Shop Around and You Will Pay More

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Introduction

This paper investigates show how shopping patterns in terms of shopping frequency and numbers of stores visited vary across demographics and explores who faces higher price.

We find store variety seeking levels that differ across different age group/household type based on UK homescan datasets, while no such store variety seeking behaviour was found based on US datasets (Aguiar & Hurst, 2007).

The older people visited more stores but used less discounts.

Related Literature

- Shopping frequency and demographics
  - Frequent vs. non-frequent shoppers; larger family, older shopper (Bawa & Ghosh 1999) (Blaylock, 1989)
  - "routine" vs. "quick/random" shoppers. (Kim & Park, 1997)
  - "loyal" vs. "non-loyal" shoppers: membership cards, discount coupons, bulk saving promotions, price deductions. (Rhee & Bell, 2002)
- Shopping frequency, price and store variety seeking
  - Households visit the store more often are more price sensitive and pay less price (Aguiar & Hurst,2007; Ainslie & Rossi, 1998; Ma et al., 2011)
  - Consumers obtain greater flexibility to choose the price level when they face higher price variability by shopping more often and by fewer units per trip. (Ho et al., 1998)
  - A higher level of store variety seeking may stand for "hedonic" consumption that often the case increases the price paid.(Miller, 1976)

Research Questions

RQ1: How does price paid vary across life cycle and household types?

RQ2: How does shopping frequency vary across life cycle and household types?

RQ3: Does higher shopping frequency relate to lower price paid?

Hypotheses

Hypothesis 1: Older consumers shop more often than younger consumers.

Hypothesis 2: Consumers without children shop more often than those with children.

Hypothesis 3: Older consumers visit more number of stores than their younger counterpart.

Hypothesis 4: Consumers without children shop in more number of stores than those without children.

Hypothesis 5: Shopping frequency is positively associated with price paid given the fact that consumers are differing in store variety seeking level.

Data

TNS Homescan data in the UK: 156 weeks from Oct 2002 to Dec 2005; Household's purchase details are recorded by using hand held barcode scanners, Universal Product Code (UPC) records product and brand sales information and information such as the category of goods, the brand name, size, flavour, etc.

21 groups of products, 15 for food(bread, sugar, butter, etc) and 6 for non-food (cleaning material, medical, personal care products,etc.)

189 products and 185,495 brands, 39 millions observation in total.

Our data covers majority of daily life shopping needs on grocery and non-grocery expenditure: weekly expenditure is £37, ONS's report in 2005 £44

Homescan dataset across all 10 regions in the UK. The households were regionally balanced in order to represent the household population equivalently.

12,477 households and all household demographics information is collected from ONS's survey data and is updated continuously.

Specific information for each household: the main shopper's age, gender, marital status, employment status, family size, children number, home ownership, car ownership, pets, the number of toilets in a house, etc.

We categorize households according to the age of main shopper into 9 cohorts. Households with age below 25 and above 75 are excluded from study, accounting for 6% of the transaction observations.

We distinguish the households by a mixed-indicator, which reflects the household's marriage, children and age characteristics.

For each purchase: ID number for household, the product category, brand specification, UPC code, the shopping trip by date, the store visited, grand weight of the item purchased, package size, price per pack, the number of packs bought, the amount of money spent on each purchase(measured by British Sterling), the amount of money saved by discounts.

The dataset covers transactions from 222 stores, including grocery stores (i.e. Tesco), convenient stores, specialty stores (i.e. Superdrug) and price-cutting stores (Savecentre)

For each household and month, we calculate shopping frequency, number of stores visited and average price paid, that are exactly the same as Aguiar and Hurst (2007). We average over the monthly observations within a household-year in order to match with the annual demographic data and to reduce measurement error.

