**Identification of the Preference Effect**

John Vandivier

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**1 Introduction**

Prices, price effects, income, and income effects are all foundational to theoretical and applied economics. There is a third key variable in theory without which no economic problem may be solved, but this variable is routinely exempted from inclusion in applied work. This paper presents experimental evidence to the effect that preferences and preference effects are key independent determinants of demand.

Hicks and Allen (1934) presented a contribution to price theory and the neoclassical approach to microeconomic problem solving. This paper is only one of many illustrating the wide use of a particular microeconomic approach. Shortly thereafter, Hicks and Allen published a follow up piece (1934) called *A Reconsideration of the Theory of Value. Part II*. In this paper we already see an emphasis on price-elasticity and income effects. There is no consideration about the possibility of a change to demand in a situation of constant prices. The thesis of this paper is that such a consideration is needed.

The second writing from Hicks and Allen elaborated and extended the mathematical approach of the first paper. The second paper did not have any illustrations. In the microeconomic literature today it is uncommon to find explicit illustrations in the manner of their first writing, but microeconomic models in the literature today continue to follow the mathematical approach of the second writing.

Almeida et al (2004) and Foster et al (2016) are examples of modern microeconomic analyses. These papers assume a constrained optimization approach consistent with the earlier work by Hicks and Allen. There is one notable difference, which is that the modern papers model firm behavior while Hicks and Allen proposed their model as a representation of individual choice.

One important difference is that the modern papers do not model firms as maximizing subjective utility. Instead of maximizing utility the firms maximize profit or dividends. This is an example of method which this paper is meant to criticize. Firms are organizations of people and a realistic model of firm behavior must ultimately refer to the preferences of individuals.

As Von Mises (2016) recognized early on, the removal of preferences from an economic problem causes the problem to fundamentally transform into a simple technical or engineering problem. This removes the ability of any optimization to reflect an improvement to human welfare. Instead, solving a technical problem simply indicates that output is maximized for a given level of expenditure. Mises stated, referring to the socialists:

There hovers before the holders of this tenet a muddled conception of technical rationality, which stands in antithesis to economic rationality, on which also they are not very clear. They are wont to overlook the fact that "all technical rationality of production is identical with a low level of specific expenditure in the processes of production." They overlook the fact that technical calculation is not enough to realize the "degree of general and teleological expediency" of an event; that it can only grade individual events according to their significance; but that it can never guide us in those judgments which are demanded by the economic complex as a whole.

Admittedly, full modelling of each agent in an organization is a difficult task and assuming profit maximization is empirically useful. The ideal complexity of a model is such that the marginal benefit of the model equals the marginal cost of the creation and use of that model, so it does not follow that maximum complexity is ideal. That being said, this paper will highlight a case where an extended model is empirically feasible. The contention of this paper is that analysts will often, not always, find that the inclusion of preference data is more beneficial than costly. The inclusion of such information also allows the analyst to better make stronger claims about welfare rather than claims only about productivity.

Hicks and Allen do not emphasize the role of preferences, but Stigler and Becker outright prohibited their analysis (1977). Stigler and Becker claimed that everyone agrees preferences “are not capable of being changed by persuasion,” but that there is some debate about whether preferences are useful data or whether they are “the same to all men.” They proceed to argue in favor of the latter using a framework called Z theory. The paper was widely accepted and the result was the methodological exemption of preferences from causal explanation of demand changes.

Z theory has come under fire from a number of angles. It is no longer clear that the consensus of economists supports the theory, although most applied papers still do not include preference variables. Behavioral economists are largely supportive of the possibility of dynamic and heterogeneous preferences, but such economists are a minority. Cowen (1989) argues that Z theory is problematic on logical grounds because it presents an infinite regress problem. Pons (2016) presents empirical evidence that preferences can be changed by persuasion.

Caplan (2003) argues that psychologists have generated a credible theory of preferences and that preference-based explanations are scientifically meaningful and empirically important. The present paper can be seen as experimental and empirical test of some of Caplan’s discussion. Dasgupta et al (2014) also presents experimental evidence in favor of heterogeneous preferences, but their selected indicators of preference are risk, competitiveness, and confidence, rather than preference for any particular good.

