On WARP, consistency and motives in buying behaviour

Abstract

The consistency in consumers' buying behaviour is studied here using the Weak Axiom of Revealed Preferences (WARP). The experiment conducted here gathers the subjects' choices and checks them for consistency using WARP violations. We inspect the possible reasons and underlying motives that explain this consistency.

§1 Introduction

Are consumers consistent in their buying behaviour? This question is fundamental to modelling consumer behaviour in economics. There are two distinct approaches to modelling consumer behaviour, namely, the preference-based approach and the choice-based approach. While the former is a traditional approach involving unobservable constructs[1] like preferences and utility, the latter treats choice behaviour, which is directly observable, as the primitive feature. [7] Mas-Colell et al assert that the central assumption of the choice-based approach, WARP imposes an element of consistency on choice behaviour, which in a sense parallels the rationality assumptions of the preference-based approach.

We assume that the consumer exercises a choice in a given budget set. This choice depicts her revealed preferences over all the other bundles in the budget set. In this paper, we design an experiment to test the consistency[2] of consumer behaviour based on their choices in different price-wealth scenarios. A consumer's buying behaviour is said to be consistent if their choices satisfy WARP. [2] We attempt to identify the various motives that could play a role in driving consistent buying behaviour.

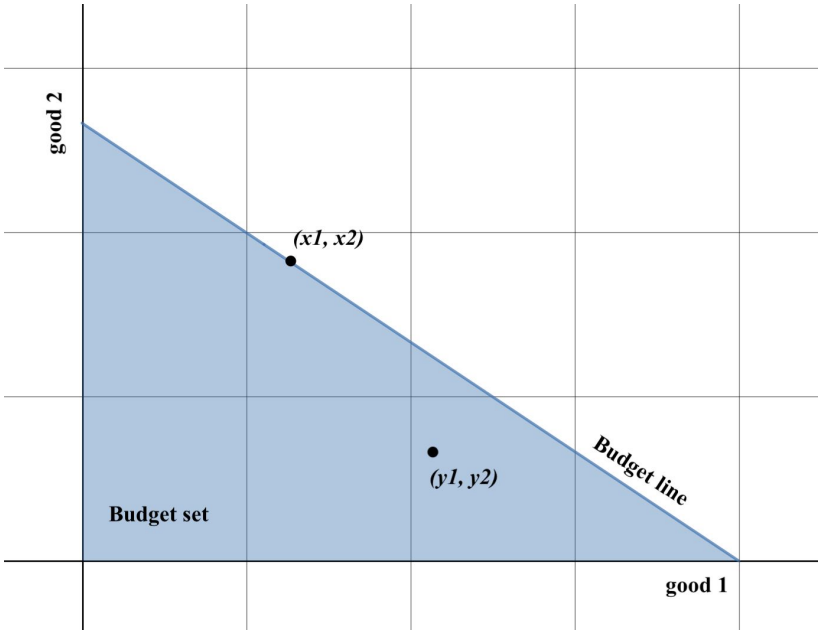
[1] In Samuelson's words, "to develop a theory of behaviour freed from any vestigial traces of the utility concept."
[2] The term consistency, here, refers to internal consistency of choice which is a central concept in microeconomics, decision theory, game theory and behavioural economics. [9]

§2 Theory

Revealed Preference

Revealed Preference is a binary relation that holds between a demanded bundle and all other bundles in the budget set that could have been demanded. [3]

Definition. Let (x_1,x_2) be the chosen bundle when prices are (p_1,p_2), and let (y_1,y_2) be some other bundle such that $p_1x_1 + p_2x_2 \geq p_1y_1 + p_2y_2$. Then if the consumer is choosing the most preferred bundle she can afford, we must have $(x_1, x_2) \succ (y_1, y_2)$.



WARP

The weak axiom states that if bundle x is ever chosen when bundle y is available, then there can be no budget set containing both alternatives for which y is chosen and x is not. [6]

Definition. Let $\mathfrak{B}$ denote a family of nonempty budget sets and let $C(.)$ denote a choice rule. The choice structure $(\mathfrak{B}, C(.))$ satisfies WARP if the following property holds:

If for some $B \in \mathfrak{B}$ with $x, y \in B$, we have $x \in C(B)$, then for any $B_1 \in \mathfrak{B}$ with $x, y \in B_1$ and $y \in C(B_1)$ we must also have $x \in C(B_1)$

In order to check for the satisfaction of WARP, the direct revealed preference (characterized by the direct comparison between two goods) is taken into account.

