to understand changes in consumer's choice of goods *within categories* in the grocery market. For each category of goods available, we group the brands into 10 different bins based on the price per weight. Here, 1 refers to the lowest price per weight, while 10 relates to the most expensive good. This is an indication of the quality of the good (actual or perceived). In comparing the relative prices to measure quality we follow the approach used by Jaimovich, Rebelo and Wong (2019). This is supported by the use of other methodologies such as cost of production (Veerhoogen, 2008), as well as structural estimates using prices, quantities and household's utility (Hottman, Redding and Weinstein (2016) and Khandelwal (2010)).

We provide an example in the coffee category. Here, NTUC FairPrice (house brand) has an indicator of 1, Nescafe has an indicator of 3, Gold Roast has an indicator of 8, while Nespresso has an indicator of 10. Subsequently, we compute each Household's Quality Index at each month by determining the (simple) average quality of the goods consumed by the household. More formally, we refer to the following equation.

$$Q_{it} = \frac{1}{n_{it}} \sum_{j=1}^{n_{it}} X_{jt} \qquad (1)$$

Q_{it} refer to Household i's Quality Index at time period t. X_{jt} refers to the quality of good j consumed by Household i at time period t. The Household Quality Index lies between 1 to 10. If a household purchases all the goods in the lowest bin for all categories, they will obtain an Index of 1. Conversely, if the household purchases all the goods in the highest bin for all categories, they will obtain an Index of 10. From Table II (Panel A), we note that the average monthly spending is around $122 Singapore dollars, while the average Household's Quality Index is about 4.79. This suggests that the average quality of goods consumed by households is in between the 4^{th} and 5^{th} bin.

Figure 1 presents changes in the Household's Quality Index during the 24 months.

<Insert Figure 1>

In Panel A, we highlight the overall change in the Quality Index for all households. We find that there is an overall increase in the index from 4.7 to 4.85. This represents an increase of 3 percent as households switch to goods of higher quality across time. Panel B presents changes in the index by consumption quintiles. Based on the households' monthly spending during the first month (January 2016), we divide them into 5 separate quintiles. Thereafter, we track the changes in quality of goods purchased. Throughout the time period, the order of the quintiles remained the same, that is households in Quintile 5 consistently purchase better quality goods than households in Quintile 4 and so on. Nonetheless, there is a faster rate of increase among the lower quintiles (around 4.5 percent), with the gap between different quintiles narrowing across time. In fact, households in Quintile 2 and 3 have converged after 24 months.

Panel C presents changes in Household's Quality Index based on the housing type. We did not find any evidence that households who stay in private property have higher Household's Quality Index. This is surprising as we would expect private property owners to consume better quality goods as they have higher income and wealth as compared to those that stay in public housing provided by the Housing Development Board (HDB). According to the Global Living report by the real estate firm CBRE (2019), Singapore's private properties are the second most expensive in the world. The average private property price is estimated to be USD 874,372. In comparison, the average 4 room HDB price in a non-central district is less than USD 200,000. Nonetheless, we find that HDB and private property owners have similar Household Quality Index, with HDB homeowners buying better quality goods in some months. In Panel D, we that the Household Quality Index for lower income households tend to converge to those of the higher income households as well. This suggests that there is a tendency for these households to "catch up with the Joneses" and upgrade to better quality goods across time.

In summary, we have seen that households in Singapore have a high tendency to upgrade to better quality products both across and within categories of goods. This is particularly true for public housing homeowners and those with lower income. We turn to the inflation expectations.

3. Survey Experiment Design

We designed a special purpose survey for this research project to measure the inflation expectations. A personal interview survey was administered with surveyors conducting face-to-face interviews with individuals across Singapore. The survey was fielded between March to July 2019 and conducted at different places such as shopping malls, food courts and train stations. Each survey takes around 15 minutes and each respondent is given $20 to complete the survey. Respondents are paid a fixed compensation and are not financially incentivised. There are three sections in the survey. Firstly, we obtained information of their demographics and individual economic circumstances. This includes information of their age, gender, race, housing type, personal financial status and financial literacy. The second section builds on the Michigan Survey of Consumers and the New York Federal Reserve (2017) Survey of

Consumer Expectations. We collected a range of household's expectations of the economy, including their personal outlook. Finally, we conducted our survey experiment.

The experimental framework follows the literature that seeks to understand the formation of households' inflation expectations using survey experiments. Using a random trial experiment, Bruin, Klaauw and Topa (2011) examined whether thoughts about specific prices have an impact on inflation expectation formation. They found that people report more extreme year-ahead inflation expectations and showed more disagreement if they are asked to recall the largest price changes. Armantier, Nelson, Topa, Van Der Klaauw and Zafar (2016) found that individuals react to information by adjusting their reported inflation expectations, leading to a convergence of expectations distribution. Cavallo, Cruces and Perez-Truglia (2017) used survey experiments to show that rational inattention and cognitive limitations are sources of information frictions. Here, we examine households' responses based on different brands of goods. The steps are as follows:

We first elicit subject's past 12 months inflation perceptions and next 12 months inflation expectations before the survey experiment. Specifically, we ask subjects the following questions:

- *In the past 12 months, what do you expect Singapore's inflation/deflation rate to be?*
- *In the next 12 months, what do you expect Singapore's inflation/deflation rate to be?*

Households would give a specific number, which constitute their prior belief. We then provide the subject with information related to different treatment goods before eliciting their inflation perceptions and expectations again. For this survey, we randomly assign households to three treatment arms. The randomization is at the household level within each enumerator to ensure the balance of treatment and control for the enumerator fixed effects. Each enumerator assigns the subjects to different treatment based on their order. For example, the first subject is assigned to Treatment 1 (T1), second subject is assigned to Treatment 2 (T2) and the third subject is assigned to Treatment 3 (T3). The fourth subject will then repeat with Treatment 1 (T1). Information of the treatment arms are provided in Figure 2.

<Insert Figure 2>

For this experiment, we introduce prices of ice cream, something most Singaporeans can relate to. Specifically, we introduced prices of well-known ice cream brands, Walls and Häagen-Dazs Ice Cream. While Walls caters to the mass market, Häagen-Dazs position itself as a *"super premium brand"*. In 2009, 1.5L of Walls Neapolitan cost $5, while 1 pint (0.473L) of Häagen-Dazs Strawberry cost $11.90. In 2019, both ice-creams increased by approximately 20% to $6 and $14.45 respectively. Since Walls and Häagen-Dazs ice-cream can be considered to be normal good and luxury good respectively, we would like to see how the subjects update their inflation expectations given information about different types of goods.

Our experimental design focused on how respondents react to price changes of different types of goods. We provide the price of Walls in 2009 for the entire sample and vary the price information in the following ways. For T1, households were given prices of the lower quality product, Walls in 2019. It serves as the control group. For T2, we provide them with price information of the higher quality product, Häagen-Dazs in 2019 only. For T3, we provide them with price information of both Walls and Häagen-Dazs in 2019. By varying the availability of the price information in 2019, the purpose is to study the impact on inflation expectations given current price information of higher and lower quality products.

We test for the upgrading channel by examining whether households have higher inflation expectations when given better quality goods in 2019. As subjects in T2 were given only prices of Häagen-Dazs in 2019, an increase in inflation expectations vis-à-vis subjects in T1 suggests that exposure to the price information of higher quality goods would increase inflation expectations. Moreover, as subjects in T3 were given prices of both Häagen-Dazs and Walls in 2019, an increase in inflation expectations vis-à-vis subjects in T1 implies that increasing product variety (involving better-quality goods) would increase inflation expectations. This is in line with the upgrading channel, whereby exposure to higher prices of better-quality goods will result in higher inflation expectations. Finally, the difference between T3 and T2 will inform us on the importance of product displacement. An increase in inflation expectations for T2 vis-à-vis subjects in T3 suggests that reducing product availability (of the lower quality product) will increase inflation expectations.

Table III shows the summary statistics of the survey that we conducted. To avoid the possibility of extreme outliers driving our results, we winsorize the (pre-treatment) inflation expectations and inflation perceptions at the 1% and 99% levels. Nonetheless, we show in Section 4.4 that our main results hold if we make use of the full sample.

<Insert Table III>

The variables have been selected to study how demographics, shopping behavior, as well as past and present view of households' finances can shape the individual inflation expectations and perceptions. We examine the following. Firstly, we include their age, logarithm of their monthly income and household size. Next, we include indicator variables about their gender, marital status, education, housing type and frequency of shopping. Female is an indicator for a female respondent. Married is an indicator for a married respondent. Tertiary Education is an indicator if the respondent has tertiary education (post-secondary and college degree). Stay in HDB is an indicator if the household stay in public housing. Frequent Shoppers is an indicator for respondents that shop at least once per week.

