

Special Feature C

Upgrading and Inflation Expectations in Singapore: A Survey Experiment

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Introduction

Inflation expectations of households are crucial for the analysis of business cycles and formulation of monetary policy. The central questions are how expectations are formed, their magnitude, and whether they are adaptive or sensitive to policy changes. To obtain a better understanding of the pass-through of inflation expectations to wage and price setting, it is essential to address the first question on the formation of inflation expectations. However, there is no consensus in the empirical literature on how households' inflation expectations are formed (Bernanke, 2007; Bachmann *et al.*, 2015 and Coibion *et al.*, 2018).

One strand of the literature focuses on consumers' personal experiences as a key driver of their inflation expectations. Malmendier and Nagel (2016) showed that individuals adapt their forecasts to new data but inflation realised during their lifetimes has a large influence on their decision-making. Individual consumer shopping experiences have also been shown to play an important role in influencing inflation

expectations. Using survey experiments, Cavallo *et al.* (2017) showed that shoppers tend to assign heavier weights to goods that they have recently purchased. In studying the drivers of inflation expectations among firms in New Zealand, Kumar *et al.* (2015) found that managers in New Zealand rely on their personal shopping experience, and not the inflation targets of the Reserve Bank of New Zealand.

Indeed, it is plausible that changes in goods purchased by households could influence the prices they pay and, ultimately, inflation expectations. To our understanding, shifts in inflation expectations due to the changing composition of goods purchased by households is largely unexplored. Lifestyle changes, together with economic growth over the past decades, have influenced consumer choice. Items that were not previously available (such as smartphones) are now considered necessities for many households. As standards of living increase for the median household, inflation expectations will change accordingly.

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As observed by Singapore's Prime Minister Lee Hsien Loong, "*Things that were considered luxury items or did not even exist before ... have now become everyday necessities ... Our standards of living have gone up ... to sustain this higher quality of life, people are spending more than before, and this can put pressure on households.*"²

Survey Experiment

Modelled after the *Survey of Consumer Expectations* conducted by the New York Federal Reserve, we ran a personal interview survey with surveyors asking questions about households' inflation expectations in different parts of Singapore via a street-intercept survey. We also obtain information on their demographics, as well as perception of financial well-being. Each respondent was given \$20 to complete the survey.

Within the survey, we embedded a randomised control trial (RCT). Our experimental framework follows several studies such as Bruin *et al.* (2011), Armantier *et al.* (2015) and Cavallo *et al.* (2017). We first elicit subjects' inflation expectations for the next 12 months. We then provide subjects with information related to different treatment goods before eliciting their inflation expectations again.

For this survey, we randomly assign respondents to three treatment arms. Information about the treatment arms are provided in Table 1. We introduce prices of two well-known ice-cream brands, Walls and Häagen-Dazs, which most Singaporeans can relate to. While Walls caters to the mass market, Häagen-Dazs positions itself as a premium brand. In 2009, 1.5 litres of Walls Neapolitan ice-cream cost \$5, while 1 pint (0.473 litres) of Häagen-Dazs Strawberry ice-cream cost \$11.90. The prices of both brands of ice-cream increased by approximately 20% between 2009 and 2019 to \$6 and \$14.45 respectively. Since Walls and Häagen-Dazs ice-cream can be considered a normal good and luxury good, respectively, we sought to see how the subjects update their inflation expectations

Consequently, this study seeks to shed light on an additional channel of inflation expectations formation in the Singapore economy: as households are exposed to better quality products, their expectations about overall inflation may be biased upwards. We term this the "upgrading channel".

given price information about these different types of goods.

Survey respondents in the three groups were given different information about ice-cream prices in 2009, and in 2019. For Treatment 1, they were given prices of Walls in 2009 and 2019. For Treatment 2, they were given prices of Walls in 2009 and Häagen-Dazs in 2019. For Treatment 3, they were given prices of Walls in 2009 and 2019, as well as Häagen-Dazs in 2019.

The experimental design is centred on how households react to different information about price changes. We test for the presence of the upgrading channel by examining whether households have higher inflation expectations when given only price information about better quality goods in 2019. As subjects in Treatment 2 were given only prices of Walls in 2009 and Häagen-Dazs in 2019, an increase in inflation expectations *vis-à-vis* subjects in Treatment 1 will suggest an upward bias on their inflation expectations when they are exposed to prices of the higher-quality good in 2019.

