

Some Anomalies Arising from Bandwagons that Impart Upward-Sloping Segments to Market Demand^{*}

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[Comment on: Becker, Gary S. (1991). "A Note on Restaurant Pricing and Other Examples of Social Influence on Price," *Journal of Political Economy* 99 (5), 1109-1116]

Abstract: In Gary Becker's (1991) theory of bandwagon effects, a portion of market demand is positively sloped. In this, he ignores Harvey Leibenstein's (1950) hypothesis that market demands for bandwagon goods are *everywhere* negatively sloped (stemming from scarcity imposed constraints). A substantial literature now invokes Becker's bandwagon, also ignoring Leibenstein. Two anomalies attend Becker's bandwagon demand when it slopes upward: 1) straightforward parameterizations are inconsistent with the economic requirement that quantities demanded be non-negative; 2) regardless of parameterization, the comparative statics of Becker's demand carry unwieldy implications.

Keywords: Bandwagon Effect; Law of Demand

JEL codes: D01, D40, D62

Harvey Leibenstein's (1950) seminal *QJE* article, "Bandwagon, Snob, and Veblen Effects in the Theory of the Consumers' Demand", defines the bandwagon effect as "the extent to which the demand for a commodity is *increased* due to the fact that others are also consuming the same commodity" (189). A key aspect of his formulation is that scarcity precludes run-away bandwagon effects. Leibenstein posits a "diminishing marginal external consumption effect":

* For providing comments on earlier drafts, the authors thank: Gary S. Becker, Jeff Biddle, Philip Coelho, Jerry Dwyer, Warren Gibson, Judy Lane, an anonymous referee, Western Economic Association International Conference Participants (Summer 2007), and seminar participants at Ball State University (November 2004). We alone are responsible for whatever errors remain.

[T]he income constraint is sufficient to establish that there must be a point at which increases in a consumer's demand must fail to respond to increases in demand by others. Since every consumer is subject to the income constraint, it must follow that the principle [of diminishing marginal external consumption effect] holds for all consumers. (193)

Invoking this principle, Leibenstein hypothesizes demand curves for bandwagon goods that are everywhere negatively sloped.

Gary Becker's (1991) model ignores Leibenstein's scarcity constraint in favor of bandwagons that impart positive slopes—despite the fact that there is no empirical evidence that bandwagon effects have ever imparted a positive slope to market demand. Back in 1971, Becker wrote: “Perhaps the most fundamental finding in economics is the ‘law’ of the negatively sloped demand curve” (Becker 1971, 11)—and yet his 1991 article contradicts that most fundamental finding without ceremony. Amplifying the importance of this reversal, a large body of literature now cites Becker's bandwagon model uncritically without any mention of Leibenstein's scarcity-constrained hypothesis on bandwagon effects.

This comment explores the theory underlying analytics of Becker's (1991) model. We show that straightforward parameterizations of the upward sloping demand he models are inconsistent with the requirement that quantities demanded be non-negative. We also show that, even if the problem of negative consumption could be finessed via more subtle parameterizations and/or specifications, the comparative static results implied by the upward-sloping segments of his hypothesized demand curve fail Milton Friedman's (1970, 28) maxim that a theory's assumptions ought not to cause it to produce unworldly implications.

Contrasting Literatures

Leibenstein developed the constrained bandwagon hypothesis (with its everywhere downward sloping market demands) with scrupulous reference to the literatures of both economics and sociology: Citing, among others, A.C. Pigou (1929 and 1913), Henry Cunynghame (1892), and sociologist John Rae (1905), Leibenstein chided Melvin Reder (1947, 64) for his assertion that economists rarely “if ever” analyze situations “where the utility function of one individual contains, as variables, the quantities of goods consumed by other persons.” Leibenstein’s analysis captured the idea that people want “to get into ‘the swim of things’; in order to conform with the people they wish to be associated with; in order to be fashionable or stylish; or, in order to appear to be ‘one of the boys’”(189). His article is widely cited in social science scholarship on conformity, fashion, style, and peer acceptance. A *Web of Science* search (26 June 08) for the years 1970 to 2008 found 218 citations to Leibenstein’s article.¹ The prominence of Leibenstein’s article is also affirmed by its appearance in a widely disseminated book, *Readings in Microeconomics* (1968 and 1971 editions), edited by William Breit and Harold Hochman.