Figure 1 illustrates how the preference effect can be isolated in theory, following the approach of Hicks and Allen. Either axis represents a quantity of some good, the oblique lines are budget constraints, and the convex curves are indifference curves. The individual begins with preferences in green and income of 40, optimizing at the bundle (20, 20). Without a change in price, the individual’s preference exogenously shifts. Given the new indifference function, the individual may choose (20, 10) and obtain a level of utility equal to the previous optimum at (20, 20). However, if the individual chooses (20, 10) he or she will not have consumed all available income. The individual finally consumes at about (26.5, 13.5) and obtains a higher level of utility.

Using this approach any change in demand is attributed to a change in the indifference curve if it is not explained by a change to income or prices. This sort of indifference curve captures many components of the economy and it can be considered to represent the ecological preference of an individual. The ecological preference stands in contrast to what can be considered a pure preference effect.

Consider that Joe likes to smoke cigarettes, but his friends think that this is a bad habit and they exert a social pressure on Joe not to engage in this behavior. If Joe values the opinions of his friends he is expected to voluntarily consume fewer cigarettes than he otherwise would. It may be convenient to consider such social pressure to be an indirect cost, but neither price nor income has changed for Joe. Formally, then, social pressure is a transformation to the indifference curve rather than a change to prices. Joe’s preference for cigarettes in the absence of this social pressure is his pure preference, while his preference conditional on social pressure is his ecological preference. It is the latter which is represented by the indifference curve.

Social pressure is only one example of the many factors captured in an indifference curve. Another factor which will later be included in the model is gender. There are particular products which women systematically prefer to consume more frequently than men. The econometrician will assign a coefficient to the dummy variable representing gender, but the coefficient assigned is consistent with a preference effect. In short, a woman prefers to consume certain feminine products precisely because she is a woman. To say that the causal effect is attributed to gender does nothing to undermine the theoretical position that the causal effect is a component of ecological preference.

A final theoretical modelling question to discuss before proceeding to the empirical model is on the question of information. In the Hicks-Allen framework, which is really the neoclassical framework writ large, the individual stock of information is a component of the indifference curve. The design of this paper includes a treatment of information. It is a survey-as-experiment design, if you will, where the experimental component is a simple exposure to textual information. From a theoretical point of view, this treatment should be a direct shifter on the indifference curve.

It is asserted that the individual’s stock of knowledge is a component of ecological preference, but a bit more work is needed to show that it is in fact a component of pure preference. Consider that Joe has some positive preference for chocolate croissants. He enters a bakery for the first time and learns that this bakery sells such croissants. Joe cannot be certain of the quality of these croissants, but he takes a gamble on the expectation that he will enjoy the croissants produced by this shop about as much as he would enjoy an average croissant from any other shop.

To his dismay, the moment the food touches Joe’s taste buds he immediately realizes that he had overestimated the utility he would gain from the purchase. From this thought experiment we learn that some kinds of information are inseparable from preferences. When Joe’s taste buds transmitted the information about the croissant to Joe’s brain, Joe’s stock of knowledge increased. This process of information change is not a confounder to Joe’s decision to value the croissant. It is not even a separate process. It is the same process. Whatever change in demand Joe obtains from this change in knowledge is considered a pure preference effect.

The remainder of the paper proceeds beginning with a review of the empirical design in section 2. Section 3 reviews the results, and section 4 concludes.

**2 Empirical Design**

This paper uses an experimental design conducted through the administration of an online survey. The questions included in the survey are found in Appendix A. Questions 1 through 4 and 10 are standard covariates. Questions 5 through 8 address the key input and output variables. Following Pulford (1996), question 9 is a question on confidence which is checked as a covariate and also as a weight.

85 individuals were surveyed, but the survey administration anticipated an unexpected problem and individuals were able to submit illegal values. For questions where individuals were instructed to enter a number between 0 and 10, the survey allowed entries between 0 and 100. Summary statistics are presented on the raw survey output, but the data is reshaped for further analysis.