§3 Protocol

The experiment was conducted on a set of 40 postgraduate students. Each subject was given an endowment in the form of candies (m). The subject (*S*) was allowed to 'buy' bundles of chocolates (c) and toffees (t) using their endowment. The prices of chocolates and toffees were varied with every trial as shown in Table 1. In the final trial, the endowment was also altered. Each trial was conducted in two scenarios, depicted by Table 2 and Table 3. In the first scenario, *S* was allowed to choose any bundle that may/may not exhaust her candies. In the second scenario, *S* was told that any remaining candies after the purchase would be taken away by the experimenter. This forced *S* to completely exhaust the given endowment.[3]

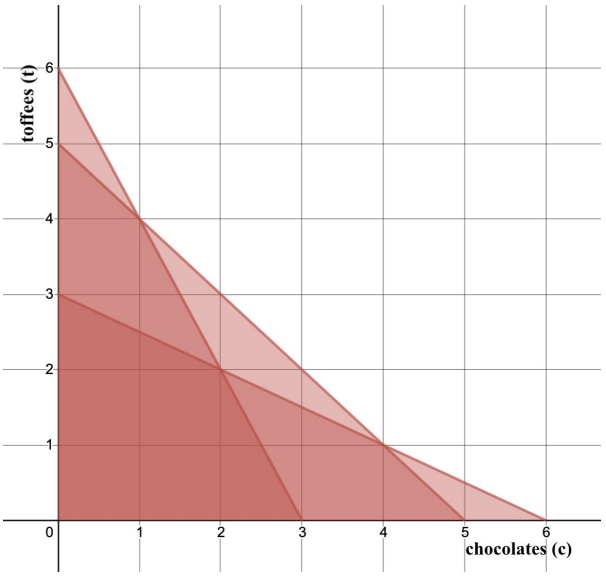
Table 1: Trials, prices and endowment, with candy as numeraire.

	Trial 1	Trial 2	Trial 3
Price of chocolates (p_c)	2	1	1
Price of toffees (p_t)	1	2	1
Endowment (m)	6	6	5

For each trial, in scenario 1, *S* was allowed to choose any feasible bundle that satisfies the budget sets shown in Table 2.

Table 2.

Scenario 1: Budget set	
Trial 1:	$2c + t \leq 6$
Trial 2:	$c + 2t \leq 6$
Trial 3:	$c + t \leq 5$

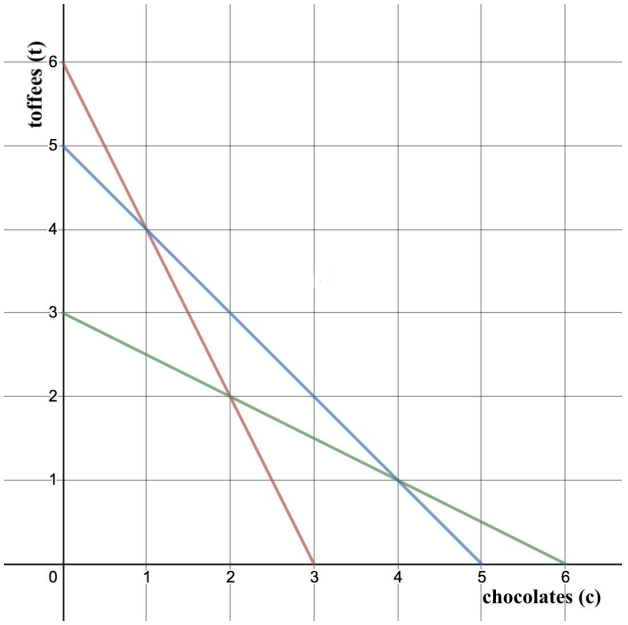


[3] The experiment conducted by Harbaugh in [8] restricted the subjects to choose only from the budget line. Here, however, we allow the subjects to choose from the budget set. The rationale here is that people in real life scenarios may not choose to exhaust their budgets completely.

For each trial, in scenario 2, *S* was constrained to choose bundles on the budget lines only:

Table 3.

Scenario 2: Budget line	
Trial 1:	2c + t = 6
Trial 2:	c + 2t = 6
Trial 3:	c + t = 5



§4 Observations and inference

The outcomes of the experiment capture various manifestations of buying behaviour of consumers. Of the **40 subjects**, **18 showed a clear case of WARP violations** in scenario 1. The following table summarises the distinct cases as observed during the experiment:

Table 4: WARP violations.