To consider future spending and income, we include Percentage Increase in Spending and Percentage Increase in Income, which indicates the corresponding expected increase in spending and income of the households over the next 12 months. In terms of their future outlook and past perspective of their household finances, we consider the following 2 indicators: Negative Outlook is an indicator for households that replied that they expect to be worst off in the next 12 months, while Negative Reflection is an indicator for households that specified that they felt worst off for the past 12 months.

Finally, we also study financial literacy by examining their knowledge of inflation. Inflation Literacy is an indicator corresponding to the correct response of the question.

- *Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, how much would you be able to buy with the money in this account?*

Households could answer, "More than today", "Exactly the same", "Less than today". It is an assessment of the respondent's financial literacy of inflation.

In all, we have 1036 respondents across all 3 treatment groups. The demographics are a good representation of Singapore's population. The average age across all samples is around 38. 48% of our respondents are female, and 44% are married. 81% of our respondents stay in public housing (HDB). 80% of the respondents have tertiary education and average household size is 3.92. 83% of the households answered the inflation literacy question correctly. 31% of the households shop at least once per week. The average expected increase in spending and income for the next 12 months is 17% and 10% respectively. 16% of the households have negative outlook for the next 12 months, while 15% of the households mentioned that they felt worst off for the past 12 months. Importantly, it is evident from the P-values that our random assignment of subjects does create balanced treatment and control groups, except for one indicator (Negative Outlook). 1 out of 15 variables is significant at the 10 percent level, which is expected under random assignment. We also conducted pairwise balance of treatment comparison between the three treatment groups and obtain similar results.

Our survey of inflation expectations shows that there is considerable disagreement between respondents. The large divergence of inflation expectations has been well documented using different surveys of inflation expectations such as the Michigan Survey and Livingstone Survey (Mankiw, Reis and Wolfers (2003)). Figure 3 presents the distribution of inflation expectations and perceptions from our survey. From the plots, we find that there is a large interquartile range of household's inflation expectations and perceptions (between 2 percent to 10 percent), depicting divergence among the beliefs of households. Furthermore, there are individuals that provide extreme values for inflation expectations and perceptions.

<Insert Figure 3>

We find that households in Singapore have significantly higher inflation expectations and perceptions as compared to the actual inflation rate. Among the treatment groups, the (pre-treatment) inflation perceptions are between 8.40% to 8.57%, while the (pre-treatment) inflation expectations are between 6.60% to 8.17%. In comparison, Singapore's inflation rate in 2017 and 2018 was 0.6% and 0.4% respectively (Figure A3 Panel B). The high inflation expectations and perceptions vis-à-vis the actual inflation rate is consistent with findings from other surveys in Singapore (Clark, Ghosh and Hanes, 2018).

4. Inflation Expectations

We have documented that households upgrade to better quality goods within categories and across categories in Singapore (Section 2) and their inflation expectations are higher than actual inflation rate (Section 3). In this section, we investigate the relationship between the upgrading channel and inflation expectations. As households upgrade to better quality goods within categories and across categories in Singapore, they might have higher inflation expectations due to their changing basket of goods. In Section 4.1, we discuss households' characteristics that could influence inflation expectations. In Section 4.2, we present the results of our survey experiment. In Section 4.3, we test the upgrading channel. In Section 4.4, we address concerns about the survey experiment.

4.1 Household's characteristics and Inflation Expectations

To study the relationship between inflation expectations and households' characteristics, we estimate the following ordinary least square (OLS) regression:

$$\pi_i = \beta X_i + \eta_d + \eta_e + \eta_m + \varepsilon_i \qquad (2)$$

where π_i refers to the inflation expectations and perceptions of individual respondents *before* the information treatment, while X_i relate to the corresponding co-variates. We focus on the following co-variates: Age, Female, Log (Monthly Income), Tertiary Education, HDB, Inflation Literacy, Frequent Shoppers, Percentage Increase in Spending, Percentage Increase in Income, Negative Reflection and Negative Outlook. Furthermore, we included the following fixed effects: η_d is a district level fixed effect. Following the Singapore District Code, we classify them into 28 districts based on where they stay. η_e is an enumerator fixed effect, while η_m is a survey month fixed effect (based on the interview date).

Columns 1 and 2 of Table IV report the relationship between inflation perceptions and the co-variates. In Column 1, we did not include the fixed effects. In Column 2, we include the fixed effects. Columns 3 and 4 of Table IV report the relationship between inflation expectations and the co-variates. In Column 3, we did not include the fixed effects. In Column 4, we include the fixed effects. Our fixed effect regressions (Columns 2 and 4) yield similar results to those without fixed effects (Columns 1 and 3). Pulling our results together from Columns 2 and 4, we find that inflation perceptions and expectations are driven by common factors. Specifically, knowledge, as well as past and future experiences shape inflation perceptions and expectations.

<Insert Table IV>

Firstly, we find that knowledge in terms of tertiary education and financial literacy of inflation matters. In the preferred specification in Columns 2 and 4, those with tertiary education experienced lower inflation perceptions and expectations of 394 basis points and 308 basis points respectively. Respondents with inflation literacy reported lower inflation perceptions and expectations of 461 basis points and 378 basis points respectively. The results above are all statistically significant at the 1 percent level. This is consistent with findings in the literature. For example, Armantier, Bruine de Bruin, Topa, Van Der Klaauw and Zafar (2015), D'Acunto, Hoang, Paloviita and Weber (2019) have shown the importance of cognitive abilities in influencing inflation expectations. As these households are more informed about inflation, they report lower (and more accurate) numbers.

In addition, we show that past experiences matter. In our survey, we find that females exhibit higher inflation perceptions and expectations of 198 basis points and 199 basis points respectively. They are both statistically significant at the 1 percent level. This could be attributed to their gender roles. This has been highlighted by studies in different countries. (See Easaw, Golinelli and Malgarini (2013) for a study on Italian Households, as well as D'Acunto, Malmendier and Weber (2019) for a study on households in the U.S.).

In this paper, we find that future expectation of the household plays an important role as well. For every 1 percent expected increase in spending, inflation perceptions and expectations increased by 13 basis points. Both results are statistically significant at the 1 percent level. In comparison, expected percentage increase in income is not statistically significant. Moreover, households that stay in public housing (HDB flats) reported higher inflation perceptions and expectations of 372 basis points (significant at 1 percent) and 178 basis points (significant at 5 percent) respectively. This could be attributed to the fact that these households expect to upgrade to private properties in the future. In Singapore, upgrading from public housing (HDB flats) to private Condominium has become part of the Singapore Dream. Together with Cash, Credit card, Country Club and Cars, they make up the Five Cs that Singaporeans strive towards

(Tan (2015)). They are often termed "HDB upgraders" in the local context and have shown to move up the "quality curve" between 2005 to 2015. (Diao, Fan and Sing (2018)).

4.2 Information Treatment and Inflation Expectations

We turn to our survey experiment for further investigation. We present the pre-treatment and post-treatment inflation expectations and perceptions of all the treatment groups, alongside the 90 percent Confidence Interval in Figure 4. It is evident that provision of information has different effects on the inflation expectations and perceptions of subjects in different treatment groups. From Panels A and B, we observe that T1 led to a decline in inflation expectations relative to pre-treatment levels, while T2 resulted in a rise in inflation expectations. The fall in inflation expectations of respondents in T3 is smaller than that in T1. On the other hand, the treatment effects did not seem to influence inflation perceptions significantly (Panels C and Panel D).

<Insert Figure 4>

Figure A4 in the appendix presents the kernel density of the inflation expectations and perceptions (pre-treatment and post-treatment) by the treatment groups. Post-treatment, respondents in T1 and T3 show lesser dispersion in terms of inflation expectations, while the dispersion increased for T2. This suggests that there could be heterogeneity in the rate at which the respondents update their beliefs when exposed to better quality goods.

We estimate the treatment effects through the following ordinary least square (OLS) regression:

$$\Delta\pi_i = \alpha + \beta_1 T2 + \beta_2 T3 + \phi X_i + \eta_d + \eta_e + \eta_m + \varepsilon_i \qquad (3)$$

where $\Delta\pi_i$ refers to the change in inflation expectations and perceptions of individual respondents *due to* the information treatment. T2 is an indicator for Treatment 2 and T3 is an indicator for Treatment 3. X_i are the controls discussed earlier. η_d is a district level fixed effect, η_e is an enumerator fixed effect, while η_m is a survey month fixed effect.

