



## Material needs and aggregate demand

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### ABSTRACT

A central conclusion of the standard theory of consumption is that consumers' preferences can be taken as theoretical primitives. Special categories of consumption, such as "basic needs", or of goods, such as "subsistence goods" are seen as extra theoretical baggage that add few, if any, insights. This theoretical orientation has been absorbed into the theory of aggregate demand, but the aggregate theory has a serious problem that is not shared by the individual-level theory: no matter how well-behaved the individual-level demand functions may be, the aggregate-level function can take on almost any form. This result follows from the SMD theorem, named after Sonnenschein, Mantel, and Debreu, who developed the theory; Kirman and Koch strengthened the results, and the SMD–KK theorem poses a fundamental challenge to models linking micro and macroeconomics. A standard response to the aggregation problem is to introduce a representative agent, but this merely sidesteps the problem. We argue that the aggregation problem arises, in part, because of the exclusion of needs from the theory. Specifically, we argue that material needs—such as basic needs for energy, water, food, and shelter—must be included as theoretical primitives because both the needs and the satisfiers of those needs are universal. We construct a microeconomic model with material needs and show that the form of the aggregate excess demand function is not completely arbitrary, so the SMD–KK theorem does not apply. We discuss the implications of this result.

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### 1. Introduction

Near the middle of the last century the theory of individual consumer demand reached a peak, as the work of Houthakker (1950) and Samuelson (1950) closed the theoretical loop between utility-based theories and the theory of revealed preference. Little (1950) and Georgescu-Roegen (1954), among others, challenged the assumptions behind the theory, while Wong (2006, first published in 1978) and Miller (1983) criticized the methodology. However, critique did not dampen the theory's success; it largely drove needs from the mainstream economic research agenda (Seeley, 1992), although not from the heterodox literature (e.g., Lutz and Lux, 1979; Canterbury, 1979). The standard micro-level theory has since been criticized for having unrealistic hypotheses about human behavior (Sen, 1977; Simon, 1984; Kirman, 1989; Ackerman, 1997), and alternative micro-level theories have been proposed that correct some of the deficiencies (Lancaster, 1966; Stigler and Becker, 1977; Encarnación, 1990; Seeley, 1992; Chattopadhyay et al., 2009). At the same time problems with the macro-level theory of aggregate consumption appeared. The aggregation problem<sup>1</sup> is by now

a widely understood but also widely unacknowledged problem within standard economic theory (Kirman, 1989, 2006; Janssen, 1993; Chipman, 2006). The situation is serious because a major tool of economic policy analysis—the computable general equilibrium model—is premised on the ability to meaningfully aggregate individual-level demand to an economy-wide demand function (Dixon et al., 1996; Ackerman, 2001; Ginsburgh and Keyzer, 2002).

The aggregation problem is captured in the so-called SMD theorem (Rizvi, 2006), named after Sonnenschein (1972), Mantel (1974), and Debreu (1974), who built up the essential argument in a series of papers. The SMD theorem shows that nearly any continuous function satisfying Walras' Law can be expressed as a sum of well-behaved individual demand functions; thus the individual theory of consumption places almost no restrictions on aggregate excess demand. Because the theorem is proved by construction, it could be, and was, criticized for the specific form of the demand functions used in the construction. This critique was strongly refuted by Kirman and Koch (1986), who showed that the theorem holds even in the case of identical preferences and almost any initial relative income distribution. In their own words,

economic relation is reproduced at the aggregate level (Janssen, 1993). In this paper we use it more generally to mean the problem of explicitly deriving a macroeconomic model from a micro-economic model by aggregating over a population.

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<sup>1</sup> The term "aggregation problem" is sometimes used to label a particular mathematical problem of finding the conditions under which the structure of a micro-scale

they showed that, “...any arbitrary excess demand function may be generated by an exchange economy with any fixed price independent relative income distribution and identical preferences for all agents.” The Kirman and Koch result, which, with Chipman (2006), we call the SMD–KK theorem, is a strong challenge to aggregation. At present there is no known way around it aside from assuming a representative agent—that is, assuming that the aggregate demand function looks like an individual demand function (Kirman, 2006; Chipman, 2006). However, there is no theory that justifies this approach (Kirman, 1992; Janssen, 1993), and the representative agent is perhaps best viewed as a practical device to generate candidate forms for aggregate demand functions that can then be tested empirically.

In this paper we argue that the introduction of human needs into the theory provides a solution to the aggregation problem. Of necessity, it does so by making assumptions at odds to the standard micro-level theory. We restate Kirman and Koch’s result in a way that is more appropriate for our argument:

Given an arbitrary excess demand function  $f$  and a relative income distribution with a lower bound well above zero,<sup>2</sup> it is always possible to construct a single, well-behaved, preference function that is shared by all consumers such that the aggregate excess demand generated by the specified income distribution and preference function is equal to  $f$ .