In contrast, Becker’s bandwagon, with its upward-sloping demand, neither uses the term “bandwagon effect” nor makes reference to the contributions of Leibenstein, much less those of Pigou, Rae, or Duesenberry (1949), also referenced by Leibenstein.

The oversights are puzzling. In a 1974 article Becker acknowledges Leibenstein’s

¹ To arrive at the 218 total we searched using: 1) “Leibenstein” as the author and “Q J ECON” and “Q J EC” as the journal; 2) “Leibenstein” (misspelling Leibenstein) as the author and “Q J ECON” and “Q J EC” as the journal. Not all of these are listed in our bibliography, but we will provide the list upon request. Because the *Web of Science* database only goes back to 1970, we also inspected the volumes of the *Social Science Citation Index* for the period from 1966 (when those volumes start) to 1970 to get a rough count of the number of citations to Leibenstein’s article during that period. We found 16. Combining these with the count for 1970 to 2008 brings the total to 234. And this still leaves out citations that occurred between 1950 and 1966.

contribution on the: “. . . ‘bandwagon’ and ‘snob’ influences on ordinary consumption theory.” (1065).²

An extensive body of literature diverges from Leibenstein’s constrained approach, instead embracing Becker’s approach. Our search of the *Web of Science* database (on 10 June 08) found 101 articles that cite Becker (1991).³ This literature is mostly confined to the model-building genre,⁴ and, as indicated in Table 1, 99 percent of the articles accept Becker (1991) as uncontroversial;⁵ 87 percent eschew Leibenstein’s hypothesis that scarcity keeps bandwagon demands downward sloping,⁶ and none provide evidence of a bandwagon demand relationship for which the own price coefficient of quantity demanded is positive. The only existing empirical estimation of a bandwagon demand relationship we are aware of is by Biddle (1991, 383) in a study of bandwagon effects in

² In the concluding paragraph, Becker (1991) writes: “Fortunately, social interactions finally are being incorporated into economic models” (1116). Maybe Becker has omitted Leibenstein (and all the earlier economic literature) because he thinks they do not qualify as economic models. But some of the then-more-recent literature he cites is no more mathematical than Leibenstein.

³ The search actually turned up a count of 102 articles, but one of them was erroneous and did not actually cite Becker’s 1991 paper.

⁴ Of the 101 articles citing Becker (1991), 28 involved empirical analysis.

⁵ Two articles have challenged Becker (1991): Haddock and McChesney (1994) provide an alternative theory of why businesses might contrive shortages, producing the kind of queues that Becker (1991) sought to explain. Their alternative, unlike Becker’s (1991), maintains downward sloping demand. Of particular note are the queuing practices of Parisian restaurants during peak tourist season that Haddock and McChesney cite in support of their theory (573). Secondly, Plott and Smith (1999) conducted experiments on Marshallian and Walrasian stability conditions that arise in the presence of experimentally created upward-sloping demand. Plott and Smith (421) concluded, specifically with regard to the theories of Becker (1991) and Karni and Levin (1994), that: “their presumption about market dynamics is wrong and their presumption about the application of game theory is wrong as well.” Neither challenge has altered the pattern of uncritical citation to Becker’s (1991) upward-sloping demand model.