Table V reports the results. Columns 1 and 2 of Table V show changes in inflation perceptions by treatment groups. In Column 1, we include controls, but did not include fixed effects. In Column 2, we include both controls and fixed effects. In both columns, there is no evidence of a treatment effect on changes in inflation perceptions. This suggests that price information of better-quality products has no effect on inflation perceptions in general. Columns 3 and 4 of Table V show changes in inflation expectations by treatment groups. In Column 3, we include controls, but did not include fixed effects. In Column 4, we include both controls and fixed effects. Both columns indicate that the treatment effects on inflation expectations are statistically significant.

<Insert Table V>

From Column 4, we see that subjects in T2 reported an increase in inflation expectations of 505 basis points (significant at 1 percent) as compared to T1. This shows that solely providing price information on higher quality goods in 2019 (and not the lower quality product) will lead to higher inflation expectations. In comparison, subjects in T3 reported an increase in inflation expectations of 162 basis points (significant at 5 percent) as compared to T1. Hence, providing additional information of the higher quality goods in 2019 (together with the lower quality product) will also lead to an increase in inflation expectations. This suggests that exposure of better-quality goods led to an increase in inflation expectations (regardless of whether the price information of the lower quality products was made available). Finally, from the Wald Test, we find that inflation expectations of households in T2 and T3 are significantly different, highlighting that product displacement of goods will lead to higher inflation expectation.

The difference between T2 and T3 shows that the inflation expectation increases less when the information of higher and lower quality products is available. It suggests that households allocate different weight on higher quality or lower quality product when adjusting their inflation expectations. To quantify the extent to which inflation expectation is affected by high price goods, we compute an upgrading parameter, alpha.

The upgrading parameter alpha (α) is defined as the ratio of the difference between the change in inflation expectations of T3 and T1, as well as the difference between the change in inflation expectations of T2 and T1. This can be more formally expressed from the following equation:

$$\alpha = \frac{\Delta\pi^{T3} - \Delta\pi^{T1}}{\Delta\pi^{T2} - \Delta\pi^{T1}} \qquad (4)$$

whereby $\Delta\pi^{T1}, \Delta\pi^{T2}, \Delta\pi^{T3}$ refer to the change in inflation expectations for Treatments 1, 2 and 3 respectively.

Intuitively, the upgrading alpha measures the weight that respondents place on the additional price information on the luxury good in forming inflation expectations. The larger the value of the upgrading alpha, the more emphasis is placed on the luxury good (Häagen-Dazs) in 2019, suggesting that the upgrading channel is stronger in influencing inflation expectations. We note that the upgrading alpha should lie between 0 and 1. When the upgrading alpha is equal to 0, it suggests that there is no difference between T3 and T1, that is the respondents in T3 ignore the additional information (of Häagen-Dazs in 2019). When the upgrading alpha is equal to 1, it suggests that that there is no difference between T3 and T2. In this case, the respondents in Treatment 3 only focus on the additional information (of Häagen-Dazs in 2019), and not Walls in 2019. Based on our results, the upgrading alpha is computed to be 32 percent. Hence, in the formation of their inflation expectations, households allocate 32 percent of weight on the price of Häagen-Dazs in 2019.

In sum, we find that exposure of better-quality products will lead to higher inflation expectations. Moreover, if households are given current price information of both higher quality and lower quality goods, the effect on inflation expectations is significantly lower. These results suggest that product displacement of goods will lead to higher inflation expectations.

4.3 Possible explanations

Why does inflation expectation respond to product variety? One possible explanation is the upgrading channel: As households are exposed to better quality products, they will focus on higher quality products in forming their inflation expectations. This could be attributed to their personal experiences. We propose two ways to test the upgrading channel.

Firstly, we leverage on our survey experiment to determine the group of households that allocate more weight on the higher quality product when they were given current price information of both higher quality and lower quality goods. To examine household's differential response to different treatments, we analyse the heterogeneous treatment effects through the following OLS regression:

$$\Delta\pi_i = \alpha + \beta_1 T2 + \beta_2 T3 + \beta_3 Z_i + \beta_4 T2 * Z_i + \beta_5 T3 * Z_i + \phi X_i + \eta_d + \eta_e + \eta_m + \varepsilon_i \quad (5)$$

$\Delta\pi_i$ refers to the change in inflation perceptions and expectations. T2 is an indicator for Treatment 2 and T3 is an indicator for Treatment 3. Z_i refers to the independent variable: Frequent Shoppers. As defined previously, Frequent Shoppers is an indicator variable if the respondent shops at least once per week. X_i are the controls discussed earlier. η_d is a district level fixed effect, η_e is an enumerator fixed effect, while η_m is a survey month fixed effect.

<Insert Table VI>

In Table VI Columns 1 and 2, we study the heterogeneous treatment effects on inflation perceptions based on their frequency of shopping. In Column 1, we include the personal experience controls, but did not include the fixed effects. In Column 2, we include both the personal experience controls and the fixed effects. The results in both columns are similar. In Column 2, we find that the effect of T3 is higher for frequent shoppers by 354 basis points and is statistically significant at the 10 percent level. In comparison, the effect of T2 is higher for frequent shoppers by 263 basis points and is statistically insignificant.

We proceed to study the heterogeneous treatment effects on inflation expectations based on their frequency of shopping in Table VI Columns 3 and 4. In Column 3, we include the personal experience controls, but did not include the fixed effects. In Column 4, we include both the personal experience controls and the fixed effects. The results in both columns are similar. We focus on our preferred specification in Column 4. We find that the effect of T3 is higher for frequent shoppers by 309 basis points (significant at 10 percent). Though statistically insignificant, the effect of T2 is higher for frequent shoppers by 198 basis points. Moreover, the effect of T2 on non-frequent shoppers is 458 basis points (significant at 1 percent), while the effect of T3 on non-frequent shoppers is 56 basis points (statistically insignificant). Based on the results in Column 4, the upgrading alpha for frequent shoppers is estimated to be 56 percent for frequent shoppers, and 12 percent for non-frequent shoppers. This means that in forming their inflation expectations, the weightage on the price information of the higher price product plays a larger role for frequent shoppers.

Consequently, we find that price information of the better-quality product plays a more important role for frequent shoppers in shaping their inflation expectations. This underscores the importance of personal experience and the upgrading channel. In line with their experience, frequent shoppers are more likely to upgrade and purchase better quality products. Hence, they allocate more weight to high quality products, leading to a larger upgrading alpha as compared to non-frequent shoppers.

Secondly, we study the upgrading channel by mapping our survey with the personal shopping experience from Nielsen's Homescan Panel. We then examine the relationship between changes in the Household Quality Index and household's inflation expectations at the group level. We cannot map our survey subjects and Nielson subjects at the individual level, so we only link them at the group level. Households are being categorised into the same group if they share the common characteristics: Household Income, Postal Code, Household Size, Race and Frequency of Shopping. This is based on the assumption that households in the Nielsen Homescan Panel and our survey are representative to the households in each group.

From our groupings, we generated 480 groups from our survey data and 511 groups from the Nielsen Homescan Panel. On average, there are around 2 households per group. We can map 195 groups that are common in both samples.

We then run the following ordinary least square (OLS) regression:

$$\pi_j = \alpha + \beta_1 U_j + \beta_2 \gamma_j + \eta_d + \varepsilon_j \qquad (6)$$

π_j refers to the average inflation perception and expectation in each group j. U_j refers to an Upgrading Index which we define as the difference between the average Household Quality Index for the last 3 months and first 3 months. To prevent outliers in a particular month from driving our results, we take the average of the Quality Index of the first 3 months and last 3 months. An increase in the Upgrading Index by 1 unit will imply that the household has purchased brands of better-quality goods by 1 bin for the entire bundle of goods. The covariates γ_j relate to the demographics and personal characteristics that we use to map them earlier (Household Income, Household Size, Race and Frequency of Shopping). η_d is a district level fixed effect.

<Insert Table VII>

In Table VII Columns 1 and 2, we report the relationship between the Upgrading Index and the (pre-treatment) inflation perceptions. Column 1 reports the results without any controls and fixed effects, while Column 2 reports the results with both controls and fixed effects. Both estimates show a positive relationship. In Column 1, we find that a unitary increase in the upgrading index corresponds to an increase in inflation perceptions by 102 basis points (significant at 5 percent). In Column 2, we find that a unitary increase in the upgrading index corresponds to an increase in inflation perceptions by 92 basis points (significant at 5 percent).

Table VII Columns 3 and 4 presents the results of the relationship between the Upgrading Index and the (pre-treatment) inflation expectations. Column 3 reports the results without any controls and fixed effects, while Column 4 reports the results with both controls and fixed effects. Both estimates show a positive relationship as well. In Column 3, we find that a unitary increase in the upgrading index corresponds to an increase in inflation expectations by 65 basis points (significant at 5 percent). In Column 4, we find that a unitary increase in the upgrading index corresponds to an increase in inflation expectations by 52 basis points (significant at 10 percent). This suggests that households that have upgraded to better quality products indeed reported higher inflation expectations, providing evidence for the upgrading channel.

