

Economics and Nonsupervenience

Abstract

In recent years, the project of providing microeconomic foundations for macroeconomics has taken on new urgency. Some philosophers and economists have challenged the project, both for the way economists actually approach microfoundations and on more general anti-reductionist grounds. Both reductionists and anti-reductionists alike, however, have taken it to be trivial that the macroeconomic facts are exhaustively determined by microeconomic ones. In this paper, I challenge this supposed triviality. I argue that macroeconomic properties do not even globally supervene on microeconomic ones. This is simply a consequence of the difference in the explanatory goals of the respective fields, which implicitly carve out the microeconomic property set in such a way that it underdetermines macroeconomic properties. It means, however, that microeconomics-based foundations for macroeconomics are inadequate in principle.

1. Introduction

Since Robert Lucas's 1976 critique of macroeconomic policymaking, much effort has been dedicated to the development of "microfoundations" for macroeconomics.¹ In recent years, a number of previously independent streams of microeconomic modeling –

¹ Lucas (1976). General equilibrium theory had historically been so idealized that few lessons could be drawn about the relations among macrovariables in a real economy. Even Arrow and Hahn (1971) suggest that the key lesson of investigating the properties of equilibria is to provide assurance of the possibility of arriving at equilibrium in a complex system, rather than being useful for macroeconomic policy (Cf. Hausman (1992)).

e.g., models of risk and incomplete information, incomplete markets, monetary phenomena, price and labor inflexibility, and departures from rationality – have begun to converge. Among these newly integrated models are real business cycle models, new Keynesian models, and others now falling under the rubric of dynamic stochastic general equilibrium (DSGE) theory. These advances have seemed to many people to hold great promise in delivering genuine microeconomic models of macroeconomic properties.

Nonetheless, there remains a good deal of skepticism among philosophers of economics with respect to the microfoundations project. The most common criticisms have been leveled against the use of “representative agents” in these models.²

Representative agent models have been criticized by a number of economists and philosophers, including Kirman, Nelson, Janssen, Hartley, Kincaid, and Hoover.³

Criticism of representative agent models is often part of a larger critique of microfoundations as well. Many philosophers and economists are pluralists about

² This involves treating agents as an aggregate of homogeneous “representative” individuals, that has properties averaged over the population. Without idealizing agents as a representative agent, the problem of aggregating individual preferences and consumption is often analytically intractable.

³ Nelson (1986); Janssen (1993); Hartley (1997); Kincaid (1997); Hoover (2001a); Hoover (2006b). Criticism of representative agents on such grounds reflects pessimism (or perhaps realism) about the degree to which those idealizations are detrimental to the realism of the model. The self-conscious employer of the representative agent model holds out the hope that even though it is possible for aggregated preferences to be ill-behaved, that they will not be. A critic will regard representative agent models to be poor idealizations, but different skeptics may draw diametrically opposed conclusions from this. Some hold that it militates for a more sophisticated approach to microfoundations, and indeed, some recent work on DSGE models has begun to incorporate heterogeneous agents. Others hold that it is evidence that microfoundational projects are a pipe dream.

explanation, and doubt the utility or necessity of microfoundations. It is not universally held that useful or robust or explanatory macroeconomic models do require microfoundations, despite Lucas's arguments.

A stronger critical stance is to doubt the possibility of microfoundations for macroeconomics altogether. This sort of skepticism is often based on similar considerations as skepticism about reduction in other special sciences. Arguments against reducibility of a high level domain ("domain A") on a low-level domain ("domain B") typically hold that there is a gap between (1) the *ontological determination* of entities and properties in domain A by entities and properties in domain B, and (2) the *explainability or identification* of events or generalizations in domain A in terms of those in domain B. It is commonly conceded, for instance, that chemical properties supervene on those of physics, but that nonetheless there may be barriers to the reduction of chemical properties to the properties of physics.

Arguments for the compatibility of supervenience with non-reducibility are by now familiar enough that they have become the default route for skepticism about reduction. It is rare even to bother assessing the claim that domain B either exhaustively determines or supervenes on domain A.⁴ As applied to economics, it is almost universally held that while the provision of microfoundations for macroeconomics is difficult in practice if not impossible in principle, nonetheless the supervenience of macroeconomic phenomena on microeconomic phenomena is trivial. This is held by reductionists and anti-reductionists alike. Typically, the claim is implicit in theorizing

⁴ In some cases this claim has been discussed at length, such as in teleofunctional accounts of biological properties, which deny that certain biological properties supervene on synchronic supervenience bases.

about the relation of macroeconomics to microeconomics, but Kevin Hoover has explicitly argued for it in a few places.⁵

My aim in this paper is to argue that this supposed triviality is in fact false. Microeconomic properties fail to exhaustively determine the macroeconomic properties. To show this first requires developing a clearer picture of the domain of microeconomics, and then showing that macroeconomic properties depend on properties outside of this domain.