Table 1 Household Age and Types

Household Age Range			Household Type		
	Observations	Share %		Observations	Share %
25-29	1,916	4.94	Lone parent	1,297	3.34
30-34	4,527	11.67	Other with children	1,953	5.04
35-39	5,102	13.16	Couple with children	10,024	25.85
40-44	4,394	11.33	Other, no children	9,449	24.36
45-49	4,199	10.83	Couple, no children	2,663	6.87
50-54	4,271	11.01	Single adult	3,502	9.03
55-59	4,479	11.55	Senior couple	6,465	16.67
60-64	3,690	9.51	Senior single	3,429	8.84
65-74	6,204	16			
Total	38,782	100	Total	38,782	100

Methods

H1-4: Multiple regression with standard error adjusted for heteroscedasticity and clustered.

H5: Two stage least square and instrumental variables

Normalized price index (similar to Laspeyres index, differences in price index reflect price differentials for the identical goods, but not reflect differences in the quality of goods purchased)

Normalized quantity

Normalized monthly expenditure

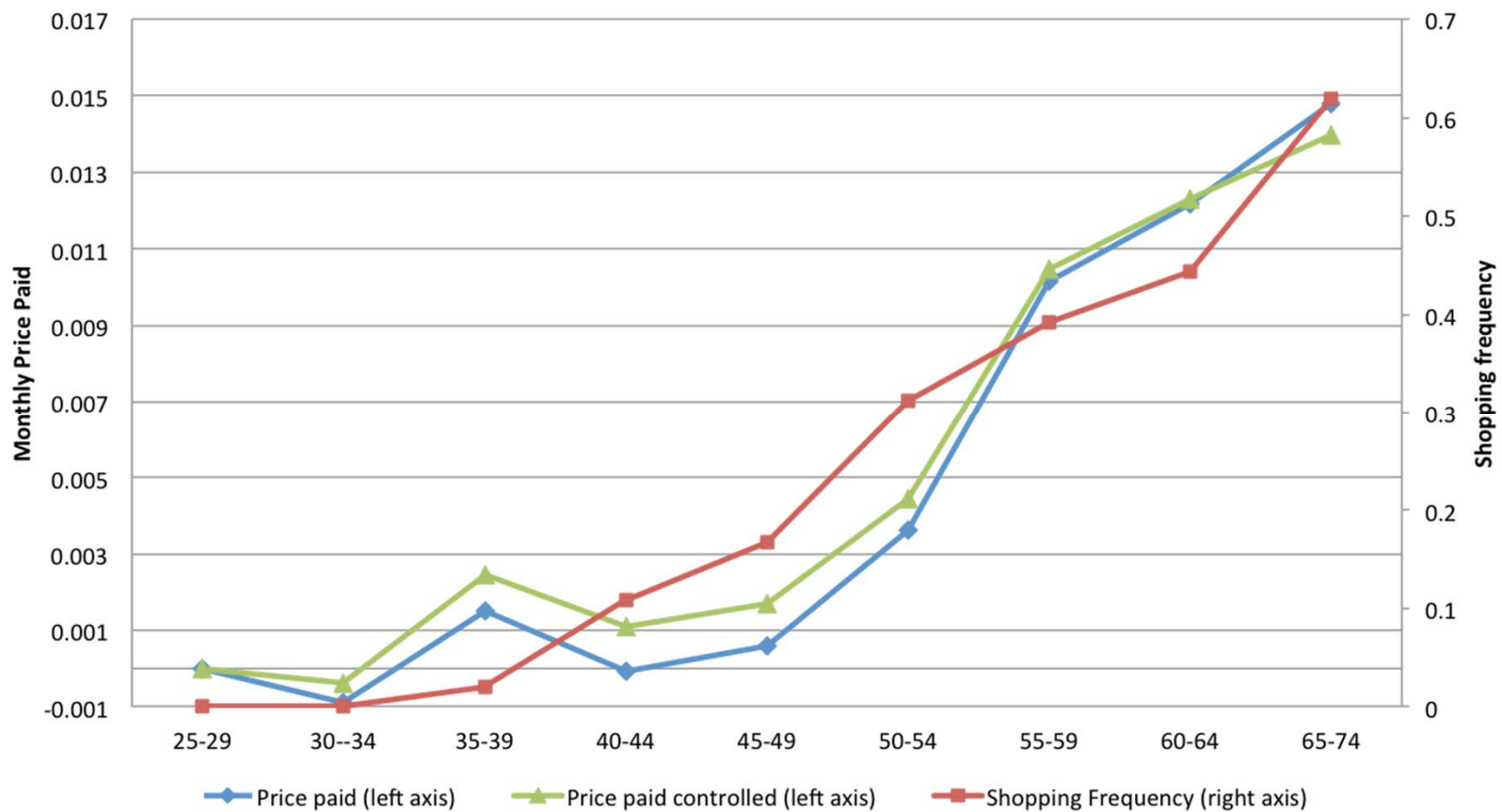## Table2. Price Paid and Shopping Frequency across Age Groups
Log Deviation from Age 25-29