Overall, we provide evidence for the upgrading channel in two ways. Firstly, we show that households consider their personal experience in updating their inflation expectations. Frequent shoppers tend to allocate more weight on higher quality goods when forming inflation expectations. Secondly, by mapping the personal shopping experience with our survey at the group level, we find a positive relationship between the increase in quality of supermarket shopping and inflation expectations.

4.4 Discussion and Robustness

One of the common criticisms of survey experiment is the issue of spurious learning (Cavallo, Cruces and Perez, 2017). Instead of inducing genuine learning, the information provision could result in respondents reporting numbers for spurious reasons. We provide two pieces of evidence to address this issue.

Firstly, if the results were indeed spurious, we should not expect heterogeneous updating by the respondents based on their personal experiences. We should expect to see households updating their inflation expectations independently of their shopping experience. However, we show that households who shop frequently focusing more on the higher quality goods in their formation of inflation expectations (Table VI). This is not consistent with spurious effects.

Moreover, should the results be spurious, we should expect to see the spurious effects to be lesser for the respondents who are financially literate in inflation. As these households have shown to be more consistent and accurate in terms of their inflation expectations (Table IV), they should be less prone to spurious learning. Consequently, we would expect to report different results for this group of respondents if there is spurious learning. However, in Table A2, we present our main results of Table V in the subsample who answer the inflation knowledge question correctly. We find that the treatment effects are positive, significant, and in the similar magnitude of Table V. These results are also not consistent with spurious learning.

We conduct several robustness tests for our results in Table IV to Table VII. Particularly, we run specifications for the entire sample as well as those who are financially literate in inflation from Tables IV to VII. In Table A1, we find that the determinants of the inflation expectations and perceptions discussed in Table IV are significant and are similar in magnitude. In Table A2, we show that our main results in Table V still hold. Households that are exposed to better quality products report higher inflation expectations. Furthermore, in comparing T2 and T3, we show that product displacement still makes a difference. In Table A3, we check the robustness of Table VI and show that frequent shoppers tend to allocate more weight on higher quality goods as well. In Table A4, we check the robustness of Table VII and find a positive and statistically significant relationship between the upgrading index and inflation expectations.

5. Conclusion

In this paper, we first document changes in the quality of goods consumed by households in Singapore across categories and within categories of goods. Using a randomised experiment, we find that exposure to prices of higher-priced goods over time, without retaining price information about lower-priced products, leads to higher inflation expectations. This suggests that the displacement of lower-priced products by higher-priced products from the market will increase inflation expectations. We also show that there is a positive relationship between upgrading and inflation expectations by mapping households from our survey with the Nielsen's Homescan Panel.

Consequently, our findings have several implications for policymakers. To reduce inflation expectations, policymakers could seek to increase the availability of goods (at the lower end of the quality spectrum). Moreover, public education could temper inflation expectations. If households are cognizant that their inflation expectations are driven by their own consumption habits, as they opt for luxury products across categories and within categories of goods, inflation expectations could be reduced. To reduce the search cost for households, more information on affordable goods should be given. This could be in newspapers, notice boards in estates or even through hand phone apps. Conversely, to increase inflation expectations, policymakers cannot neglect household's decisions to switch to different types of goods. Our findings imply that quality matters.

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Table I. Change in Credit Card Spending by Categories (in percentage)

	Restaurants	Apparel	Department Stores	Entertainment	Watches and Jewelry
Overall mean:	14.54	7.74	2.72	-1.09	7.09
Quintile 1	-20.34	-2.67	-1.36	20.62	8.1
Quintile 2	-7	9.38	-8	12.29	14.05
Quintile 3	5.3	14.36	-1.72	3.17	12.42
Quintile 4	14.4	16.69	1.97	-3.05	7.55
Quintile 5	16.72	5.51	3.86	-1.72	6.44

Notes: This table summarises the percentage change in annual spending of credit card holders as well as their respective quintiles in 5 categories: restaurants, apparel, department stores, entertainment, as well as watches and jewellery from 2011 to 2016.

Table II. Summary Statistics of Nielsen Data

	Number (1)	Mean (2)	Percentage (3)
Panel A: Household-Month level			
Monthly Spending	900	122	
		(89.3)	
Household Quality Index	900	4.79	
		(0.72)	
Panel B: Household Characteristics			
Household Size			
1 to 4 members	644		71.56
More than 4 members	256		28.44
Household Income			
Less than $3500	300		33.33
$3500 to $7000	274		30.44
More than $7000	326		36.22
Age of Household Buyer			
Less than 35	37		4.11
35 to 44 years old	176		19.56
45 to 54 years old	307		34.11
More than 55 years old	380		42.22
Race Description			
Chinese	721		80
Malay	80		11
Indian/Others	99		9
Housing Type			
Public Housing (HDB)	738		82
Private Housing (Non HDB)	162		18

Notes: This table reports descriptive statistics of our household-month level panel from the Nielsen Homescan Panel (Panel A), as well as their corresponding household characteristics (Panel B). The standard deviations are reported in parenthesis.

Table III. Summary Statistics of Survey Results

	Total	T1	T2	T3	P-value
Panel A: Baseline					
Age	38.49	38.32	38.22	38.95	0.8105
	(15.75)	(16.26)	(15.03)	(15.98)	
Female	0.48	0.50	0.46	0.46	0.4261
	(0.50)	(0.50)	(0.50)	(0.50)	
Married	0.44	0.44	0.44	0.45	0.9589
	(0.50)	(0.50)	(0.50)	(0.50)	
Log (Monthly Income)	7.32	7.38	7.35	7.23	0.3239
	(1.41)	(1.14)	(1.44)	(1.63)	
Tertiary Education	0.80	0.80	0.80	0.80	0.9543
	(0.40)	(0.40)	(0.40)	(0.40)	
Stay in HDB	0.81	0.82	0.82	0.79	0.7224
	(0.39)	(0.39)	(0.38)	(0.40)	
Household Size	3.92	3.84	3.91	4.01	0.2958
	(1.44)	(1.35)	(1.51)	(1.47)	
Inflation Literacy	0.83	0.86	0.82	0.82	0.3432
	(0.37)	(0.35)	(0.38)	(0.38)	
Frequent Shoppers	0.31	0.33	0.30	0.30	0.6166
	(0.46)	(0.47)	(0.46)	(0.46)	
Percentage Spending	16.75	18.52	15.33	16.33	0.1075
	(19.71)	(24.27)	(14.97)	(18.48)	
Percentage Income	9.76	10.51	8,99	9.78	0.7303
	(23.47)	(21.25)	(30.34)	(16.3)	
Negative Outlook	0.16	0.19	0.12	0.17	0.0473
	(0.37)	(0.39)	(0.33)	(0.37)	
Negative Reflection	0.15	0.16	0.14	0.17	0.5089
	(0.36)	(0.36)	(0.34)	(0.37)	
Panel B: Pre-Intervention					
Past 12 months Inflation Perceptions	8.57	8.41	8.40	8.94	0.7902
	(11.60)	(11.67)	(11.55)	(11.61)	
Next 12 months Inflation Expectations	7.45	8.17	6.60	7.58	0.1355
	(10.33)	(11.44)	(10.00)	(9.29)	
Panel C: Post-Intervention					
Past 12 months Inflation Perceptions	5.55	5.34	6.25	5.04	
	(8.00)	(7.93)	(8.48)	7.51	
Next 12 months Inflation Expectations	6.86	5.58	8.86	6.12	
	(13.3)	(7.42)	(20.16)	(7.66)	
Sample Size	1,036	358	351	327	

Notes: This table reports descriptive statistics of our survey for each treatment group. Panel A presents the demographics, Panel B shows the pre-intervention inflation perceptions and expectations, while Panel C shows the post-intervention inflation perceptions and expectations. The standard deviations are reported in parenthesis. P values are for Wald test of equal means of all the groups.