⁶ Leibenstein’s article was uncited by 86 articles of the articles, but the count of articles that “eschew” his hypothesis (again, that bandwagons leave market demands *downward* sloping) rises to 87 because Wolfgang Pesendorfer (1995) errantly attributes to Leibenstein the notion that bandwagon effects make market demands slope upward.

the demand for vanity license plates; it indicates that: “sales [of license plates] are related negatively to both current and lagged prices.”⁷

Table 1: Characteristics of Journal Publications Citing Becker’s (1991) Upward-sloping (unconstrained) Bandwagon Demand Model*	
Fraction citing Becker as uncontroversial	99/101
Fraction that eschewed Leibenstein’s Downward-sloping (constrained) Bandwagon Demand Model	87/101
Fraction providing bandwagon demand estimates with a positive, significant own price coefficient	0/101

**A link to the data spread sheet that we compiled and used to create this table is available at the end of this paper.*

It is peculiar that such a substantial body of literature has found Leibenstein’s hypothesis less compelling than Becker’s. Beyond the nonexistence of evidence that bandwagons give rise to market demands that slope upward, the specific shape of market demand hypothesized by Becker introduces scientific ambiguity because for a broad range of prices *the* quantity demanded takes on *three* distinct values. As shown in Figure 1, Becker hypothesizes that market demand is downward sloping for small quantities, upward sloping for larger quantities, and downward sloping for the largest quantities:

⁷ A search of the Web of Science database (17 June 08) indicated that Biddle’s 1991 paper had been cited a total of 8 times. None of the 101 articles that cited Becker (1991) cited Biddle.

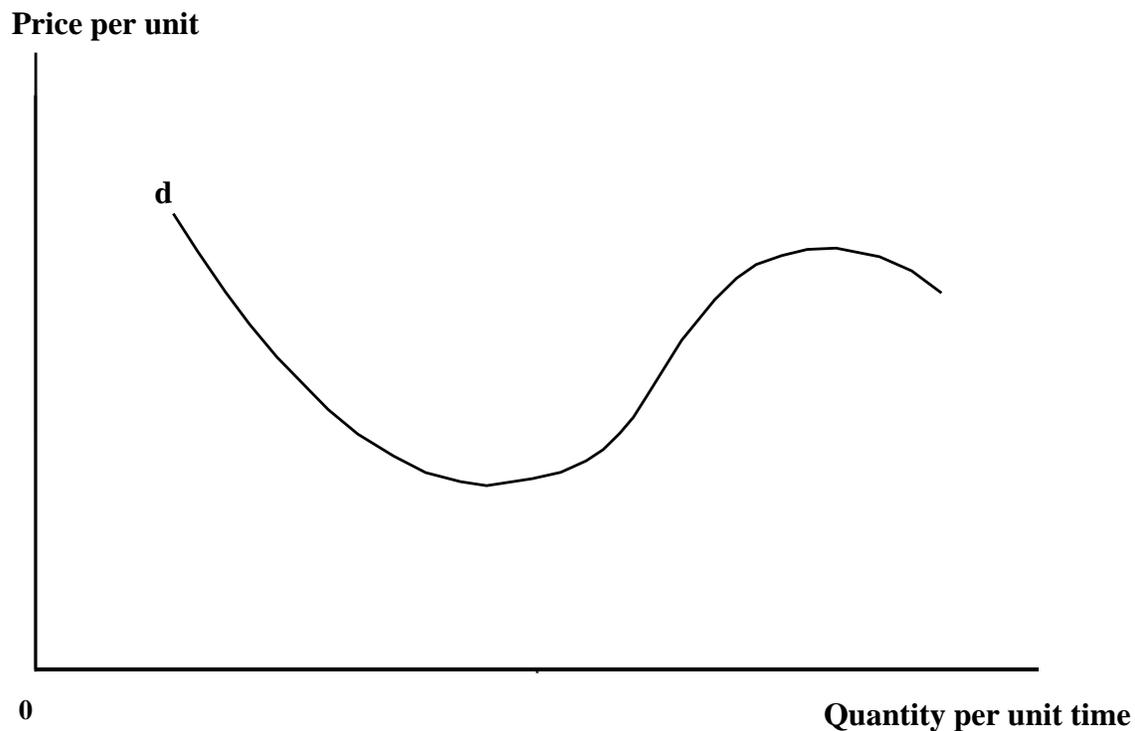


Figure 1: Market Demand Hypothesized by Becker (1991, 1113)