The predicted variable is quantity demanded. Key right hand variables include price and a treatment dummy. Other standard covariates are included as well. Each individual is asked 4 questions about the quantity of a good they would consume under certain conditions, and these 4 responses are reshaped into 4 separate observations for regression analysis.

In each of the four scenarios the individual is told that they have a budget of $10 which they must completely exhaust toward consumption of chocolate or almond croissants. In the first and third scenarios they are told that both kinds of croissants cost $1. In the second and fourth scenarios the chocolate croissant costs $1.50 while the almond croissant costs $1.

In the first and second scenario they are told that they are visiting a new café, but in the third and fourth scenarios they are told that they are returning to the café after having learned that the chocolate croissants are not as good as they had originally expected. This magnitude of the reduction in value is intentionally left subjective, but it is expected to have a negative sign. In theory it becomes clear that we expected Q1 ≥ Q2 ≥ Q3 ≥ Q4, where each Q is the quantity demanded by the individual in a given scenario.

Each individual was randomly assigned an ID and the sample was split based on whether the ID was even or odd. A model was derived by exploring the even group and tested for robustness against the odd group. If the individual preferred to consume 0 from the beginning, they were assigned a value of one on the dummy indicator ZeroBaseline.

**3 Results**

The preference effect was identified with significance and importance. The p-value for the treatment variable in the final specification was larger than the p-value on the price variable. The point value on the coefficient of the treatment variable is smaller than the coefficient on the price variable, but the 95% confidence interval on the price variable entirely includes the 95% confidence interval on the treatment variable. As a result, the preference effect is considered not only theoretically co-equal with the price effect, but empirically so as well.

Summary statistics provided in Table 1 and 2 show that the expected relationship Q1 ≥ Q2 ≥ Q3 ≥ Q4 exists in the raw survey output regardless of whether illegal values are dropped, although dropping those values greatly reduces the variance. A crude difference in difference variable is summarized.

Covariates add mildly to explanatory power over the short model, but few are significant and robust to sample splitting. Figure 2 illustrates a difference in means test on quantity by treatment, and the related statistics are reported in Table 3. After the data is shaped and viewed this way the treatment effect is identified as significant.

Table 4 presents specifications run against the split subsamples. Categorical variables are exempted for brevity. Model 1 and 2 were derived from the first sample and tried against the second sample. Certain variables were not robust in the context of the second sample and Model 3 and 4 resulted. Model 3 is the preferred long model and obtains the larges adjusted R-squared value, while model 4 obtains the largest number of individually significant variables.

Table 5 presents specifications run against the whole sample. After identifying Model 3 as the preferred long regression and Model 4 as another interesting model, these models were tried against the whole sample as Model 5 and Model 6. Model 7 leverages Confidence as a weigh instead of a covariate and achieves a greater adjusted R-squared with less variance in the independent variables. Model 9 is the short model and Model 8 is the short model with the addition of two structural variables, ZeroBasline and Confidence. Model 7 is the preferred specification, but note that the treatment is significant across every specification. The coefficient on the treatment variable is both robust and important.

**Data Source and Design**

The model uses a survey-as-experiment design which involves a treatment of pure information in order to shift preferences in an expected direction. The survey will be an own-procured data set which will be included in a table attached to the final paper as an appendix. The survey will be conducted through Survey Monkey and the expected sample size is between 70 and 100.

Respondents are queried for a total of 10 questions including personal factors for control purposes, hypothetical demand before treatment, and hypothetical demand after treatment. A difference-in-difference effect is measured prior and post treatment.