In this paper we show that when basic needs are introduced into individuals’ consumption decisions, one avoids the implications of Kirman and Koch’s result, for two reasons. First, we argue that theories of human needs suggest that, for a class of “material” needs, people within a given society have very similar preferences and, moreover, the form of those preferences is not arbitrary, as the SMD–KK theorem requires (Chipman, 2006). Second, we argue on empirical evidence provided by Jackson and Marks (1999) that, even in highly industrialized societies, expenditure on these categories of needs is a large part of many household budgets. By the first argument we place both a weaker and a stronger constraint on the form of the excess demand function than assumed by Kirman and Koch. It is weaker because individual preference functions differ for some goods, but are identical for other goods; it is stronger because it fixes the form of the individual preference function for goods that satisfy material needs. From the second argument we conclude that even if material needs provide only a portion of household expenditure, it is a large enough portion to significantly constrain aggregate demand.

## 2. Human needs and consumption

There is a long history within economics of hierarchical (or, more narrowly, lexicographic) needs-based approaches to consumption (Drakopoulos and Karayiannis, 2004). Indeed, Alfred Marshall, one of the early theorists of the dominant consumption model, proposed a hierarchy of needs (Drakopoulos and Karayiannis, 2004; Haines, 1982). Important contributions to an economic theory of hierarchical needs were produced close to the time of Houthakker and Samuelson’s papers (Roy, 1943; Georgescu-Roegen, 1954), but these had little influence on mainstream economics. Outside of economics there has been continued interest in human needs (Drakopoulos, 1994). Perhaps the best-known psychological theory is that of Maslow (1943), who proposed a hierarchy of needs that is similar to that of Marshall. Needs lower in Maslow’s hierarchy, such

as physiological and safety needs, must be satisfied before people can pursue higher needs, such as belonging or “self-actualization”.

### 2.1. Characteristics of needs

Fishburn (1974) identifies two trends in the literature on lexicographic preferences—the mathematical and the pragmatic. The mathematical approach uses both the formal mathematics of consumption theory and an axiomatic approach to defining needs. While the present paper takes a mathematical approach to constructing aggregate excess demand functions, it is firmly in the pragmatic tradition of research on preferences. We therefore turn to a more descriptive, and less axiomatic, discussion of needs. Lavoie (1994, 2004) identifies the characteristics of a Post Keynesian theory of consumer choice, which provides a useful reference framework for the present paper. Lavoie argues that Post Keynesian theory adheres to the following principles:

1. procedural rationality,
2. existence of satiable needs,
3. separability of needs,
4. subordination of needs,
5. growth of needs,
6. non-independence of needs.

Principles 2–4 are explicitly included in the model presented in this paper, and Principles 1 and 5 are implicit. Principles 2–5 suggest that income effects are more important than substitution effects: separability and subordination of needs mean that individuals substitute at most within broad categories of goods, rather than between categories; growth of needs and satiability together imply that, as their incomes rise, consumers can both completely satisfy some needs and discover others. Principle 1 offers a mechanism for making definite consumption choices despite cognitive limitations. This principle fits comfortably with the notion of the separability of needs, as separate needs can be placed in different cognitive “bins” for processing.

Principle 5, the non-independence of needs, makes an important but indirect appearance in the model presented below. Other authors have referred to this phenomenon, that the consumption of others influences one’s own consumption, as interdependence (Pollak, 1976; Alessie and Kapteyn, 1991). Interdependence has been observed empirically. Yang and Allenby (2003) build and test a Hierarchical Bayesian model of interdependent preferences using US data on car consumption, and find evidence that geographical proximity and group similarity help to explain the similarity of consumption bundles. Heffetz (2010) tests US consumption data for several goods and finds that more visible goods have a higher price elasticity, suggesting that as consumers’ incomes increase, they spend at least part of the increase on conspicuous consumption. As Kirman (1989) points out, interdependence offers a possible route to avoiding the implications of the SMD theorem. While we agree, in this paper we focus on another mechanism—common consumption bundles for basic material needs. The two mechanisms have in common that they lead to convergence between consumers’ buying patterns. We introduce interdependence through an assumption of relatively homogeneous consumption patterns for poor and low-income households.

### 2.2. Representing hierarchical needs

The standard theory of consumer choice requires indefinite substitutability, largely to avoid “kinks” in preference and demand functions. This is unsatisfactory, as it generates a theory of human psychology on the basis of mathematical convenience. Theorists who start with observed consumer behavior are led to hierarchical

<sup>2</sup> The assumption of an income distribution bounded far away from zero is not emphasized in the body of Kirman and Koch’s paper, but appears in the appendix, where they write, “We may further assume that the endowments are large enough to make the individual demand  $\phi_i(p) > 0$  for every  $p \in S_\epsilon$  and every consumer  $i$ .”

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