Inframarginal values and demand: Contra Dwight Lee

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Abstract   Happiness studies show that there has been no discernable rise in happiness in the United States between 1959 and 2004, yet the same period saw per capita income nearly triple. Dwight Lee modifies the theory of consumer demand to resolve this apparent conflict. Using the concepts of consumer surplus and rising incomes causing demand shifts, Lee posits that the law of downward sloping demand only fleetingly applies. He hypothesizes that the values of all units consumed become the same as the value of the last unit soon after the change in income. This makes the demand curve horizontal for all units consumed, and that makes the existence of consumer surplus ephemeral. There are difficulties with this; some are: (1) His formulation gives rise to predictions that are at odds with commonly observed market phenomena; (2) The attempted resolution is quixotic because the theory of demand and consumer surplus holds time, place, and circumstances constant, while happiness surveys do not and, indeed, cannot hold things constant over decades; and (3) because standard economic theory is timeless it is inapplicable to many phenomena that occur over extended periods.

Keywords   Law of demand · Adaptation · Happiness surveys · Consumer surplus · Relative income · Heraclitus

JEL Classification   I31 · B40 · D11

> *Perhaps the most fundamental finding in economics is the 'law' of the negatively sloped demand curve.*
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> *Gary S. Becker (1971, p. 11)*

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Dwight Lee (2009) asks: How might the economic theory of consumer demand be modified to accommodate evidence that shows no increase in surveyed happiness from 1959 to 2004 while over the same period per capita income has almost tripled.[1] Lee alludes to two possible explanations: (1) it is relative income that determines happiness rather than the absolute level of income; an increasing absolute income that has unchanged relative incomes does not affect happiness; and (2) it is the process of *changing* conditions rather than the absolute levels of income that are key to changing happiness; as Lee (p. 5) explains: 'more money does increase happiness, but only temporarily.' Lee chooses to rely solely upon the process of *changing* income levels in his reconciliation of demand theory and the empirical evidence of happiness studies. Nevertheless, Lee (p. 6) explicitly acknowledges that relative income also matters: 'This is not to deny the importance of relative income to happiness. The influence of relative income and adaptation can work together in explaining the results of happiness studies.'

1 Lee's reconciliation: Eschewing the law of demand

Lee starts with standard consumer theory; an increase in income causes a downward sloping demand curve to shift to the right. When increasing income causes a demand shift to the right (for a normal or superior good[2]), this increases 'consumer surplus' which is the area bounded above by the demand function and below by the market price line. The presumed increase in 'consumer surplus' generated by increased income over the period 1959–2004 is not reflected in any surveys of 'happiness'. Thus a near tripling of per capita over a 45 year period has had no measurable impact upon 'happiness'; we all know that money does not buy love, but this suggests that money does not affect happiness! If money is so unimportant in life, why do people make such efforts to acquire it? This is puzzling in the extreme. Lee's (p. 8) explanation for the puzzle is embedded in his Figure 3; we reproduce the aspects of it relevant to our discussion below in Fig. 1.[3]

   In Fig. 1 downward sloping demand curves D_1 and D_2 illustrate standard demand theory for 'normal' goods. The original demand curve is D_1 which is associated with a specific income level; when real income increases, then demand shifts to the right to

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[1] The evidence presented in Lee's (p. 4) Fig. 1 illustrates graphically the absence of correlation between per capita income in the United States and 'happiness' from 1959 to 2004.

[2] A normal (and/or superior) good is one where demand increases as income increases. This contrasts to an inferior good where an increase in income reduces demand. (For examples of inferior goods one might think of powdered skim milk, or *Boones Farm* wine.) We are in complete agreement with Lee's (p. 9) discussion: 'A change in national income affects the consumption of all goods in a more uniform way than a change in price, by shifting almost all demand curves (with inferior goods being an exception) in the same direction. And even when inferior goods are considered, it is reasonable to assume that the consumer's total surplus will be increased with an increase in income and reduced with a reduction.'
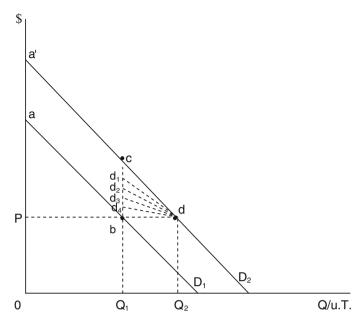
[3] There are two differences between Lee's Figure 3 and our Fig. 1: (1) we have labeled the vertical axis intercepts as *a* and *a'*, whereas Lee (p. 7) did not label these in his Figure 3 (although he did in his Figure 2 using these same labels). (2) We have simplified Lee's Figure 3 by including only the geometry relevant to the discussion of an increase in income; thus we excluded dotted lines on Lee's Figure 3 labeled $-d_1$, $-d_2$, and $-d_3$, as well as the solid line labeled $P - D_2$.