Unlike Treatment 1 and Treatment 2, Treatment 3 provides information about the prices of both Walls and Häagen-Dazs ice-cream in 2019. The latter gives respondents information on relative price differences for the same mass-market option over time, as well as relative price differences between the mass-market and luxury options in the current time period. In this case, we seek to examine whether providing current price information about lower-priced products will reduce the upward bias on inflation expectations from the upgrading channel.

² Excerpt from the English translation of the 2018 National Day Rally Speech by Prime Minister Lee Hsien Loong in Chinese (<https://www.pmo.gov.sg/Newsroom/national-day-rally-2018-speech-chinese>).

Table 1
Treatment Categories

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

To further quantify the extent to which the provision of current price information will de-bias households' inflation expectations, we introduce an upgrading parameter (α) which is the ratio of the difference in 12-month ahead inflation expectations between respondents in Treatment 3 and Treatment 1 to the difference between those in Treatment 2 and Treatment 1:

$$\alpha = \frac{E_t \pi_{t+12}^{T3} - E_t \pi_{t+12}^{T1}}{E_t \pi_{t+12}^{T2} - E_t \pi_{t+12}^{T1}}$$

The larger the value of α , the more emphasis is placed on the luxury good (Häagen-Dazs) in 2019, suggesting that the upgrading channel is stronger in influencing inflation expectations. Intuitively, α measures the weight that respondents place on the additional price information about the luxury good in forming inflation expectations. We note that α should lie between 0 to 1.

Results

Table 2 shows the summary statistics of the survey results. In all, we had 1,086 respondents across the three treatment groups. The demographic characteristics of the respondents provide a good representation of Singapore's population. The average age across all samples is around 38. 48% of the respondents are female, 45% are married, and 81% live in public housing (HDB). The average number of years of education is 13.22, and average household size is 3.92.

More importantly, as shown by the p -values of the Wald test of equal means in Table 2, our

When α is equal to 0, it suggests that there is no difference between Treatment 3, where respondents know the price of Häagen-Dazs ice-cream in 2019, and Treatment 1, where they do not. In this case, the respondents in Treatment 3 form inflation expectations only using the information on price changes in Walls ice-cream from 2009 to 2019, ignoring the additional price information on Häagen-Dazs ice-cream in 2019. Conversely, α is equal to 1 when there is no difference between Treatment 3 and Treatment 2. In this case, the respondents in Treatment 3 form inflation expectations only using the additional price information on Häagen-Dazs ice-cream in 2019, and not the price changes in Walls ice-cream from 2009 to 2019. Hence, exposure to better quality products will influence inflation expectations completely, giving rise to the upgrading channel.

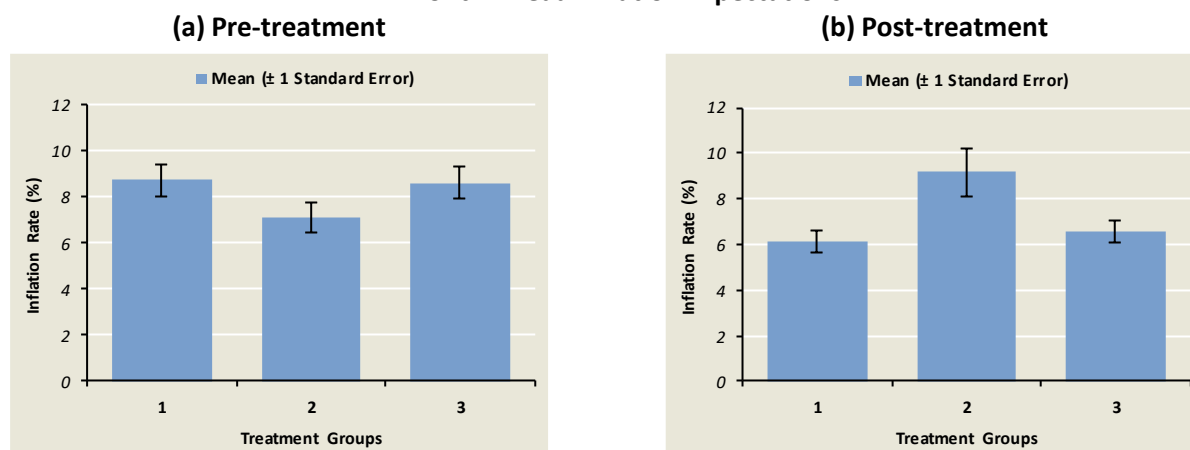
random assignment of subjects does create balanced treatment and control groups in terms of demographics and inflation expectations. We present the pre-treatment and post-treatment inflation expectations of all the treatment groups in Charts 2a and 2b. While Treatment 1 led to a decline in inflation expectations relative to pre-treatment levels, Treatment 2 resulted in a rise in inflation expectations. The fall in inflation expectations of respondents in Treatment 3 is smaller than that in Treatment 1.