**Limitations**

There are several potential limitations to the paper. First, there may be selection bias into the survey which exceeds the ability to control. Second, there may be low significance due to the relatively small expected sample size. Third, the paper will only be able to establish an effect on self-reported demand, which has known deviations compared to revealed demand. Fortunately, however, there are also known corrective practices for self-reported demand.

notes

1. Whole response yields expected results
2. Difference in means test, q1 vs q3 and q2 vs q4
3. More likely than not, q3-q4 !=0, although any estimate has low confidence
4. Q5 increases variance or attenuate swings or increase swings
5. Hypothesis that illegal values are bad noise, so removing them should reduce variance
   1. Confirmed
6. Method is means tests and diff in diff
7. Consider if baseline was 0. In real world they aren’t a consumer at all.
8. Show theoretical and empirical approach. The indifference curve captures many factors which will show up separate from a pure preference effect in an econometric model. For example, if women tend to consume particular products more frequently than men this will show as a coefficient for a gender variable on an econometric model, but in theory this is still a preference effect.
   1. In practice many variables will move with price and preference simultaneously. This is an important practical issue, but in our experimental context this consideration is not needed because we control the only source of treatment. In practice there may be regional differences in both price and tastes, for example. In such a situation it remains possible to extract distinct price and preference effects by including proper interaction terms and examining the cross-correlation between the independent variables.
   2. The fact that B explains C does not undermine that A mutually explains C if it is the case that A explains B. It may be the case that an individual consumes a particular product more frequently because that individual has a property called gender which takes a particular value. From an econometric point of view we rightly claim that it is the gender which has explanatory power, but we are equally right to say based on theory: “True, preference is influenced by gender, but it is still her preference.”
   3. An interesting specification puzzle arises. If the economist truly believes that preferences are the causal element in the selection of quantities, why don’t we model preference directly as an independent variable? The answer is that such a specification is expected to be fraught with variance and error due to behavioral considerations.
      1. Would could construct a two-stage model where various factors predict preference level and preference level in turn predicts quantity consumed. That approach is worth exploring but it is not taken up in this paper and it will also involve an interesting issue. From behavioral science we have evidence that people are better at giving answers to concrete problems, such as the number of croissants they would buy, compared to abstract problems, such as their level of preference for croissants. If I had implemented such a two-stage model I would expect larger variance and error. As a result, the two-stage approach is not expected to be a good applied model, although it is the proper theoretical model. In practice I have adopted a more concrete model where the value of preference is “backed out” rather than fed in. This occurs plenty in the theoretical work as well.
   4. Todo: weighted regression, maybe chi-squared (given non-treatment, odds treatment would have same distribution)
   5. Demonstrate economic importance: 1) compare coefficient of price and preference. 2) given sample A, predict sample B with and without treatment on rhs
   6. Clean up tables to use labels