Subject $[p_c, p_t]$	**Trial 1 [2,1]**	**Trial 2 [1,2]**	**Trial 3 [1,1]**	**WARP Violation**	**Inference (Reason)**
4	3,0	6,0	5,0	No	WARP was not violated because the consumer had a strict preference for one of the goods and aims to maximize the quantity of that good
22	0,3	6,0	3,2	No	Although the first bundle was affordable in successive trials, the bundle chosen in trial 2 was not affordable in trials 1 and 3, likewise, the bundle chosen in trial 3 was not affordable in trials 1 and 2.
21	1,1	1,1	1,1	No	The consumer consecutively chose the same bundle irrespective of price or endowment.

16	0,0	0,0	0,0	No	The consumer saves all her endowment in all trials showing consistency in buying behaviour.
27	2,2	2,2	2,3	No	The consumer chose the same bundle in the first two trials. The bundle chosen in trial 3 was not affordable in the other trials.
34	0,6	6,0	5,0	No	The consumer maximizes the number of goods, irrespective of price or endowment showing no strict preference towards any good.
25	1,2	2,1	2,2	Yes	All bundles were affordable in all three trials, showing inconsistency in buying behaviour.
30	1,4	0,3	0,5	Yes	The consumer chose different bundles in trials 1 and 3, although both were affordable in both the trials.

However, in scenario 2, there were **no violations of WARP**[4]. This appears to be a peculiar case at face value. However, a close inspection would show that this was a result of restricting them on the budget line, i.e, exhausting their endowments. Even the choice of bundles that were common to any two budget lines did not lead to a WARP violation. This is because, if the subject chose the common bundle in one trial, she could not have chosen that bundle in the other trial as it did not belong to the choice set of the former budget.

For example, a subject chose (1,4) in trial 1 and (0,5) in trial 3. The bundle (1,4) was affordable in the trial 3 as well. But, this did not lead to a WARP violation because the bundle (0,5) was not in the choice set (as it was not exhausting the endowment) during trial 1.

[4] WARP violations have been checked manually and graphically, here. This method has been cross-checked with the algorithm in the Mathematica notebook provided by Harbaugh and with the methodology implemented in [1].

§5 Results & Discussion

The following results can be drawn from the experiment:

- The consumer having a strict preference for any one of the goods is unlikely to violate WARP, indicating consistent behaviour. This appears to be a valid proposition as the consumer's motive is to maximize the quantity of the good she likes irrespective of the prices and endowment.
- The consumer who chooses the same bundle irrespective of price and endowment doesn't violate WARP as she exhibits clear consistency in buying behaviour.
- The consumer who chooses not to buy any of the goods in all the three trials also doesn't violate WARP and exhibits consistency. It is fair to conclude that consumers whose motive is to, trivially, spend nothing and save money are consistent.[5]
- The consumer whose motive is to maximize the total quantity of goods and does not have any strict preference towards any of the goods is likely to show consistent behaviour as she will always choose the lowest priced good in maximum quantity.
- Consumers who chose different bundles that were affordable in all price-wealth trials, violated WARP and showed a clear inconsistency in choices.
- When consumers were compelled to exhaust their endowment, they showed no WARP violation indicating consistency.
- It was observed that 60% of the subjects chose to save some quantity of the endowment. This alludes to the tendency to save that is often observed in consumer behaviour.

[5] Although in reality, such a case is unlikely to occur as the consumer will spend some wealth due to autonomous consumption. (c=a+mdY)

§6 Conclusions

It was seen that in all the above cases of consistent consumer behaviour, there was an underlying motive behind the choice made. Some of these motives are - *strict preference for one good, quantity maximization, saving tendency* etc. Even previously inconsistent subjects were consistent in the *endowment exhaustion* scenario. Our assertion is that endowment exhaustion drives them to consistent buying behaviour. Thus, it can be concluded that *if the consumer has an inherent motive while making a purchase, she is likely to be consistent in her choices*.

This conclusion is in conformity with Amartya Sen's arguments presented in [9]. He argues against restricting the explanation of buying behaviour solely using internal correspondences and further asserts that consistency of buying behaviour cannot be examined without external factors such as motivation, objectives and substantive principles.

Through this paper, we can now assert that consistency in buying behaviour can be checked using WARP. Motivations and other external factors influence this consistency in different contexts.

Limitations

- The framing problem: This experiment does not accommodate the variations in behaviour arising from the framing problem. Choices may have varied if the order of the trials/scenario was different.
- People with a strict preference towards any particular good are likely to behave differently when a different set of goods is offered. Experiments based on a finite set of goods cannot yield generalized results about this consumer's behaviour.

§7 References

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