One reason that Becker's hypothesis has displaced Leibenstein's might be because Leibenstein presents the "principle of diminishing marginal external consumption effect" via a meticulous discussion (190-196) that guides the reader step-by-step through a "conceptual experiment" and a "diagrammatical method" rather than via concise mathematical symbols. Whatever the reasons, the consequences of ignoring Leibenstein's hypothesis are unfortunate. Our exploration of the analytics of Becker's model shows that nonsensical implications attend the upward sloping segment of the

demand he hypothesizes—negative quantities demanded—as well as anomalous comparative static results.

The Inconvenient Implications of Becker’s Bandwagon Demand

The touchstone of the literature that breaks from Leibenstein’s theory is Becker’s (1991) formalization of a bandwagon effect that can impart positive slopes to segments of market demand curves. We begin with a brief review of his formalization.

We write the market demand functions as:

$$Q = \sum_{i=1}^n q_i(p, Q_E) = F(p, Q_E), \quad (1)$$

where $q_i(p, Q_E)$ denotes the demand of the i^{th} consumer; Q denotes quantity demanded in the market; p denotes the relative price of the commodity; and Q_E denotes the market demand quantity expected by each consumer.⁸ Consistent with the presence of a bandwagon effect, assume that Q and Q_E are positively related (that is, $\partial F/\partial Q_E > 0$). In addition, assume that the direct effect of a change in price on quantity demanded is negative (that is, $F_p < 0$).⁹ At this level, the model does not necessarily conflict with downward-sloping demand. The conflict will arise as a result of an assumption made about the magnitude of $\partial F/\partial Q_E$.

⁸ See Becker (1991) for a similar specification. Becker’s formalization of individual demand as a function of market demand is not precisely representative of the notion that the bandwagon effect depends on what “others” are consuming. A truer specification of individual demand is that $q_i = q_i(p, Q - q_i)$. This is of little consequence if market demand (Q) is large relative to individual demand (q_i). Again, Leibenstein (189) defines the bandwagon effect in terms of “others”; so does Becker (1991).

⁹ Both Leibenstein and Becker (1991) analyze bandwagon effects exclusively in terms of their impact on demand functions, eschewing more complicated modeling alternatives. Like theirs, our analysis is in terms of demand functions.

Closing the demand model in equation (1) requires a specification of consumer expectations. The standard assumption in this literature is that consumers' expectations immediately converge on the actual aggregate quantity demanded in the market. The equilibrating condition is that:

$$Q = Q_E. \quad (2)$$

Substituting equation (2) into (1), the equation for market demand is:

$$Q = F(p, Q). \quad (3)$$

In this model, the presence of a bandwagon effect ($F_Q > 0$) is not sufficient to make market demand slope upward.¹¹ This requires that the magnitude of the bandwagon effect be sufficiently large; specifically, upward sloping demand is implied only when $F_Q > 1$.¹² To show this, take the total derivative of equation (3):

$$dQ = F_p dp + F_Q dQ.$$

Upon rearranging terms, it follows that

$$\frac{dp}{dQ} = \frac{1 - F_Q}{F_p} > 0 \quad \text{as} \quad F_Q > 1. \quad (4)$$

From equation (4) it is clear that in Becker's model when $F_Q > 1$, market demand has a positive slope, and when $F_Q < 1$ it has a negative slope. The purpose of this comment is to bring to light previously unnoted, and peculiar, implications that attend

¹⁰ This condition is implicit in Becker's (1991) paper; making it explicit clarifies that issues of risk, uncertainty, and imperfect information are absent. Stiglitz (1987) provides an extensive discussion of demand and supply where product quality is uncertain. Because there is no quality uncertainty in Becker's model, these difficulties apply neither to his model, nor to our critique of it.