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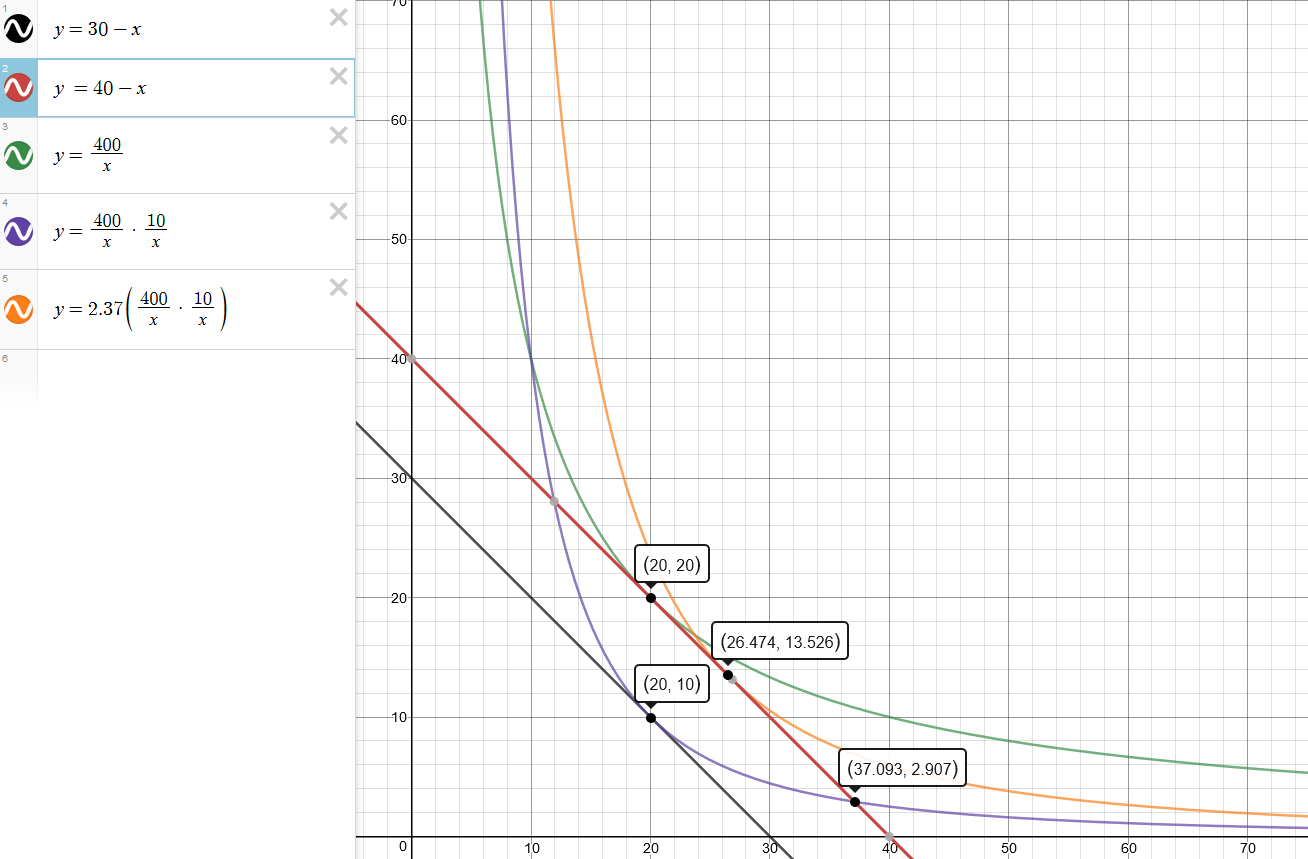
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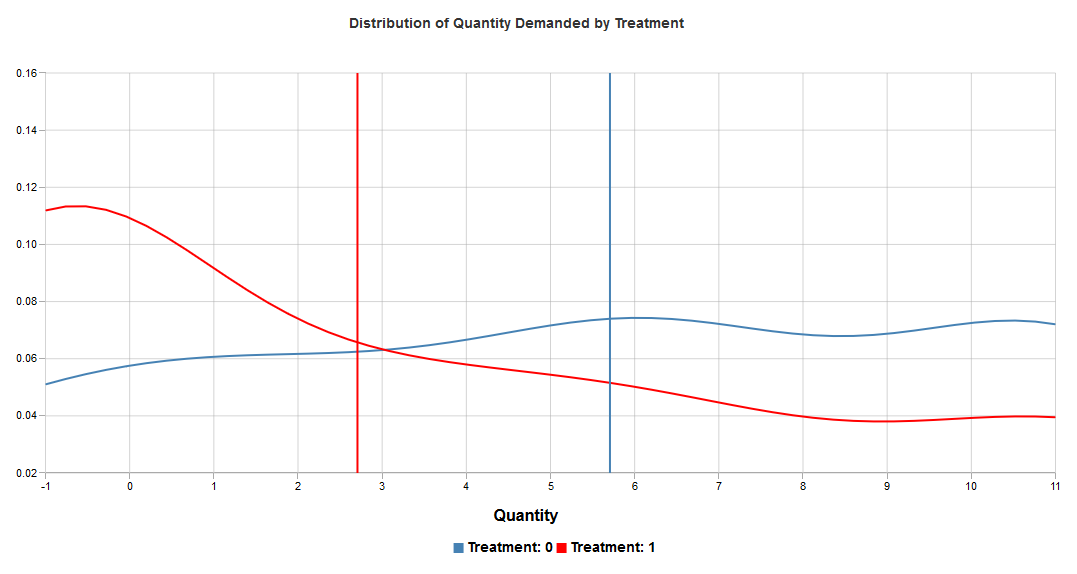
**Appendix A – List of SurveyMonkey Survey Question**

