Giffen Goods, the Survival Imperative, and the Irish Potato Culture: My Comments

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Abstract

Davies (1994) creates a graphical model to explain the specialization in consumption of potatoes that happened in Ireland prior its 1845 famine. In this paper, I share three comments on Davies's paper. First, I argue that Davies's model cannot explain this specialization, because his model lacks a prediction. Second, I argue that micro-evidence does not support his theory. And third, I argue that his paper has an incorrect implication of convex preferences.

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Summary of Davies's Paper

Davies (1994) creates a graphical model to explain the specialization in consumption of potatoes that happened in Ireland prior its 1845 famine.[2] His model consists of an indifference curves map that includes an indifference curve that separates the bundles that provide utility to the consumer from the bundles that do not. According to Davies, this indifference curve is a "subsistence constraint" and it represents "the necessity of consuming sufficient calories for maintaining health and life" (552). His justification for adding this assumption is that "[l]ogically, no indifference curve, in whole or in part, could ever exist below the subsistence constraint. Otherwise, a consumption bundle that could not sustain life would be held to sustain pleasure" (552).

Davies claims that his model reconciles the two competing theories of Giffen behavior (i.e. upward sloping demands) for food staples among the extreme

[1]Political Economy and Commerce Department and Global Food Security Initiative at Monmouth College. I would like to thank Eric McDermott for his outstanding help with this project.

[2]In page 557, Davies says, "The arrival of the nineteenth century saw this pattern reinforced, with milk largely disappearing from the diet to be replaced by yet more potatoes. Thus we have arrived at a picture of essentially complete specialization in consumption, with over 90 per cent of the country's population subsisting solely o a diet of potatoes. The level of potato consumption, by today's standards, was astronomical, ranging between 8 and 14 pounds per (adult) person per day."

poor: the classical theory and the modern theory. "[C]lassical theorists attributed [the Giffen effect] to exogenous circumstance. In their view it was a behavior mandated by the needs of subsistence: a survival imperative arising from the fact that consumption was subject not just to budgetary constraints but also to additional constraints issuing from the basic nutritional requirements for health and life" (548). While, "modern theorists conceive it as a utility-maximizing response to a price change in the presence of a preference function manifesting indifference curves of a rather peculiar configuration, something routinely explained by, and contained wholly within, standard consumer theory" (548).

To match the data from Ireland, Davies calibrates the subsistence constraint at 2,500 calories per capita, because, as he says, the "representative family, if engaged in manual labor, would require a daily intake of perhaps 15,000 calories (each individual burning, on average, 2,500 calories, certainly not an inflated requirement for young manual workers)" (561).

After introducing his subsistence constraint theory, Davies concludes that his model has the following prediction: "a corner solution will arise [i.e., the consumer will specialize her consumption in potatoes] when the following conditions simultaneously apply: (i) when the subsistence constraint is linear, (ii) when it is everywhere binding so that the consumer is compelled to purchase the cheapest source of subsistence, and (iii) when the caloric yield per dollar of one commodity exceeds that of the other. If the subsistence constraint is everywhere binding but is convex in shape, an interior solution would result. Here the cheapest source of subsistence would comprise that bundle of goods such that the marginal caloric yield per dollar would be the same for both commodities" (554). Therefore, since potatoes were the cheapest source of calories and each household's wealth was barely enough to obtain 15,000 calories worth of food, Irish people specialized in the consumption of potatoes before they faced their 1845 famine (because the subsistence constraint is not convex).[3]

My Comments

In this paper, I have three comments on Davies's paper. First, I argue that Davies's theory is incapable of explaining the specialization in consumption of potatoes, because his model lacks a prediction (due to incomplete preferences). Second, I argue that Davies's subsistence constraint thesis lacks empirical support. In particular, a large segment of the world's population lives consuming well under the caloric level that Davies calls subsistence level. And third, I argue that, even if we ignore that Davies's model represents incomplete preferences, it is false that the specialization of consumption in potatoes is a consequence of

[3]Davies says, "Again, for analytic convinience, the subsistence constraint is assumed to be linear. In reality it would likely prove concave because of the advantages of a balanced diet; though, again, the linearity assumption would not make any material difference to the results. For as can be seen, there is but one way by which the subsistence constraint can be satisfied, namely through the sole production and consumption of potatoes, another corner solution."

the subsistence constraint not being strictly convex.

Davies's theory lacks a prediction.

In standard consumer theory, completeness is a fundamental assumption of consumer preferences. Without this assumption, the individual demand may not be well-defined. Specifically, by definition, the individual demand is the set of affordable bundles that are at least as preferred as any other affordable bundle; and, to find the set of bundles that belong to the individual demand, it is convenient to create an ordinal utility function (Debreu, 1959).[4] For any pair of bundles, ordinal utility functions assign more utility to the bundle that is at least as preferred as the other. Therefore, when there are bundles that do not assign utility, we cannot tell whether these bundles are at least as preferred as other bundles or not. This lack of relationship between bundles is known as incomplete preferences. And, the problem with incomplete preferences is that the individual demand is not well-defined when there are affordable bundles that do not assign utility, because we cannot tell whether these bundles are at least as preferred as any other affordable bundle or not. In particular, Davies's model is a clear example in which there are no bundles that fully satisfy the definition of individual demand; thus, it is incapable of predicting which bundles will be consumed.[5]

Perhaps, one way to interpret Davies's model that could justify his subsistence constraint theory is by assuming that consumers would never choose bundles that cannot maintain "health and life"; and, therefore, these bundles do not assign utility. However, by the axiom of revealed preferences, this choice behavior only reveals that the bundles that satisfy the subsistence constraint provide more utility than the bundles that cannot maintain health and life, not that the latter do not assign utility at all. Thus, never choosing a bundle does not imply that such a bundle does not assign utility. Moreover, this interpretation raises a puzzle: why do we observe anorexic agents if they never choose bundles that keep them calorie deprived?