Fig. 1 Lee's hypothesis about how sensor adaptation alters demand theory

D_2, this is the demand at a level of income exceeding the initial level. Demand theory predicts that the consumer surplus triangle (the sum of the differences between the demand curve's height and the market price), for a normal good, increases in size *pari pasu* with increasing income. In the notation of Fig. 1, the triangle expands from Pba to Pda'. Lee argues that this increase in consumer surplus is indicative of increased happiness; this creates the divergence between standard demand theory and 'happiness studies'. Emphasizing a previous point, these studies show that American happiness levels were unaltered from 1959 to 2004 in spite of a near tripling in per capita income.

To reconcile standard demand theory with the observation that happiness does not appear to be related to per capita income, Lee suggests that soon[4] after an increase in income (causing demand to shift) the value of all units consumed becomes the same as the value of the last unit consumed. This means that all units consumed become equally valued; each unit's value is equal to the market price, denoted as P. This makes the demand curve horizontal for all units consumed.[5] Lee's writes: 'Eventually the happiness-relevant demand curve becomes PdD$_2$.' Lee's revised demand theory implies that there is no consumer surplus after adaptation because for all units consumed the height of demand is exactly equal to the market price; the value of each inframarginal

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[4] Lee leaves the durations of adjustment times unspecified, but they must not be lengthy for otherwise observed happiness would rise with per capita income and his approach would not reconcile demand theory and 'happiness study' evidence.

[5] Lee (p. 7) explains the process by which this occurs: 'As time passes, however, and adaptation begins, the happiness-relevant demand curve begins declining over the inframarginal units of the increased consumption, as shown by the dashed line[s] d$_1$, d$_2$, d$_3$, . . . , with larger-numbered subscripts representing more time since the beginning of adaptation.'

unit that is consumed is exactly the same as the value attached to the marginal unit which equals the market price.

2 The anomalous predictions of Lee's revised theory of consumer demand

A theoretical statement may be assessed by examining the implications of its assumptions. Milton Friedman (1970, p. 28) stated it succinctly: '... what are called assumptions of a hypothesis can be used to get some indirect evidence on the acceptability of the hypothesis ... in so far as the assumptions may call to mind other implications of the hypothesis susceptible to casual empirical observation.' One way to test Lee's theory is to examine the implications of his revised demand theory; the implications are not consistent with observed phenomena.[6]

Lee's theory suggests that with habituation and a demand curve of PdD_2, a trivial increase in price will result in a reduction in demand falling from Q_2 to 0. Lee explicitly posits a horizontal demand curve at the market price up to the amount purchased; given the horizontal demand, the amount sold will fall to zero from some finite amount with no intermediate steps. A horizontal demand curve facing a firm in a perfectly competitive industry makes sense; but it contradicts both intuition and empirical data when applied to an individual consumer. Consumer demands do not fluctuate between zero and some relatively large amount (Q_2) with trivial price increases; we have the 'law of demand' because it is empirically verifiable.

Also contrary to observational reality, the habituation hypothesis (after adaptation occurs) leaves no room for price discrimination in markets where individual firms possess market power. After adaptation, there is no consumer surplus to be captured by price discrimination. Commonly observed pricing phenomena such as college and university tuition being affected by financial 'need', quantity discounts, and price-reducing coupons become inexplicable if an individual's demand is horizontal because inframarginal values converge to the price paid for the last unit.

3 Demand theory and time

Notwithstanding our critique, Lee's analysis does provide some useful insights. Sensory adaptation may make demand more price elastic following an increase in consumer income. In terms of Fig. 1 the counter-clockwise pivot from D_2 to d_1 or to d_2 could occur; whether it occurs is an empirical question. But there is a limit to how far the counter-clockwise pivot can continue without giving rise to implications that are immediately contrary to everyday experience: the pivot cannot include Lee's hypothesized horizontal demand for all units consumed. Excluding the horizontal limit maintains the law of demand and ameliorates the anomalous implications of Lee's

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[6] Lee (p. 9) may have applied this criterion elsewhere in his paper. He wrote a statement that we quoted in the last sentence of footnote 3: 'And even when inferior goods are considered, *it is reasonable to assume* that the consumer's total surplus will be increased with an increase in income and reduced with a reduction.' (Emphasis added). What makes it 'reasonable' is that it calls to mind no implications that are immediately at odds with observational reality.

hypothesis. Unfortunately, eliminating the horizontal segment from Lee's hypothesis leaves it incapable of reconciling demand theory with 'happiness studies'.