Regressors	ln(Price)		ln(Shopping Frequency)		ln(Num.of Store Visited)	ln(Num.of Trips per Store
	I	II	III	IV	V	VI
Age 30-34	-0.001	0	0.041	0.001	-0.002	0.002
	(0.001)	(0.001)	(0.032)	(0.028)	(0.025)	(0.012)
Age 35-39	0.002	0.002	0.146	0.021	0.015	0.005
	(0.001)	(0.001)	(0.031)	(0.027)	(0.025)	(0.012)
Age 40-44	0.000	0.001	0.249	0.109	0.078	0.031
	(0.001)	(0.001)	(0.033)	(0.028)	(0.026)	(0.012)
Age 45-49	0.001	0.002	0.34	0.167	0.099	0.067
	(0.002)	(0.002)	(0.033)	(0.029)	(0.027)	(0.013)
Age 50-54	0.004	0.004	0.474	0.312	0.199	0.113
	(0.001)	(0.001)	(0.033)	(0.029)	(0.027)	(0.013)
Age 55-59	0.01	0.01	0.601	0.392	0.293	0.099
	(0.001)	(0.001)	(0.033)	(0.028)	(0.027)	(0.013)
Age 60-64	0.012	0.012	0.631	0.444	0.318	0.127
	(0.001)	(0.001)	(0.034)	(0.03)	(0.028)	(0.013)
Age 65-74	0.015	0.014	0.812	0.619	0.452	0.168
	(0.001)	(0.001)	(0.031)	(0.027)	(0.025)	(0.012)
Include Controls for Shopping Needs	No	Yes	No	Yes	Yes	Yes
N	38,782	38,782	38,782	38,782	38,782	38,782

Figure 1. Price and Shopping Frequency across Age Ranges

Table 3. Price Paid and Shopping Frequency across Household Types
Log deviation from lone parent

Independent Variable	ln(Price)		ln(Shopping Frequency)		ln(Num.of Store)	ln(Num.of Trips)
	I	II	III	IV	V	VI
other_with_child	-0.003	-0.002	0.144	-0.098	-0.06	-0.037
	(0.002)	(0.002)	(0.026)	(0.037)	(0.033)	(0.016)
couple_with_child	0.001	0.002	-0.409	-0.19	-0.121	-0.066
	(0.002)	(0.002)	(0.030)	(0.031)	(0.028)	(0.013)
Other no child	0.009	0.01	-0.224	0.047	0.035	0.015
	(0.002)	(0.002)	(0.025)	(0.031)	(0.028)	(0.014)
couple_no_child	0.01	0.011	-0.327	0.11	0.055	0.056
	(0.002)	(0.002)	(0.033)	(0.035)	(0.032)	(0.016)
single_adult	0.012	0.012	-0.511	0.313	0.184	0.126
	(0.002)	(0.002)	(0.041)	(0.034)	(0.031)	(0.016)
senior_couple	0.016	0.016	-0.469	0.342	0.279	0.073
	(0.002)	(0.002)	(0.024)	(0.032)	(0.030)	(0.014)
senior_single	0.019	0.018	-0.428	0.496	0.314	0.208
	(0.002)	(0.002)	(0.035)	(0.034)	(0.031)	(0.015)
Controls for shopping Needs	No	Yes	No	Yes	Yes	Yes
N	38,782	38,782	38,782	38,782	38,782	38,782