Another way to interpret Davies's model, as Davies himself does, is that bundles that cannot maintain health and life cannot sustain pleasure either; and, consequently, these bundles are not a source of utility. But, problem is, this is an incorrect interpretation of ordinal utility. In standard consumer theory, an ordinal utility function represents a preference relation of consumption bundles, not a ranking of pleasure. In fact, ordinal utility theory is so strong that it can be used to model preferences in extreme cases when consumers are left to choose between two options that cannot sustain life. For example, consider the Death with Dignity Act in the state of Oregon. This act "allows terminally-ill Oregonians to end their lives through the voluntary self-administration of lethal

[4] Utility functions are a theorem in standard consumer theory, not an assumption. In fact, there are preference relations that cannot be represented by ordinal utility function (e.g., lexicographic preferences).

[5] For an example of a mathematical model that can explain the specialization in consumption of potatoes and predicts well-defined upward sloping demands, see Armendariz (2016).

medications, expressly prescribed by a physician for that purpose" (oregon.gov, 1997). In neither choice option, whether it is to live with a terminal illness or to end life, it is justifiable to argue that the patient derives pleasure. And yet, by the axiom of revealed preferences, whatever choice the patient takes assigns at least as much utility as the other.

Therefore, Davies's subsistence constraint theory is not only incompatible with standard consumer theory (because it breaks the fundamental assumption of completeness); his theory is also unnecessary to characterize preferences for bundles that cannot sustain life.

The subsistence constraint theory lacks empirical support.

In addition, as Jensen and Miller (2010) say, "there is no consensus at all on what the correct minimum or subsistence calorie threshold is, how it should be computed, or even whether such a threshold exists." In the particular case of Davies's paper, he calibrates the subsistence constraint at 2,500 calories per capita. There is, however, a large section of the world population that lives consuming significantly less calories. For example, Jensen and Miller (2008) document Giffen behavior among manual laborers in China who consume 1,800 calories on average. And the Starvation and Rehabilitation Experiment from the University of Minnesota shows that people can live consuming even less calories. Specifically, they put subjects on a 1,500 calorie diet for 24 weeks in a process they call "semi-starvation." So definitely, if such a constraint exists, it is not 2,500 calories.

Similarly, if a subsistence constraint exists, we do not know how to compute that threshold either, because the energetic requirement is heterogeneous across abilities to adapt to new environments. In particular, when people face caloric deprivation, their metabolic system slows down, saving energy to keep the body alive. To control for this fact, some researchers use anthropometric measurements while others use blood samples to measure levels of nutrients inside the body. Therefore, if there is a subsistence constraint, we do not know if it is measured in terms of caloric intake, body size, intake of macro nutrients, etc.[6]

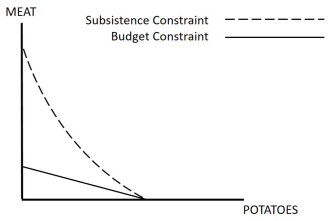
And finally, on the one hand, some researchers doubt that the threshold exists because people are more likely to die from other diseases caused by a weak immune system before they die of starvation. On the other hand, since poverty is highly related with low levels of education, the feeling of hunger is more likely to drive the preference order for food bundles among the extreme poor, not the knowledge that there is a subsistence constraint that they must satisfy in order to maintain health and life.

Strict convexity does not imply interior solution.

Davies's paper has an incorrect implication of convex preferences. As mentioned previously, in the last paragraph of the summary of Davies's paper to be precise,

[6] To see the complexity of measuring subsistence constraints, see Leathers and Foster (2009).

Figure 1: Indifference Curve Map



Davies claims that Ireland specialized in the consumption of potatoes because the subsistence constraint is not convex. Otherwise, his model predicts that the solution would be interior. However, even if we were to make the heroic assumption that his prediction fully satisfies the definition of individual demand, a corner solution could arise even when the subsistence constraint is strictly convex as I show in Figure 1.

Instead, in standard consumer theory, there is another assumption that guarantees an interior solution.[7] This assumption is known as Inada Conditions. Graphically, these conditions assure that indifference curves never touch the axes. Therefore, these conditions avoid corner solutions.

In reality, this last comment does not overturn Davies's general results (the previous two comments do overturn his results), because he claims that the subsistence constraint cannot be convex. However, this last comment suggests that Davies may have a poor knowledge of standard consumer theory. Therefore, when he created his model, he did not realize that he broke the fundamental assumption of completeness and left unexplained why the Irish specialized in potatoes when they could have chosen other bundles that do not assign utility.

I am not saying that it is impossible to create models with incomplete preferences. In fact, economists are working nowadays on models that break this assumption (e.g. Ok, 2002). These models portray "indecisive" consumers. Davies's theory, however, is not about "indecisiveness." His theory is about being decisive on choosing life over dead, where life is always strictly preferred. This decisive behavior explains why specializing consumption in potatoes is a "Survival Imperative." In other words, in a Survival Imperative world, bundles that cannot maintain life do provide utility to consumers. Their level of utility is so low that consumers will do anything in their possibility to avoid consuming those bundles, including specializing their consumption in potatoes.

[7] The standard assumptions of ordinal utility functions are strictly increasing, quasi-concave, and continuous. When these assumptions are broken, basic theorems in microecomic theory may fail (e.g., the welfare theorems). Also, economists usually assume that ordinal utility functions are continuously differentiable. This assumption makes mathematical models more tractable.

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