¹¹ Becker (1991, 1111) called this a function for "aggregate quantity demanded", but as mentioned in the text above used different notation. And again Becker labels the curve in Figure 1 above as "d", exactly as we have reproduced it. Elsewhere in his article Becker alludes to a "positively inclined demand curve" (1112), and finally mentions "shocks that lower demand" (1115). Our comment takes Becker at his word that his is a model of market demand.

¹² See, as well, Corneo and Jeanne (1997, 64) who show that this type of condition leads to an upward sloping market demand curve for their "conspicuous good."

Becker's hypothesis that F_Q can be large enough to result in an upward sloping portion of market demand.

Linear Parameterization makes Consumption Negative for Positively Sloped

Demand

In this section, we examine the implications of a linear parameterization of a straightforward parameterization of Becker's bandwagon model as presented in equations (1) through (4) above. First, assume that the good is private in consumption, and, to ease exposition, assume n identical consumers. Let the demand of the i^{th} individual for the good, q_i , ignoring any bandwagon effect, be $q_i = f(p)$, where p is price per unit and $dq_i/dp < 0$. Since negative quantities are nonsensical, it must be that $f(p) \geq 0$.

As previously mentioned, the bandwagon effect is "the extent to which the demand for a commodity is *increased* due to the fact that others are also consuming the same commodity" (Leibenstein, 189).¹³ In line with this definition, suppose the individual's demand for q contains a bandwagon effect of size $c > 0$ such that the increment in the individual's demand caused by the demand of others for the good is

$$c \sum_{j=1}^{n-1} q_j, \quad i \neq j.$$

Assuming that the bandwagon effect enters individual demand linearly, our parameterization of the i^{th} individual's demand is as follows:

$$q_i = f(p) + c \sum_{j=1}^{n-1} q_j, \quad i \neq j. \quad (5)$$

¹³ In addition, see Biddle (375).

Since the individuals are identical, $q_i = q_j$ in equation (5), which allows the i^{th} individual's demand to be expressed as $q_i = f(p) + c(n-1)q_i$.¹⁴ Solving this expression for q_i yields:

$$q_i = f(p)/[1 - c(n-1)]. \quad (6)$$

Market demand, Q , is equal to nq_i or

$$Q = nf(p)/[1 - c(n-1)].^{15} \quad (7)$$

A positive relationship between price and quantity demanded can result if the bandwagon effect is large enough.¹⁶ To see this, differentiate Q with respect to p :

$$\partial Q/\partial p = nf'(p)/[1 - c(n-1)]. \quad (8)$$

In equation (8), $\partial Q/\partial p > 0$ if and only if $c(n-1) > 1$; in words: Becker's market demand has a positive slope if and only if the bandwagon effect is sufficiently large. The dilemma this parameterization exposes is that for bandwagons large enough to make market demand slope upward, consumption is negative. Equation (7) makes it clear that if $c(n-1) > 1$, it follows that $Q < 0$. Of course, negative consumption makes no economic sense.¹⁷ This anomaly vanishes when the bandwagon effect is constrained

¹⁴ Parameterizations of the bandwagon effect that arise out of the consumption of *others* avoid the problem of a person's own consumption contributing to the bandwagon effect. As we mentioned in footnote 9 this is of little consequence if market demand is large relative to individual demand: in terms of this parameterization this translates into n being large. But if $n=1$, it is clear that our parameterization, which *is* in terms of the consumption of *others*, avoids the possibility that even though there is only one consumer there would still be a bandwagon effect; letting $n=1$ in $q_i = f(p) + c(n-1)q_i$ one finds that the bandwagon term vanishes as $q_i = f(p)$. This technicality does not alter any of the qualitative results derived in this paper.

¹⁵ This parameterizes equation (3).

¹⁶ See Becker (1991, 1111-1112).