Figure 2. Price and Shopping Frequency across Household Types
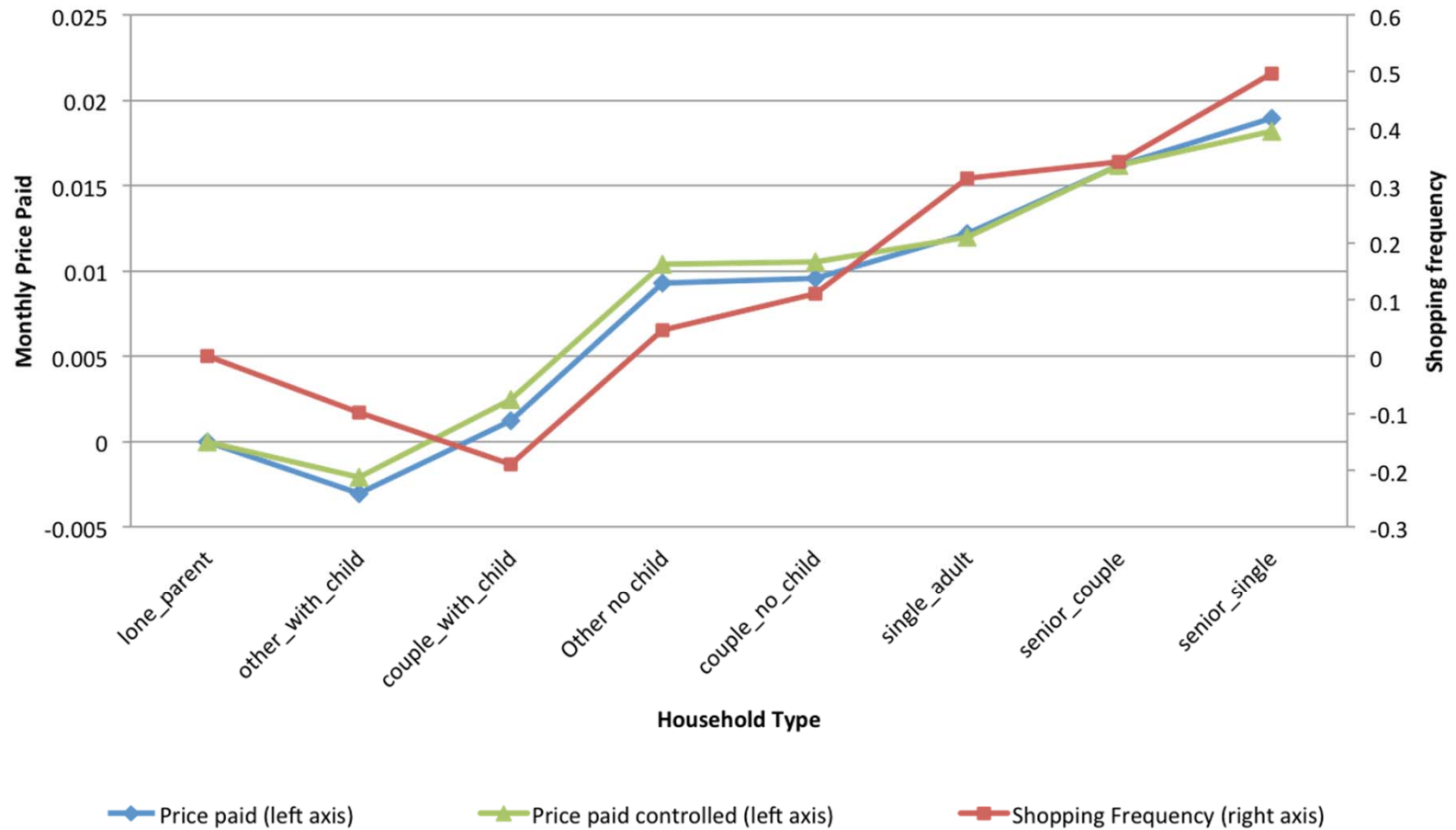
Figure 3. Store Variety and Store Intensity across Age Range