1. What is your gender?
2. What is your age group?
3. What is your income group?
4. Which race/ethnicity best describes you? (Please choose only one.)
5. You must spend $10 on chocolate or almond croissants at a new cafe. They each cost $1. How many chocolate croissants would you purchase?
6. You must spend $10 on chocolate or almond croissants at a new cafe. Chocolate costs $1.50 and almond costs $1. How many chocolate croissants would you purchase?
7. You eat a chocolate croissant from the new shop. It's not as good as you expected, but you've had worse. The next day, you must spend $10 on chocolate or almond croissants again. They each cost $1. How many chocolate croissants would you purchase?
8. You eat a chocolate croissant from the new shop. It's not as good as you expected, but you've had worse. The next day, you must spend $10 on chocolate or almond croissants again. Chocolate costs $1.50 and almond costs $1. How many chocolate croissants would you purchase?
9. On a scale from 1 to 10, how confident are you that your previous numerical answers reflect what your real behavior would be in the real world?
10. In what region of the US do you live?

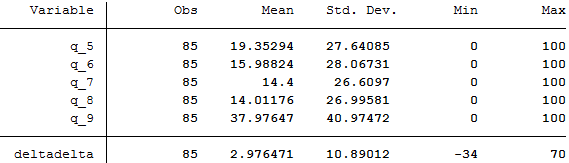
**Figure 1**



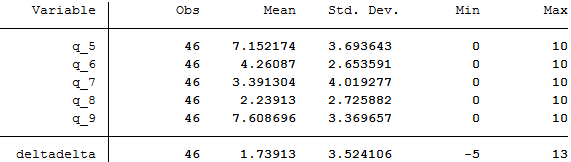
**Figure 2**



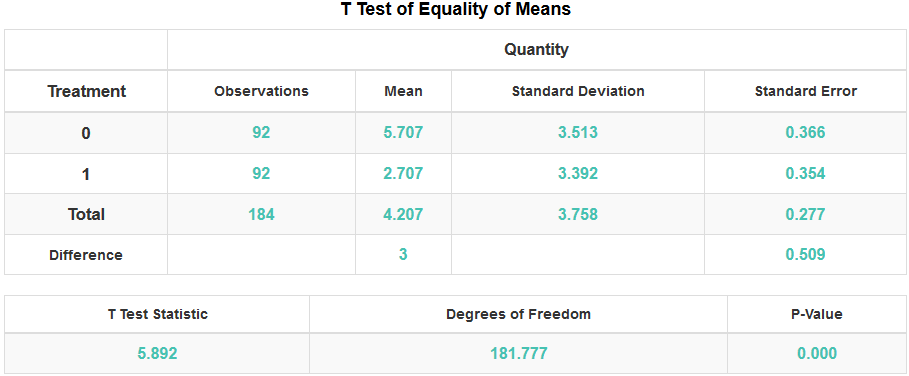
**Table 1 – Summary Statistics of Survey Output**



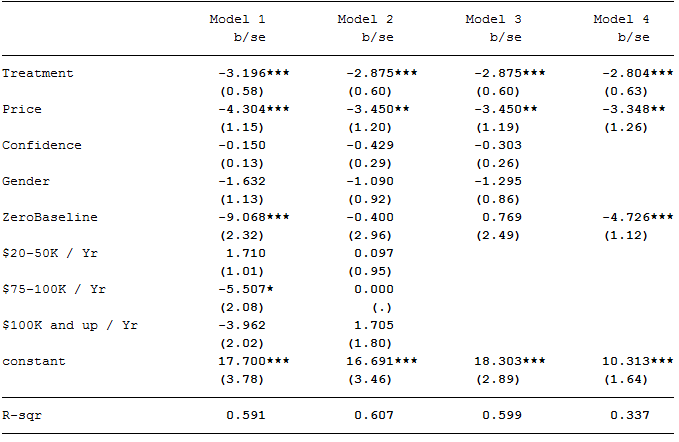
**Table 2 – Summary Statistics of Survey Output, Illegal Values Removed**



**Table 3 – T Test of Equality of Means: Quantity Demanded by Treatment**



**Table 4 – Split Sample Multiple Regression**



**Table 5 – Full-Sample Regression**