¹⁷ Readers who like geometry might consider a two-dimensional illustration as follows: Consider two consumers with two "reaction functions" $q_1 = f_1(P) + c_1 q_2$ and $q_2 = f_2(P) + c_2 q_1$. A selection of relatively small c -coefficients would result in an intersection of the two reaction functions in the positive quadrant (*quadrant I*). Moreover, a small price reduction would lead the intersection point to move in the northeast direction -- an indication of a negative slope. A selection of relatively large c -coefficients would result in an intersection of the two reaction

sufficiently to ensure that $0 < c(n-1) < 1$, for in this case: (a) $\partial Q/\partial p < 0$, from equation (8); and (b) $Q > 0$, from equation (7). To rule out negative consumption in the parameterization, one would have to rule out upward sloping demand entirely.¹⁸

An objection to the above criticism of Becker's model would arise if someone were to produce a sensible specification of it that conforms to Figure 1. To address this possibility, we explore some of implications of Becker's (1991) model under the assumption that there does in fact exist a sensible specification of the model for which positive consumption corresponds to upward sloping demand exactly as in Figure 1.

Upward-sloping Demand Reverses Standard Comparative Static Implications

In this section we set aside issues of parameterization and negative quantities demanded. We simply accept Becker's model as he specified it, and proceed *as if* the demand appears just as Becker hypothesizes (reproduced in Figure 1). On the basis of equations (1) through (4) we derive the comparative static implications that attend bandwagon effects in two separate cases: 1) when the effect is so unconstrained ($F_Q > 1$ in equation (4)) that market demand slopes upward; and 2) when the effect is constrained ($F_Q < 1$ in equation (4)) so that market demand slopes downward. This methodology comports with remarks by Milton Friedman (1970, 23 and 28): The analysis of assumptions "sometimes facilitate an indirect test of the hypothesis by its implications ... [W]hat are called assumptions of a hypothesis can be used to get some indirect evidence

functions in *quadrant III*. Moreover, a small price reduction would lead the intersection point to move in the southwest direction – an indication of a positive slope. A perceptive reader will recognize the second case (large c-coefficients) as a freak of mathematics. The economic interpretation is that the two reaction functions intersect at infinity, which cannot happen when consumers have finite budgets.

¹⁸ This is consistent with Leibenstein's hypothesis (192). It is also consistent with Biddle which is the only paper we are aware of that attempts to empirically isolate the bandwagon effect.

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.” In other words, we should look askance on assumptions that carry strange implications.

To derive the comparative static implications of bandwagon models under alternative assumptions about the size of F_Q , we introduce a shift variable, Z , which, by definition, has a negative impact on *individual* demand; symbolically this is expressed as $\partial q_i / \partial Z < 0$. Standard examples of Z include: a) the announcement of evidence of heretofore unknown health hazards associated with product usage; b) a decrease in the price of a substitute good; and c) an increase in the price of a complementary good or service. It immediately follows from the aggregation process used in equation (1) that the partial derivative of Q with respect to Z is negative (symbolically, $F_Z < 0$).

To derive the impact of changes in Z on market demand, begin by inserting Z into market demand equation (3) as follows:

$$Q = F(p, Q, Z). \quad (9)$$

Taking the total derivative of (9), rearranging, and assuming $dp = 0$ yields

$$\frac{dQ}{dZ} = \frac{F_Z}{1 - F_Q} \quad ^{19} \quad (10)$$

The assumption that $dp = 0$ in equation (10) allows us to examine the change in the amount demanded in the market, holding price constant. Intuitively, the sign of equation (10) indicates whether market demand shifts horizontally to the left or to the right. If dQ/dZ is positive, then the amount demanded in the market increases at each

¹⁹ Although this equation is not in Becker’s (1991) article, it can be found, in different notation, in the ninth chapter of a book by Becker and Murphy (2000). This co-authored book reasserts the results of Becker’s (1991) article, *sans* acknowledgement of Becker’s preceding article.

price (shifting market demand rightward). Conversely, if dQ/dZ is negative, then the market quantity demanded decreases at each price (shifting market demand leftward).