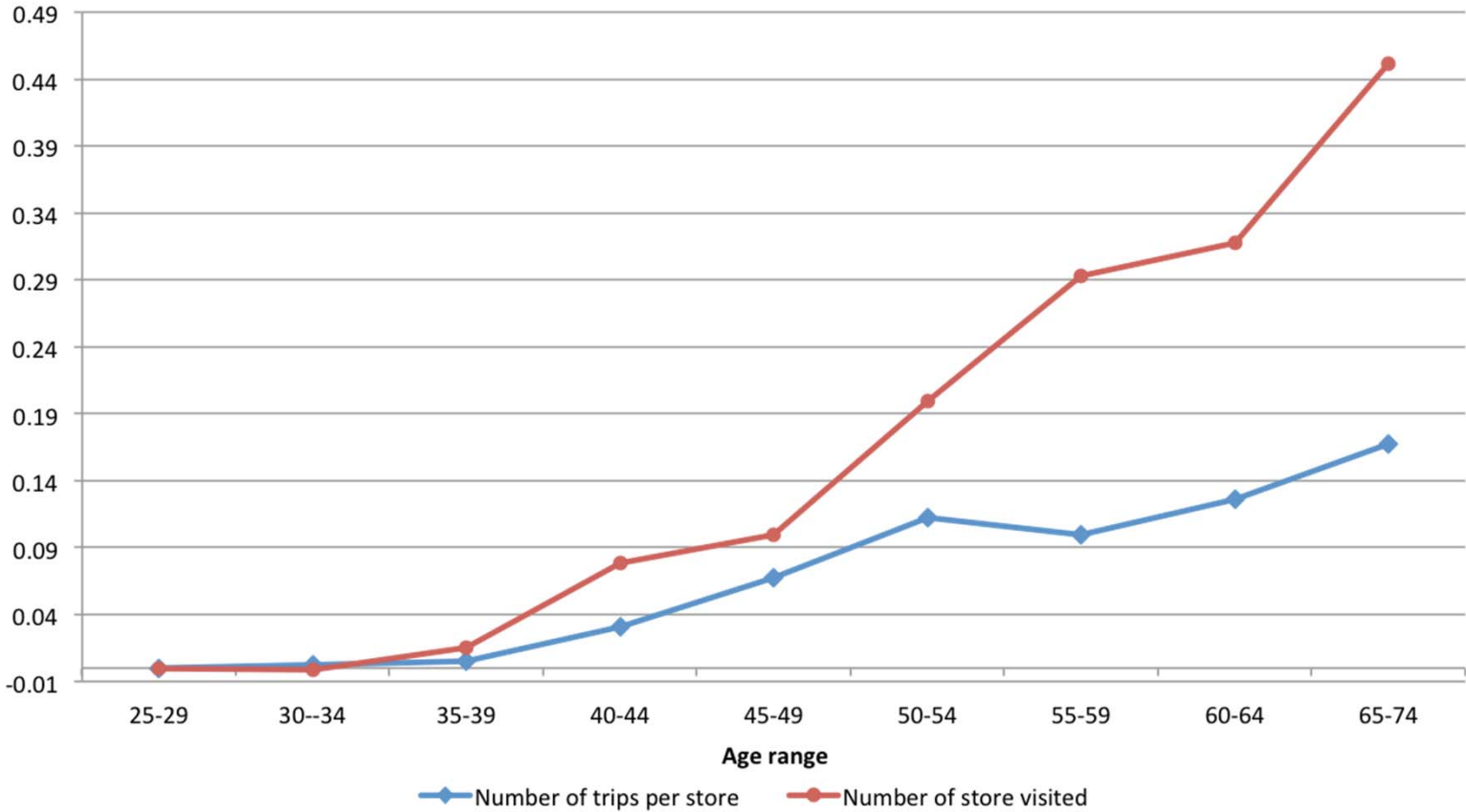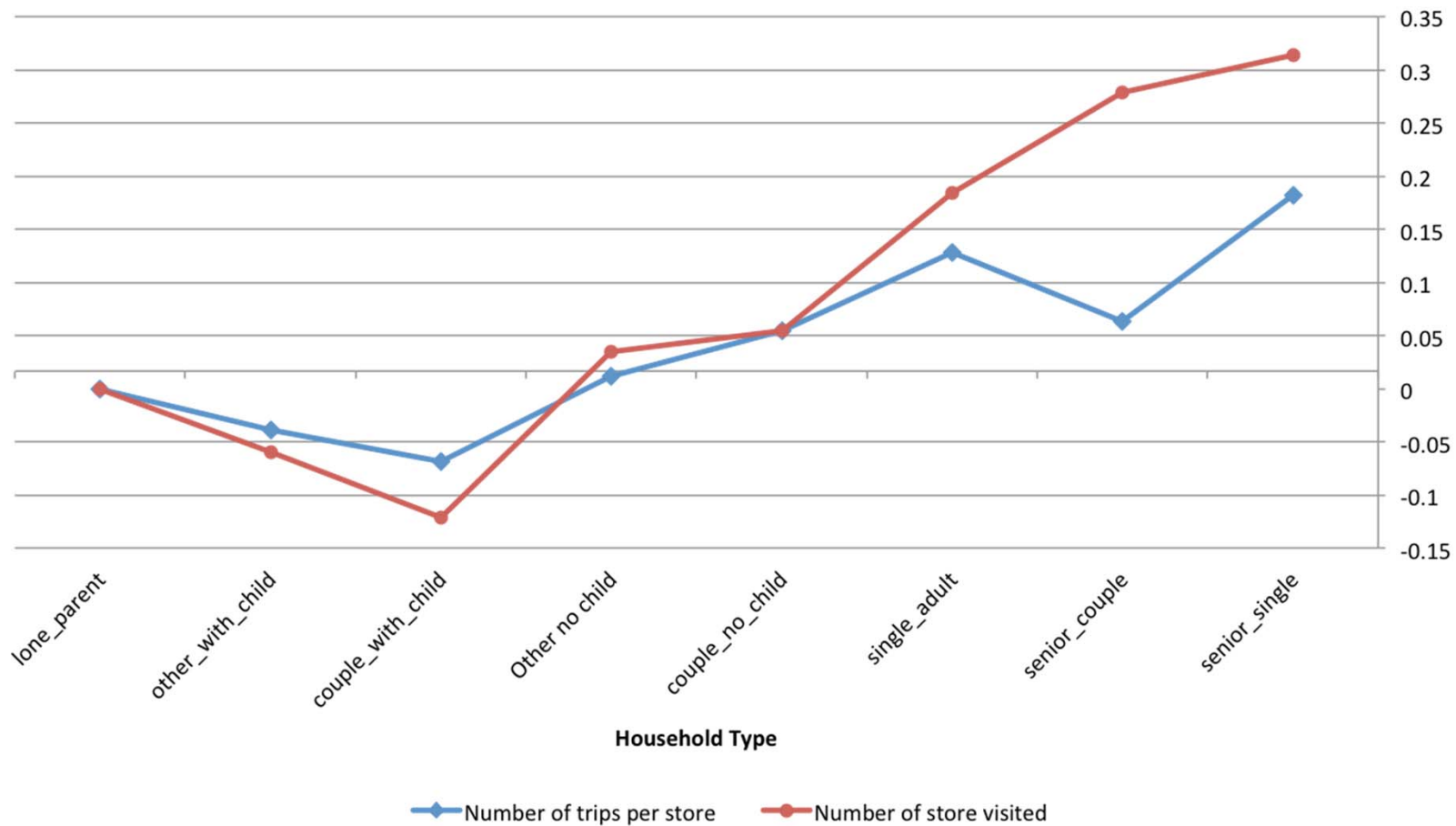# Figure 4. Store Variety and Store Intensity across Household Types