Table IV. Determinants of Inflation Expectations

Dependent Variable:	(1) Past 12 months Perceptions	(2) Past 12 months Perceptions	(3) Next 12 months Expectations	(4) Next 12 months Expectations
Age	0.0390	0.0526*	0.0238	0.0319
	(0.0284)	(0.0295)	(0.0236)	(0.0260)
Female	1.640**	1.977***	1.665***	1.989***
	(0.680)	(0.738)	(0.611)	(0.663)
Log (Monthly Income)	0.152	-0.0516	-0.0760	-0.299
	(0.230)	(0.262)	(0.228)	(0.264)
Tertiary education	-3.978***	-3.935***	-3.023***	-3.081***
	(1.297)	(1.295)	(1.073)	(1.116)
HDB	3.093***	3.718***	1.940***	1.783**
	(0.581)	(0.799)	(0.577)	(0.738)
Inflation Literacy	-5.596***	-4.610***	-4.519***	-3.784***
	(1.292)	(1.280)	(1.111)	(1.182)
Frequent Shoppers	0.303	0.272	-0.709	-1.013
	(0.799)	(0.911)	(0.710)	(0.809)
Percentage Spending	0.131***	0.128***	0.128***	0.128***
	(0.0276)	(0.0282)	(0.0282)	(0.0281)
Percentage Income	-0.00427	-0.00641	-0.00227	-0.000879
	(0.0142)	(0.0171)	(0.0171)	(0.0209)
Negative Outlook	0.387	0.188	1.161	1.089
	(0.956)	(1.092)	(0.936)	(1.040)
Negative Reflection	0.917	1.278	-0.158	-0.112
	(1.004)	(1.047)	(0.776)	(0.824)
Observations	1,023	1,006	1,023	1,006
R-squared	0.154	0.297	0.139	0.258
District Fixed Effects	N	Y	N	Y
Enumerator Fixed Effects	N	Y	N	Y
Survey Month Fixed Effects	N	Y	N	Y

Notes: This table presents the OLS estimation of the (pre-intervention) Past 12 months inflation perceptions and Next 12 months inflation expectations with key demographics and expectations variables based on the trim sample (winsorized at 1% and 99% levels). We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively.

Table V. The Effects of Treatment on Inflation Expectations

Dependent Variable:	(1) Change in Inflation Perceptions	(2) Change in Inflation Perceptions	(3) Change in Inflation Expectations	(4) Change in Inflation Expectations
T2	0.821	0.762	5.021***	5.046***
	(0.688)	(0.715)	(1.311)	(1.261)
T3	-0.816	-0.648	1.372*	1.617**
	(0.820)	(0.831)	(0.751)	(0.781)
Wald Test (T2=T3)				
P-Value	0.0992	0.1819	0.0007	0.0008
Observations	1,023	1,014	1,023	1,014
R-squared	0.051	0.121	0.042	0.084
Controls	Y	Y	Y	Y
District Fixed Effects	N	Y	N	Y
Enumerator Fixed Effects	N	Y	N	Y
Survey Month Fixed Effects	N	Y	N	Y

Notes: This table presents the OLS estimation of changes in inflation perceptions and expectations for each treatment group. Controls include the following: Age, Female, Log Income, Tertiary Education, HDB, Inflation Literacy, Frequent Shoppers, Percentage Increase in Spending, Percentage Increase in Income, Negative Reflection and Negative Outlook. We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. This is based on the trim sample (winsorized at 1% and 99% levels).

Table VI. Heterogeneous Effects on Changes in Inflation Expectations

Dependent Variable:	(1) Change in Inflation Perceptions	(2) Change in Inflation Perceptions	(3) Change in Inflation Expectations	(4) Change in Inflation Expectations
T2	0.137	-0.0918	4.386***	4.576**
	(0.795)	(0.825)	(1.666)	(1.784)
T3	-1.891**	-1.812*	0.389	0.563
	(0.947)	(0.949)	(0.869)	(0.901)
Frequent Shoppers	-2.307*	-2.722**	-1.248	-1.239
	(1.289)	(1.344)	(1.406)	(1.466)
T2 x Frequent Shoppers	2.080	2.628	1.929	1.979
	(1.632)	(1.659)	(2.382)	(2.589)
T3 x Frequent Shoppers	3.371*	3.543*	3.082*	3.090*
	(1.861)	(1.953)	(1.695)	(1.798)
Observations	1,023	1,016	1,023	-1.239
R-squared	0.055	0.118	0.044	(1.466)
With Personal Experience Controls	Y	Y	Y	Y
With District Fixed Effects	N	Y	N	Y
With Enumerator Fixed Effects	N	Y	N	Y
With Month Fixed Effects	N	Y	N	Y

Notes: This table presents the OLS estimation of the change in inflation perceptions and expectations for T2 and T3, as well as its interaction with the independent variable, Frequent Shoppers. Controls include the following: Age, Female, Log Income, Tertiary Education, HDB, Inflation Literacy, Percentage Increase in Spending, Percentage Increase in Income, Negative Reflection and Negative Outlook. We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. This is based on the trim sample (winsorized at 1% and 99% levels).

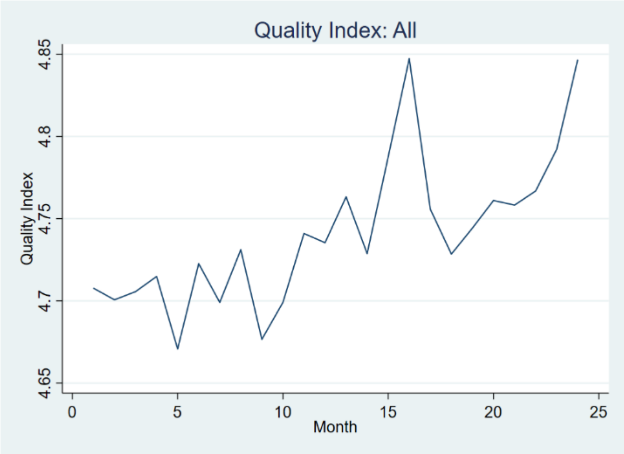
Table VII. Relationship between Upgrading Index and Pre-Treatment Inflation Expectations

Dependent Variable	Inflation Perceptions		Inflation Expectations	
	(1)	(2)	(3)	(4)
Upgrading Index	1.024**	0.919**	0.646**	0.517*
	(0.450)	(0.423)	(0.326)	(0.263)
Observations	195	194	195	194
R-squared	0.041	0.196	0.034	0.176
Controls	N	Y	N	Y
District Fixed Effects	N	Y	N	Y

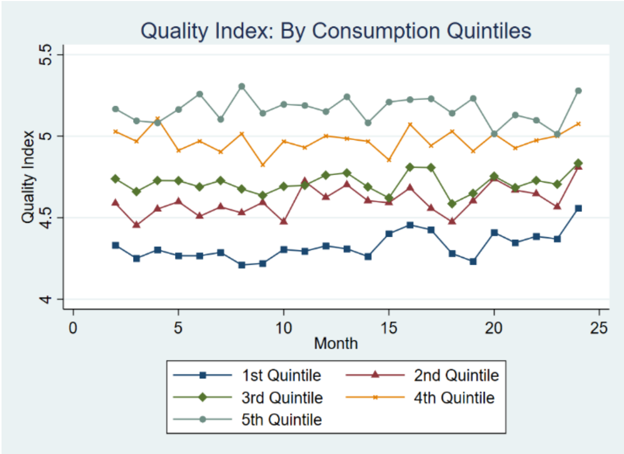
Notes: This table presents the OLS estimation of the pre-treatment inflation perceptions and expectations as well as the Nielsen's Upgrading Index for matched households based on the following matching groups: Postal Code, Race, Household Income, Household Size, Frequency of Purchase. Controls include Race, Household Income, Household Size and Frequency of Purchase. We use district level fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. This is based on the trim sample (winsorized at 1% and 99% levels).

Figure 1: Household Quality Index across Categories

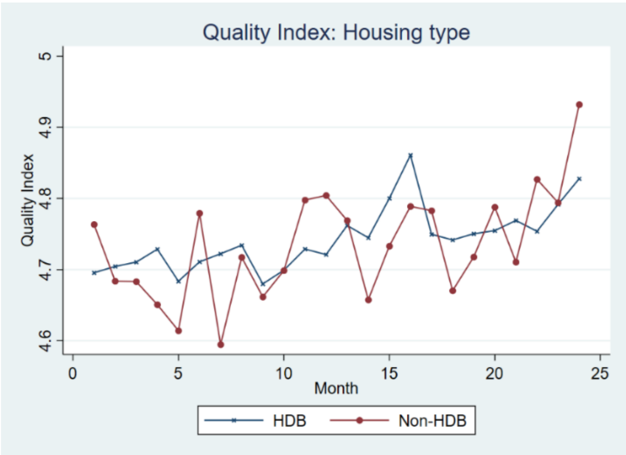
Panel A:



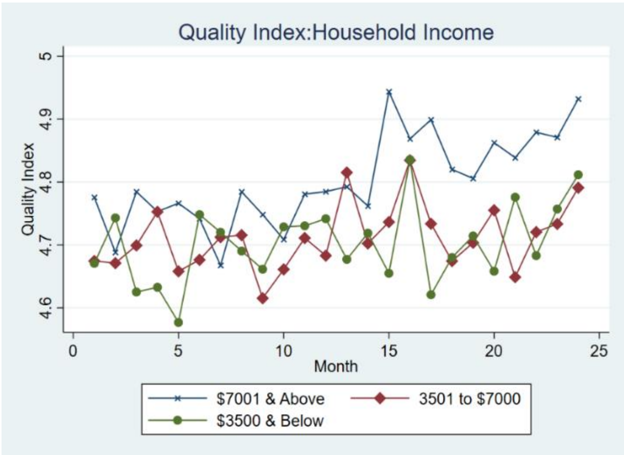
Panel B:



Panel C:



Panel D:



Notes: This figure presents the changes in Household's Quality Index derived from the Nielsen Homescan Panel based on household's characteristics. Panel A shows the overall trend, Panel B separates them based on their consumption quintiles. Panel C is based on housing type, while Panel D distinguishes them based on household's income.