Table 2
Summary Statistics of Survey Results

	Total	T1	T2	T3	<i>p</i> -value
Panel A: Pre-treatment					
Age	38.61 (15.83)	38.46 (16.21)	38.26 (15.18)	39.02 (15.91)	0.80
Female (% of respondents)	0.48 (0.50)	0.50 (0.50)	0.46 (0.50)	0.46 (0.50)	0.49
Married (% of respondents)	0.45 (0.50)	0.44 (0.49)	0.45 (0.50)	0.46 (0.50)	0.83
Log Monthly Income	7.32 (1.41)	7.40 (1.13)	7.35 (1.43)	7.23 (1.61)	0.29
Stay in HDB (% of respondents)	0.81 (0.39)	0.83 (0.38)	0.81 (0.39)	0.80 (0.40)	0.92
Years of Education	13.22 (2.96)	13.00 (2.77)	13.44 (2.81)	13.30 (3.13)	0.10
Household Size	3.92 (1.50)	3.84 (1.37)	3.92 (1.54)	4.01 (1.45)	0.25
12-month Ahead Inflation Expectations (%)	8.15 (12.93)	8.75 (13.27)	7.11 (12.81)	8.61 (12.62)	0.17
Panel B: Post-treatment					
12-month Ahead Inflation Expectations (%)	7.28 (14.08)	6.11 (9.67)	9.17 (20.44)	6.56 (8.62)	0.03
Sample Size	1,086	378	366	342	-

Note: This table presents the demographic characteristics, as well as pre- and post-treatment inflation expectations for each treatment group. *p*-values shown are for the Wald test of equal means across all treatment groups. Robust standard errors are reported in parentheses.

Chart 2
12-month Ahead Inflation Expectations



More formally, we run an Ordinary Least Squares (OLS) regression of the change in inflation expectations on Treatment 2 and Treatment 3 relative to Treatment 1. Column 1 in Table 3 reports the results of the benchmark experiment. For subjects in Treatment 2, there is an increase in inflation expectations by 426 basis points relative to those in Treatment 1. Hence, there is evidence 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 biases inflation expectations upwards. Subjects in Treatment 3 experience an increase in inflation expectations of 39 basis points. However, the difference in inflation expectations relative to Treatment 1 is not statistically significant. Based on these results, the upgrading parameter α is computed to be 0.09, providing support for the presence of a small upgrading channel in influencing 12-month ahead inflation expectations.

Table 3
Treatment Effects on Inflation Expectations

Dependent Variable:	Change in 12-month Ahead Inflation Expectations		
Independent Variables:	-	Non-negative Financial Well-being for the Past 12 Months	Non-negative Expected Financial Well-being for the Next 12 Months
	(1)	(2)	(3)
Treatment 2 (T2)	4.264*** (1.138)	7.240** (2.850)	12.73* (6.504)
Treatment 3 (T3)	0.386 (0.891)	5.615*** (2.082)	1.691 (2.288)
Variable	-	1.778 (1.770)	0.789 (1.911)
T2 × Variable	-	-3.014 (3.159)	-9.310 (6.580)
T3 × Variable	-	-6.007*** (2.292)	-1.342 (2.471)
Constant	-12.11** (4.355)	-4.124** (1.646)	-3.275* (1.808)
Observations	1,067	1,067	1,067
R-squared	0.021	0.023	0.030

Note: Robust standard errors are reported in parentheses. *, **, *** denote statistical significance at the 10%, 5% and 1% levels respectively.