Reconciliation may occur if we include the 'relative income' effect that Lee was uncomfortable with excluding from his analysis. There is evidence that competition for relative income/status affects human happiness,[7] but it is expressly eliminated from welfare analysis because once it is included, the analysis becomes intractable and ambiguous. In welfare economics, the 'Pareto principle' specifically states that welfare has improved if one person in a society is better-off and no one else is worse-off; relative income effects are explicitly excluded because if there is envy,[8] then all welfare analysis is problematic. Demand theory assumes 'all other things are constant' (i.e., *ceteris paribus*); it offers no prediction when things other than the price of the good in question are in flux. The inclusion of relative income into the analysis violates *ceteris paribus*.

The triangular measures of consumer have no correspondence in the physical world; they are abstractions that allow the analysis of the welfare costs and benefits of a limited set of economic phenomena. The analysis of changed welfare has some validity, but only under a restrictive set of assumptions. The net benefits or costs of changes measured by the consumer surplus triangles are specific to conditions of time, place, and expectations. Suggesting that there is a conflict between demand theory and happiness studies is mistaken because one (demand theory) is explicitly timeless, while the other is all about time. When we use demand theory to predict changes in the real world we are violating a strict interpretation of the *ceteris paribus* assumption because all actions take place in real time, while real time does not exist in demand theory. We use demand theory anyways because it is useful and the violation of the *ceteris paribus* condition is considered minor if we are thinking of the next day, week, month, quarter, or year. But when we are measuring over decades the violation of *ceteris paribus* is so extreme as to vitiate the entire analysis. The greater the time gap the less valuable is this measure of welfare. We have Lee to thank for our recognition of the limits of demand theory. A longitudinal study of happiness may be useful, but it is more sociology than economics. Take a concrete example: We measure one person's happiness in years x and in x+10. The individual in question is 10 years older in year x+10, and in the intervening years s/he has won a multi-million dollar lottery and also has suffered the loss of a beloved child. Is this person happier than in year x? This is a bizarre question; the situations are incomparable. Even under less extreme circumstances comparing levels of happiness for widely separated time periods is injudicious. Heraclitus stated that 'you cannot step into the same river twice'; his reasoning was that both the river and the person are changing. The only constant is change. Measuring the happiness of a society by asking individuals how happy they are does not give us any reliable results on how happy people are because both people and circumstances are changing.

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[7] In the article immediately following Lee's, Kevin Kniffin (2009, pp. 29–31) discusses several studies that support his hypothesis that 'Individual salary preferences are relative within workplace-based peer groups.' In a related work, Coelho et al. (2004) hypothesize that the evolutionary propensities that *Homo sapiens* share with other social animals of higher intelligence toward status seeking and reciprocal altruism provide insights that may aid in managing teams of workers.

[8] If envy does not exist, this raises questions: Why is there a word describing it? Why have so many religions proscribed covetousness?

Consider the United States over the period 1959 to 2004; during this period, cultural mores and conditions changed markedly. A 16 year old surveyed in 1959, relative to a one surveyed in 2004, would have been more likely to have: (1) grown up in a family with a greater number of siblings; (2) been cared for by his stay-at-home mother (as opposed to at a day care facility); and (3) lived his/her whole life with his biological and married parents. The typical 16 year old in 2004 has more material goods, but a less secure family. These subtleties are unaccounted in happiness studies; but family conditions are probably more important in an individual's happiness than increasing consumption.

Happiness studies and demand theory cannot be reconciled; any attempt to reconcile them is quixotic. Reconciliation has to fail because it violates the central tenets of demand theory. Heraclitus was correct; we cannot reasonably compare happiness over 45 years (1959–2004). Neither can we compare 16 year olds from different eras, nor can we compare the happiness of teenagers to the happiness of the senior citizens they become in 50 years.

4 Concluding comments

Dwight Lee's discussion of the way in which the 'sensory adaptation' effect impacts demand is innovative, but the implications that attend his hypothesis are at odds with standard economic theory and observational reality. Lee's discomfort with eschewing 'relative income' effects was valid, but if we include it, then we forego all hope of non-ambiguous analysis. There are inherent restrictions in demand theory that are contained in its assumptions. It would be nice to use demand theory to reconcile the apparent anomaly between it and longitudinal studies of happiness, but it is not within the realm of the possible.

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