Ln_P	I	II	III	IV	V	VI	VII	VIII
Estimated elasticity:	-0.002	0.01	0.01	0.01	-0.004	0.016	0.01	0.01
Standard error	0.0004	0.004	0.002	0.002	0.0004	0.007	0.003	0.003
Measure of shopping patterns	Shopping frequency per month	Shopping frequency per month	Shopping frequency per month	Shopping frequency per month	Number of stores visited per month	Number of stores visited per month	Number of stores visited per month	Number of stores visited per month
Regression type	OLS	IV	IV	IV	OLS	IV	IV	IV
Instrument set	None	Toilet number dummies	Marriage dummies	Marriage and Number of Toilets as dummies	None	Toilet number dummies	Marriage dummies	Marriage and Number of Toilets as dummies

Table 4. Elasticity of Price with Respect to Shopping Patterns

Discussion

Older consumers shop more frequently but pay higher prices.

Consumers without children shop more frequently but pay higher prices.

Does higher shopping frequency relate to lower price paid?

No.

Why?

Store variety make the differences.

Behavioural Explanation:
we re-estimated the regressions of Table 2 and Table 3, Column II, including the average number of store visited (store variety). This additional control explains a large proportion of variation in price paid across age ranges and household types. Specifically, the 1.4 per cent differential in price paid between those aged 65-74 and those aged 45-49 increases to 1.7 per cent. It means that 22 per cent of the increase in price paid by post-middle age can be explained by store variety seeking behavior.
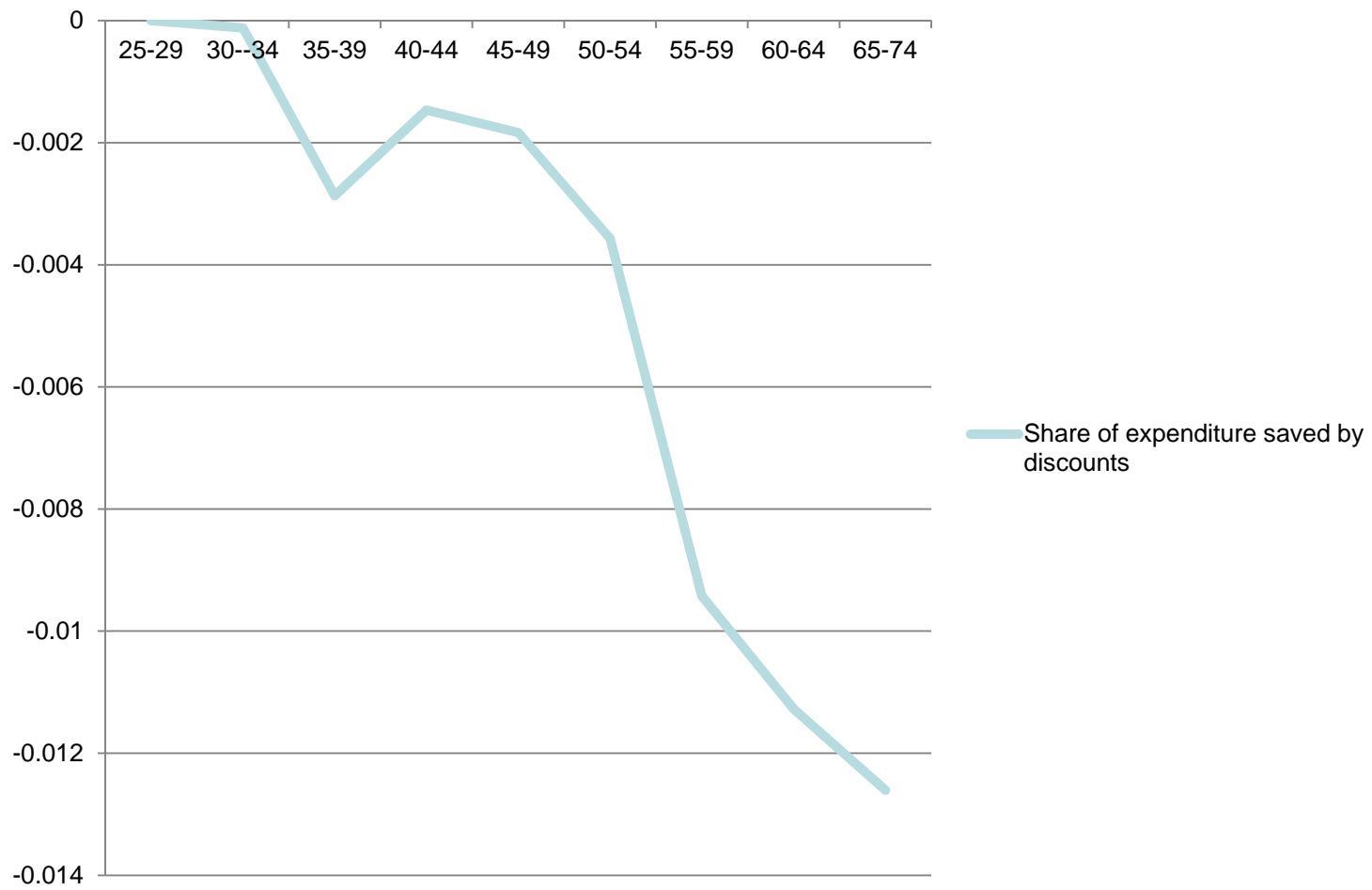
Discussion