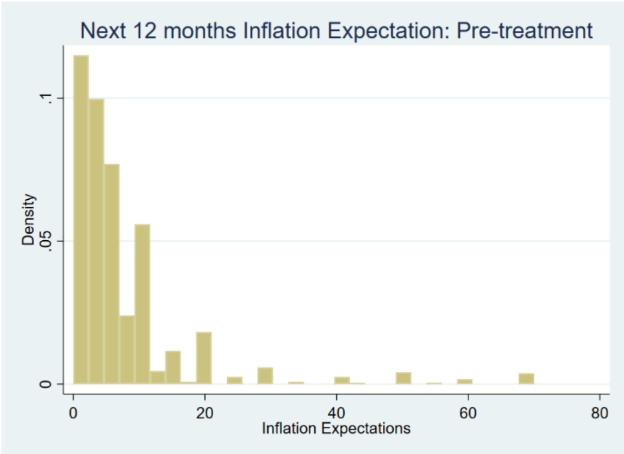
Figure 2: Treatment Categories

Year	Treatment 1:		Treatment 2:		Treatment 3:
2009	Walls Neapolitan 1.5L: $5		Walls Neapolitan 1.5L: $5		Walls Neapolitan 1.5L: $5
2019	Walls Neapolitan 1.5L: $6		Häagen-Dazs 1 Pint (0.473L): $14.45		Walls Neapolitan 1.5L: $6
2019					Häagen-Dazs 1 Pint (0.473L): $14.45

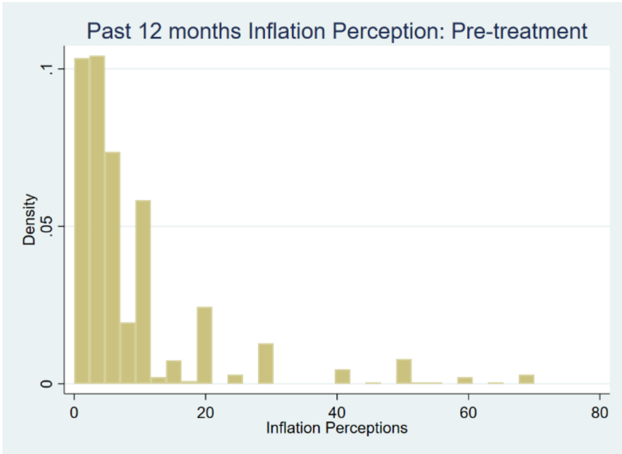
Notes: This figure presents the information given to each Treatment Group.

Figure 3: Distribution of Inflation Expectations

Panel A:



Panel B:

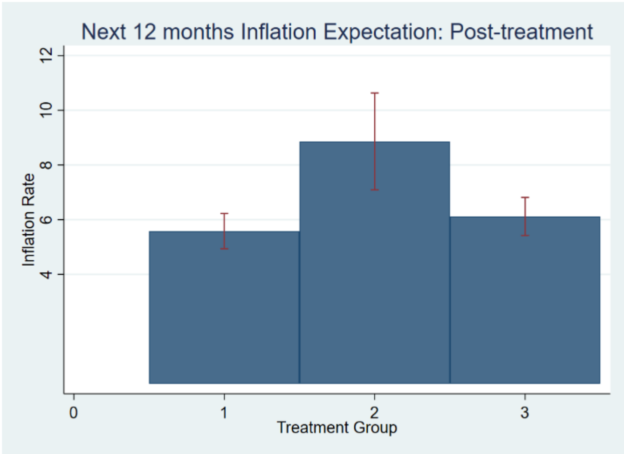


Notes: This figure presents the distribution of household's pre-treatment inflation expectations (Panel A) and pre-treatment inflation perceptions (Panel B). This is based on the trim sample (winsorized at 1% and 99% levels).

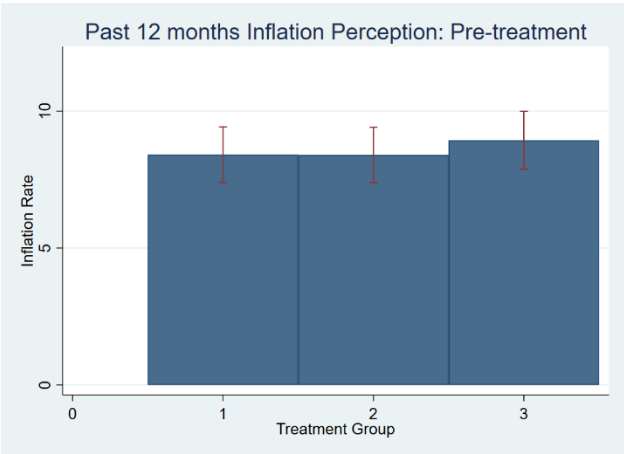
Figure 4: Inflation Expectations: Pre and Post Treatment

Panel A:

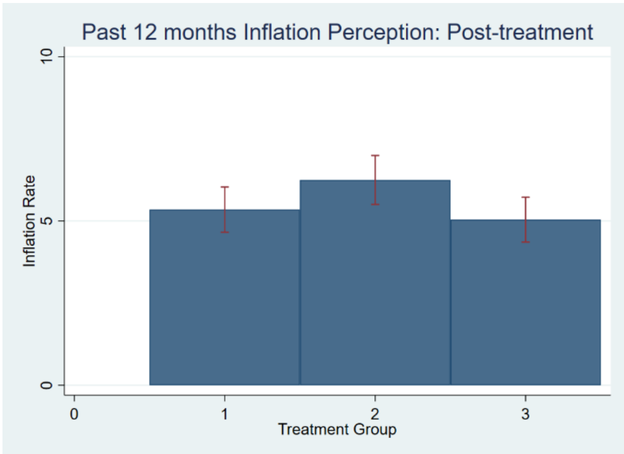
Panel B:



Panel C:



Panel D:



Notes: This figure compares household's inflation expectations and perceptions (pre and post treatment) by Treatment Groups. Panels A and B present the past 12 months inflation expectations based on pre and post treatment respectively. Panels C and D show the next 12 months inflation perceptions based on pre and post treatment respectively. We also include the 90 percent confidence interval. This is based on the trim sample (winsorized at 1% and 99% levels).

Internet Appendix

Not Intended for Publication

Table A1. Determinants of Inflation Expectations (Full Sample and Inflation Literate Sample)

	Full Sample		Inflation Literate Sample	
VARIABLES	(1) Inflation Perceptions	(2) Inflation Expectations	(3) Inflation Expectations	(4) Inflation Perceptions
Age	0.0602*	0.0185	0.103***	0.0348
	(0.0343)	(0.0302)	(0.0354)	(0.0326)
Female	1.587*	1.805**	2.342***	1.723**
	(0.885)	(0.783)	(0.900)	(0.729)
Ln (Income)	0.0141	-0.152	-0.0496	-0.240
	(0.283)	(0.281)	(0.304)	(0.295)
Tertiary education	-4.270***	-4.279***	-3.181**	-3.608**
	(1.526)	(1.382)	(1.588)	(1.478)
HDB	4.153***	2.338***	3.847***	2.276***
	(0.863)	(0.814)	(0.847)	(0.805)
Often Shopping	-0.529	-1.767**	-0.0361	-0.878
	(1.042)	(0.891)	(1.069)	(0.901)
Percentage Spending	0.167***	0.185***	0.128***	0.127***
	(0.0386)	(0.0394)	(0.0342)	(0.0304)
Percentage Income	-0.00494	0.00232	-0.0183	-0.00382
	0.0602*	0.0185	(0.0195)	(0.0234)
Negative Outlook	0.928	1.904	1.524	2.440*
	(1.442)	(1.235)	(1.536)	(1.282)
Negative Reflection	0.781	-0.466	-0.133	-1.884*
	(1.286)	(1.014)	(1.188)	(0.960)
Inflation Literacy	-5.766***	-4.906***		
	(1.446)	(1.358)		
Observations	1,038	1,038	857	857
R-squared	0.287	0.291	0.229	0.225
District Fixed Effects	Y	Y	Y	Y
Enumerator Fixed Effects	Y	Y	Y	Y
Survey Month Fixed Effects	Y	Y	Y	Y

Notes: This table presents the OLS estimation of the (pre-intervention) Past 12 months inflation perceptions and Next 12 months inflation expectations with key demographics and expectations variables. Columns 1 and 2 report the results from the full sample, while Columns 3 and 4 report the results from the inflation literate sample. We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively.