To examine how financial well-being plays a role in influencing the upgrading channel, we ask subjects the following questions:

- *Do you feel that you, and your family, are currently better off, worse off, or roughly the same, financially, compared to 12 months ago?*
- *Looking forward, do you feel that you, and your family, will be better off, worse off, or roughly the same, financially, in 12 months' time compared to now?*

Respondents who replied “Much better off”, “Somewhat better off”, and “About the same” were considered to have a non-negative financial well-being. We then include indicators for non-negative financial well-being for the past 12 months and next 12 months in our regression and interact them with Treatment 2 and Treatment 3. Columns 2 to 3 in Table 3 report results of the heterogeneous treatment effects. We find that the interaction terms for Treatment 2 and Treatment 3 with non-negative financial well-being for the past 12 months and next 12 months are negative.

Specifically, the interaction term for non-negative financial well-being for the past 12 months and Treatment 3 is statistically significant. The coefficient on this interaction term is negative, suggesting that the additional information about the price of Häagen-Dazs ice-cream in 2019 did not upwardly bias inflation expectations for those with non-negative financial well-being for the past 12 months as much as for those with negative financial well-being. Moreover, the coefficient on

Treatment 3, which includes information on the price of Walls ice-cream in 2019, becomes significant once we control for financial well-being and the interaction terms, and it is smaller than the coefficient on Treatment 2, suggesting that the additional information helps to reduce the upward bias on inflation expectations from the upgrading channel.

Discussion

Our results show that exposure to prices of luxury goods upwardly biases inflation expectations. Hence, one plausible reason for the high inflation expectations in Singapore could be changes in product variety. Using the Nielsen Homescan Shopper Panel, which tracks household purchases of all grocery goods based on a provided scanner sample of households that is demographically and geographically representative of households in Singapore, we study changes in product variety by examining the total amount of unique choices made by these households across 79 categories of goods. On average, there is an increase in the variety of goods from 2016 to 2017. Nonetheless, this increase is not consistent across all categories of goods. For example, while there has been an increase in the variety of biscuits, there is a fall in the variety of toilet paper.

Both decreases and increases in the variety of goods could increase inflation expectations. Lower quality and less profitable products have been removed by retailers, leading to a fall in the variety of some products. However, retailers have also introduced new products that are of better

quality in other categories of goods. As documented in our survey experiment, both will contribute to an increase in inflation expectations.

Our results suggest that even if consumers are increasingly exposed to higher-priced products, providing current price information about lower-priced products can help to mitigate the upward bias on inflation expectations from the upgrading channel. Policymakers could seek to increase the availability of goods at the lower end of the price spectrum to provide households with more choices. 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 handphone apps. Moreover, with rising standards of living and exposure to better quality products, greater awareness by households of the role of changing consumption habits in shaping their perceptions of inflation can help to temper inflation expectations.

References

Armantier, O, Bruine de Bruin, W, Topa, G, van der Klaauw, W and Zafar, B (2015), "Inflation Expectations and Behavior: Do Survey Respondents Act on their Beliefs?", *International Economic Review*, Vol. 56(2), pp. 505–536.

Bernanke, B (2007), "Inflation Expectations and Inflation Forecasting", Speech at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts, 10 July.

Bachmann, R, Berg, T O and Sims, E R (2015), "Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence", *American Economic Journal: Economic Policy*, Vol. 7(1), pp. 1–35.

Bruine de Bruin, W, van der Klaauw, W and Topa, G (2011), "Expectations of Inflation: The Biasing Effect of Thoughts About Specific Prices", *Journal of Economic Psychology*, Vol. 32(5), pp. 834–845.

Cavallo, A, Cruces, G and Perez-Truglia, R (2017), "Inflation Expectations, Learning, and Supermarket Prices: Evidence from Survey Experiments", *American Economic Journal: Macroeconomics*, Vol. 9(3), pp. 1–35.

Coibion, O, Gorodnichenko, Y and Kumar, S (2018), "How Do Firms Form Their Expectations? New Survey Evidence", *American Economic Review*, Vol. 108(9), pp. 2671–2713.

Kumar, S, Afrouzi, H, Coibion, O and Gorodnichenko, Y (2015), "Inflation Targeting Does Not Anchor Inflation Expectations: Evidence from Firms in New Zealand", *NBER Working Paper* No. 21814.

Malmendier, U and Nagel, S (2016), "Learning from Inflation Experiences", *Quarterly Journal of Economics*, Vol. 131(1), pp. 53–87.