Theoretical implications

Shopping frequency is a valuable resource for to understand consumer behaviour. In this study, we explore factors that constitute shopping frequency --- store variety and store intensity, and find that store variety account for 22% differences in price paid between middle aged households and their older counterparts.

Contribution

1. A substantial contribution that pin down how shopping frequency influence price paid, complementing previous empirical findings in U.S.

2. A methodological contribution

   We take heterogeneity across households into consideration due to the fact that households may differ in their shopping skills, preferences and inventory costs by using instrumental variables. By doing this, we can generate a more reliable comparison in real purchasing power across time and consumers.

3. Unavoidable Cohort effects

   Normalization for variables can minimize cohort effects

Thank you!

Questions…

Following Aguiar and Hurst (2007), we build a price index that is used to compare the actual cost of a household's shopping basket to the cost of the identical shopping basket at average prices. Specifically, we define the price of item $k \in K$ shopped by household $i \in I$ on date t by $p_{k,t}^i$, and the relevant quantity bought by $q_{k,t}^i$. Accordingly, we can calculate the actual total expenditure during month l as $E_l^i = \sum_{k \in K, t \in l} p_{kt}^i q_{kt}^i$. We can define the average price of item k as a ratio between the total expenditure across different households and the total quantity bought by all households, which can be shown as:

$$\bar{p}_{k,l} \equiv \frac{\sum_{i \in I, t \in l} E_l^i}{\sum_{i \in I, t \in l} q_{k,t}^i} \qquad (1)$$

Then, we can calculate the cost of a basket of goods under average prices as:

$$C_l^i = \sum_{i \in I, t \in l} \bar{p}_{k,l} q_{k,t}^i \qquad (2)$$

Therefore, the price index for the household i during month l can be calculated as the ratio of expenditures at actual prices divided by the cost of the basket at the average price, normalized by dividing through the average price index across households:

$$p_l^i = \frac{\frac{E_l^i}{C_l^i}}{\frac{1}{I} \sum_i \frac{E_l^i}{C_l^i}} \qquad (3)$$

The price index constructed above is similar to Laspeyres index that the basket of goods is the same though the prices between numerator and denominator can vary. We need to point out that differences in our price index just reflect price differentials for the identical goods, but do not reflect differences in the quality of goods purchased.