Table A2. The Effects of Treatment on Inflation Expectations (Full Sample and Inflation Literate Sample)

	Full Sample		Inflation Literate Sample	
	(1)	(2)	(3)	(4)
VARIABLES	Change in Inflation Perceptions	Change in Inflation Expectations	Change in Inflation Perceptions	Change in Inflation Expectations
T2	0.504	5.269***	1.228	5.991***
	(0.935)	(1.531)	(0.919)	(1.698)
T3	-1.362	1.118	-0.982	2.203*
	(1.084)	(1.055)	(1.129)	(1.131)
Wald Test (T2=T3)				
P-Value	0.1867	0.0018	0.0947	0.0021
Observations	1,038	1,038	857	857
R-squared	0.148	0.170	0.142	0.186
Controls	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y
Enumerator Fixed Effects	Y	Y	Y	Y
Survey Month Fixed Effects	Y	Y	Y	Y

Notes: This table presents the OLS estimation of changes in inflation perceptions and expectations for each treatment group. Controls include the following: Age, Female, Log Income, Tertiary Education, HDB, Inflation Literacy, Frequent Shoppers, Percentage Increase in Spending, Percentage Increase in Income, Negative Reflection and Negative Outlook. We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. Columns 1 and 2 report the results from the full sample, while Columns 3 and 4 report the results from the inflation literate sample.

Table A3. Heterogeneous Effects on Change in Inflation Expectations (Full Sample and Inflation Literate Sample)

	Full Sample		Inflation Literate Sample	
VARIABLES	(1) Change in Inflation Perceptions	(2) Change in Inflation Expectations	(3) Change in Inflation Perceptions	(4) Change in Inflation Expectations
T2	-0.838	4.097**	0.422	5.706**
	(1.165)	(1.989)	(1.148)	(2.237)
T3	-3.375**	-0.289	-2.529*	0.764
	(1.356)	(1.319)	(1.420)	(1.352)
Frequent Shoppers	-3.593**	-1.798	-2.903	-1.730
	(1.670)	(1.635)	(1.775)	(1.731)
T2 x Frequent Shoppers	4.044*	3.559	2.470	0.789
	(2.065)	(2.920)	(2.090)	(3.370)
T3 x Frequent Shoppers	6.018**	4.166*	4.689*	4.475*
	(2.405)	(2.153)	(2.656)	(2.336)
Observations	1,038	1,038	857	857
R-squared	0.157	0.172	0.148	0.189
With Personal Experience Controls	Y	Y	Y	Y
With District Fixed Effects	Y	Y	Y	Y
With Enumerator Fixed Effects	Y	Y	Y	Y
With Month Fixed Effects	Y	Y	Y	Y

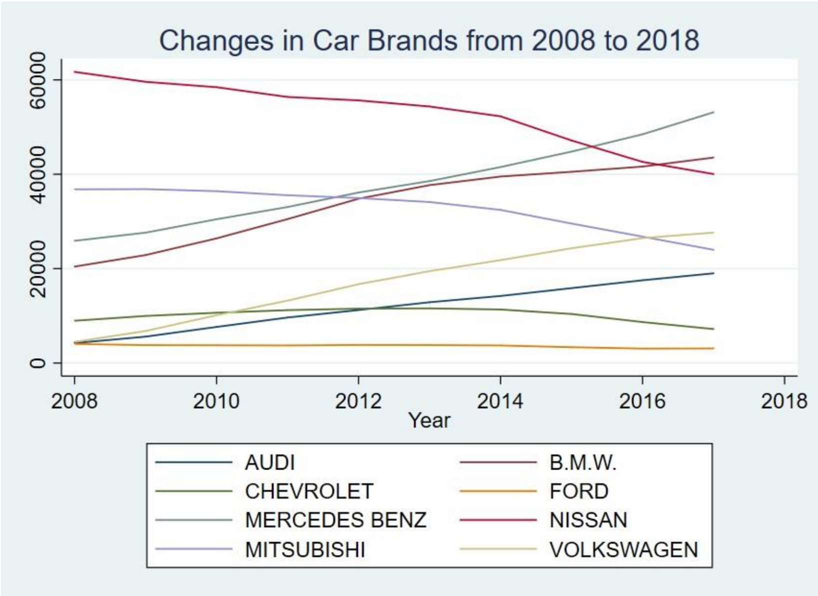
Notes: This table presents the OLS estimation of the change in inflation perceptions and expectations for T2 and T3, as well as its interaction with the independent variable, Frequent Shoppers. Controls include the following: Age, Female, Log Income, Tertiary Education, HDB, Inflation Literacy, Percentage Increase in Spending, Percentage Increase in Income, Negative Reflection and Negative Outlook. We use district level, enumerator and month fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. This is based on the trim sample (winsorized at 1% and 99% levels).

Table A4. Relationship between Upgrading Index and Pre-Treatment Inflation Perceptions/Expectations (Full Sample and Inflation Literate Sample)

	Full Sample		Inflation Literacy	
Dependent Variable	Inflation Perceptions	Inflation Expectations	Inflation Perceptions	Inflation Expectations
	(1)	(2)	(3)	(4)
Upgrading Index	1.135**	0.679**	0.907**	0.509*
	(0.449)	(0.276)	(0.403)	(0.268)
Observations	195	195	182	182
R-squared	0.159	0.131	0.154	0.102
Controls	Y	Y	Y	Y
District Fixed Effects	Y	Y	Y	Y

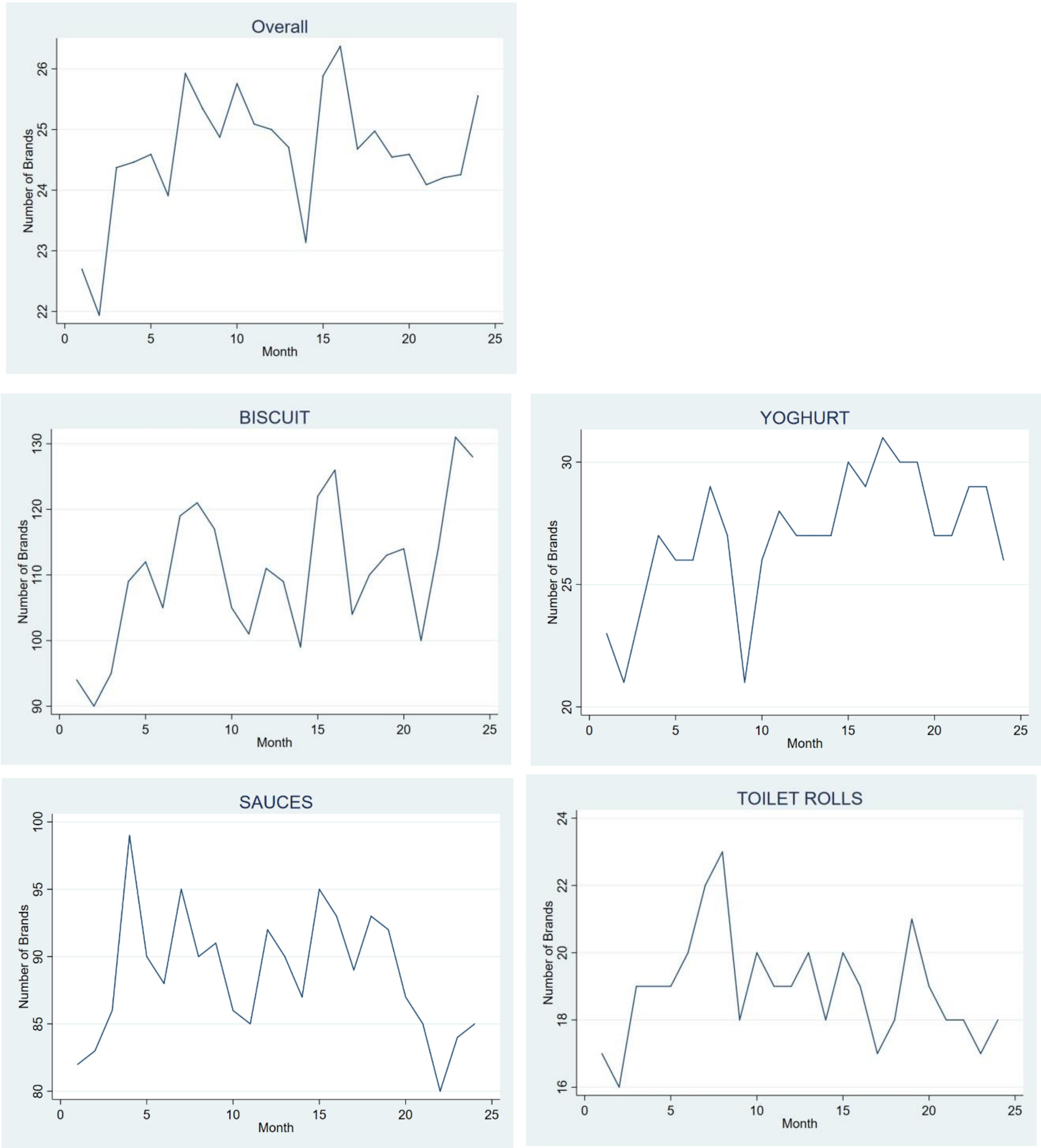
Notes: This table presents the OLS estimation of the pre-treatment inflation perceptions and expectations as well as the Nielsen's Upgrading Index for matched households based on the following matching groups: Postal Code, Race, Household Income, Household Size, Frequency of Purchase. Controls include Race, Household Income, Household Size and Frequency of Purchase. We use district level fixed effects. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. Columns 1 and 2 report the results from the full sample, while Columns 3 and 4 report the results from the inflation literate sample.