Case 1: Downward Sloping Market Demand

Recall that in Becker's model if the bandwagon effect is constrained so that $0 < F_Q < 1$, then market demand slopes downward as in two of the segments of the curve in Figure 1. Given this constraint on the bandwagon effect, shifts in market demands conform with the direction of the shifts in the individual demand schedules and the expression in equation (10) takes on a negative sign (that is, $dQ/dZ < 0$). Shifts in market demand relationships possessing bandwagon effects conform to those predicted by the standard comparative statics that constitute traditional demand theory so long as market demands everywhere slope downward.

Case 2: Upward Sloping Market Demand

If the bandwagon effect in Becker's model is sufficiently large (with $F_Q > 1$), market demand slopes upward as along the positively sloped segment of the curve in Figure 1. In this case, the expression in equation (10) is positive: that is, $dQ/dZ > 0$. When bandwagon effects are so large as to lend positive slopes to market demand curves, shifts in market demands are in the direction opposite of shifts in the individual demand schedules. Despite the decrease in marginal valuation at the level of the individual, this model implies that quantity demanded in the market rises at each and every price due to the increase in Z . This is polar to conventional demand analysis; shift a downward sloping demand curve vertically downward (illustrating a decrease in marginal valuation) and the horizontal view of the demand shift implies a *decrease* in the amount demanded at each price.

The implications of comparative static analyses are contrary to everyday experience and common observation (Friedman's test) in the case of positively sloped demand. For bandwagon effects so large that $F_Q > 1$, market quantities demanded at constant prices would *increase* in the wake of: 1) the release of evidence about heretofore unknown product risks; 2) a rise in the price of a complementary good; and 3) a fall in the price of a substitute product. In Milton Friedman's (1970; 28) words, these implications are inconsistent with "casual empirical observation."²⁰ Because these results follow directly from Becker's formulation along the upward sloping portion of the market demand he hypothesizes, objections to these comparative statics are, *ipso facto*, an objection to Becker's hypothesis that the market demand curve for bandwagon goods contains a positively inclined segment as shown in Figure 1.

Summary and Conclusion

In 1971, Gary S. Becker characterized the "law" of "negatively sloped demand" as "perhaps the most fundamental finding in economics." In 1991, he hypothesized that restaurant pricing can be explained by assuming a bandwagon effect is present that is so large that it implies a "positively inclined demand" (1112) over a range of positive quantities.

This comment shows that 1) if a bandwagon effect is large enough to make Becker's

²⁰ Although this paper focuses exclusively upon the anomalous demand *shifts* that arise from upward sloping bandwagon effects ($F_Q > 1$), there are other potential anomalies. It has long been recognized that if the slopes of demand and supply are of like sign, then either *Marshallian* or *Walrasian* equilibrium stability is compromised; for a detailed discussion of these stability issues see Henderson and Quandt (1971). As they conclude (134): "The ordinary supply-demand situation [with downward sloping demand intersecting upward sloping supply], is therefore stable according to both the Walrasian and Marshallian definitions." The authors thank Jeff Biddle for commenting on an earlier draft that we should not allow other anomalies (beyond the anomalous shifts derived above) to go unmentioned. As noted earlier (see footnote 5 above): as a results of experiments they conducted on Marshallian and Walrasian stability conditions in the presence of upward-sloping demand, Plott and Smith (421) concluded that the theories of Becker (1991) and Karni and Levin (1994) are wrong.

market demand slope upward, straightforward demand parameterizations are inconsistent with the economic requirement that quantities demanded be non-negative; and 2) parameterizations aside, if a bandwagon effect is large enough to make Becker's market demand slope upward, the hypothesis will fail Milton Friedman's test by generating comparative static implications that are untenable. Consequently, it came as no surprise that we could find no empirical estimate of a bandwagon demand relationship for which the own price coefficient of quantity demanded is positive.

Throughout this comment we assumed that Becker (1991) used the term "demand" in the conventional sense: a function that tells us the quantity demanded given a price (in footnote 11 we stated our reasons for this assumption). If the zigzagged curve that Becker (1991) labeled "d" shown in Figure 1 is not *really* a demand curve then the question becomes: What is it?

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