Figure A1: Changes in Car Brands in Singapore from 2008 to 2018



Notes: This figure presents changes in selected car brands by households in Singapore.

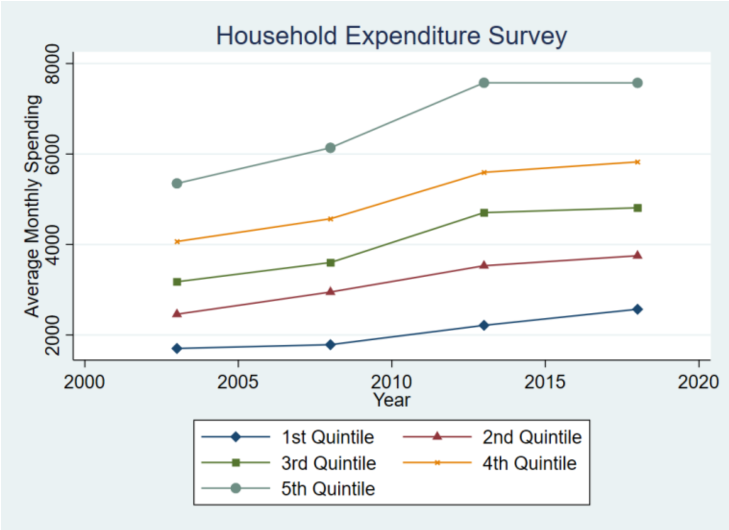
Figure A2: Variety Index: By Products



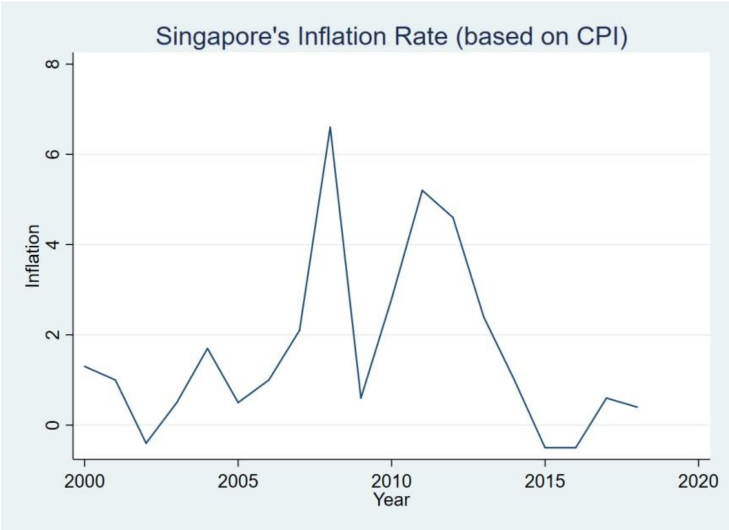
Notes: This figure presents changes in variety of goods in the Nielsen Panel.

Figure A3: Average Monthly Household Expenditure by Income Quintile and Inflation Rate

Panel A:

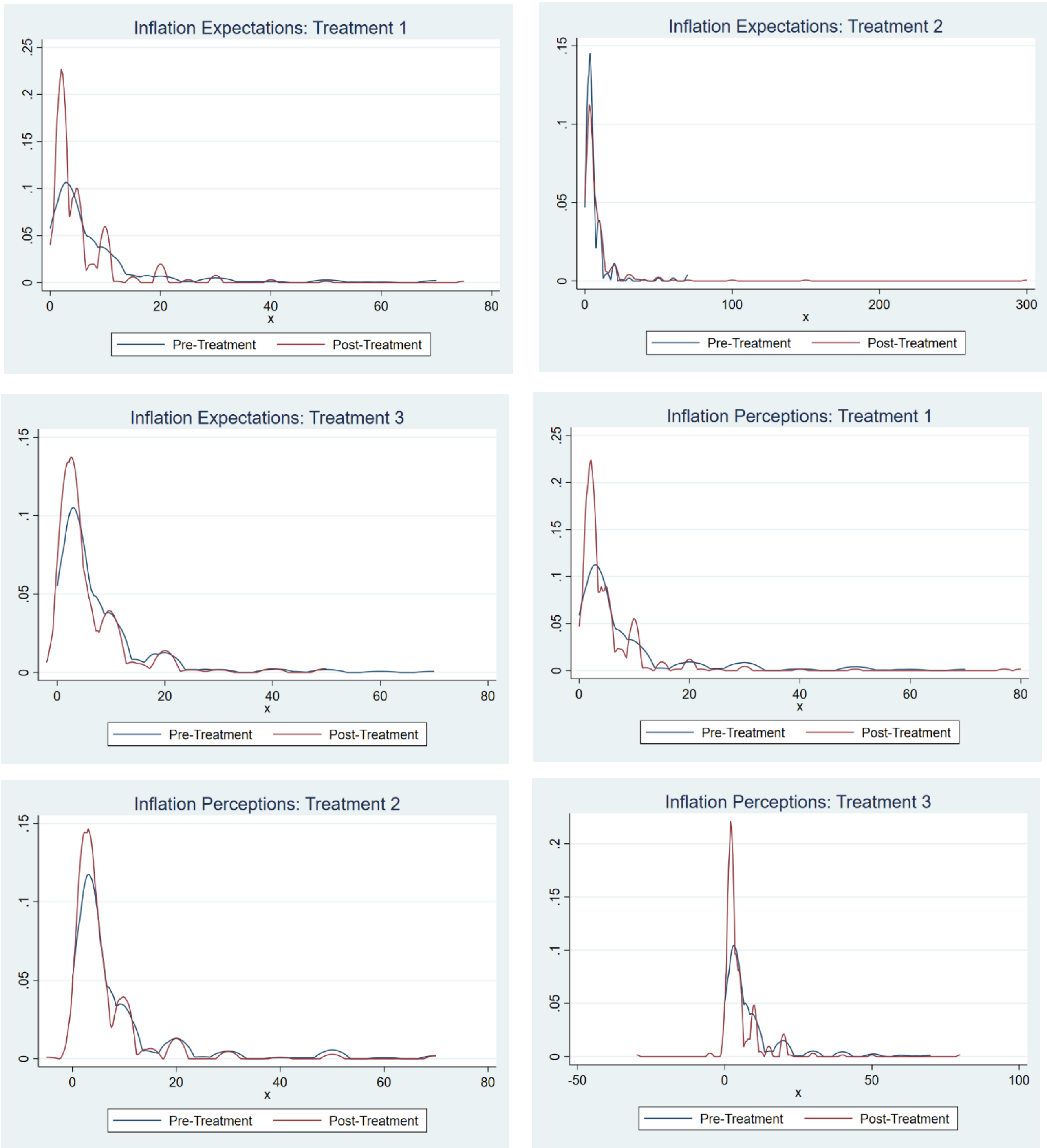


Panel B:



Notes: This figure presents Singapore's Average Monthly Household Expenditure by quintile (Panel A) and Inflation Rate (Panel B).

Figure A4: Kernel Density of Inflation Expectations and Perceptions (by Treatment Groups)



Notes: This figure presents the kernel density of the inflation expectations and perceptions of households (both pre-treatment and post-treatment) by treatment groups.