The failure of macroeconomics to supervene on microeconomics does not mean that macroeconomics is ontologically “free-floating” or that it involves a dualistic ontology or some Hegelian spirit-world. It is simply a consequence of the difference in the explanatory goals of the respective fields, which implicitly carve out the microeconomic property set in such a way that it underdetermines macroeconomic properties. This is not a shortcoming, but a reasonable outcome of the implicit design principles behind microeconomics. Clarifying the different goals of micro and macroeconomics, we should not even expect macroeconomics to supervene on microeconomics, even though of course both supervene on physics.

2. Preliminaries on supervenience

It is generally agreed that the supervenience relation is a useful way of understanding important necessary conditions for the “exhaustive determination” of a set of properties by another set.⁶ There are many varieties of supervenience, so in evaluating

⁵ Hoover (1995); Hoover (2001b); Hoover (2001a); Hoover (2006a).

⁶ Supervenience is not generally regarded as sufficient to capture the full “ontological dependence” relation, as supervenience involves a modal covariation, while ontological dependence arguably involves

the supervenience of macroeconomic properties on microeconomic ones, we need to be clear on which variety is involved in the claim. The most common form of supervenience is local supervenience.⁷ It is widely recognized, however, that social properties do not supervene locally on individualistic properties in general,⁸ nor does the claim of the supervenience of macroeconomics on microeconomics seem to require local supervenience. Rather, the claim of determination and exhaustion of macroeconomics by microeconomics seems to involve the weaker claim of global supervenience.

On Jaegwon Kim's definition, A-properties supervene globally on B-properties just in case if two worlds w_1 and w_2 are as a whole B-indiscernible, then they are A-indiscernible.⁹ To apply it to the present case: Macroeconomic properties globally supervene on microeconomic properties just in case if two worlds w_1 and w_2 are microeconomically indiscernible, then they are macroeconomically indiscernible. To test for supervenience, we must set up two worlds or circumstances that have the same microeconomic properties and show that nonetheless they may have different macroeconomic properties.

essentiality rather than only necessity (Cf. Fine (1994); Correia (2004)). Still, modal covariation seems to be a necessary even if insufficient condition for ontological dependence.

⁷ On Jaegwon Kim's definition, A-properties supervene locally on B-properties just in case for every pair of objects x and y , if x and y are B-indiscernible then they are A-indiscernible. Kim (1984).

⁸ Currie (1984); Pettit (2003).

⁹ There is a variety of interpretations of global supervenience, turning on how we are to understand the indiscernibility of worlds. (Cf. Sider (1999); Bennett (2004); Shagrir (2002)). But discriminating among these complicates the discussion, and all of them will fail for the same reason, in the present context.

The one denial I am aware of, of the supervenience of macroeconomics on microeconomics, is by Julian Reiss in a review of Kevin Hoover's *The Methodology of Empirical Macroeconomics*.¹⁰ Reiss's argument, however, does not correctly construe the nature and role of supervenience.¹¹

Reiss makes two points against the supervenience claim:

One point is that, clearly, macro entities causally influence micro entities (when, for example, agents react to inflation or recessions or changes in the federal funds rate). This contradicts both the spirit and the letter of supervenience theories.

The second point is that it is not clear whether one would really "fix" the macro entities by "fixing" the micro entities... this is due to the liberty with which macro aggregates are constructed. There is no one way in which, say, the price level can be measured. Importantly, different ways of measuring have different, and in some cases very different, results. These results, in turn, may have effects that spread throughout the economy... Even if one assumes strict determinism at the micro level, copying a microeconomy would not ensure that the history of the duplicate would be identical to the history of the original. In order to ensure that, one would also have to fix the methods of measurement, but this is exactly the "additional bit" macro entities have and whose existence supervenience theorists deny.¹²

On the first point, Reiss is mistaken that the ability of macro entities to have causal effects on micro entities is incompatible with, or even in tension with, the letter or spirit of supervenience. Changes in the chemical properties of a bar of iron cause changes in the magnetic fields surrounding the iron, but that does not imply that chemical

¹⁰ Reiss (2004)

¹¹ Kevin Hoover has also responded to Reiss in a recent paper (Hoover (2006a)), pointing out some different issues than I do here.

¹² Reiss (2004), pp. 232-233.

properties fail to supervene on physical ones.¹³

On the second point, the supervenience theorist would presumably allow that historical properties are included in both the microeconomic and macroeconomic supervenience bases. Some theorists might postulate that macroeconomic properties of an entity at time t supervene on its microeconomic properties at t , but that is not required for a global supervenience claim to hold, on a plausible understanding of the micro- and macroeconomic property sets. Moreover, assessing a supervenience claim involves determining whether two worlds, w_1 and w_2 , exemplify the same macroeconomic properties, not whether the inhabitants of the worlds would ascribe the properties to their own situations. A supervenience claim involves the prior delineation of the sets of A-properties and B-properties, which are evaluated across worlds. Reiss states that the effects of a choice of measurement systems, by which macroeconomic properties are chosen, can spread through an economy. But in this case, then either they spread in a way that makes the worlds microeconomically discernible, in which case the worlds are not B-indiscernible in the first place, or else it does not make them microeconomically discernible, in which case it is irrelevant to the supervenience claim whether the inhabitants of the world would ascribe those properties to themselves or not.

¹³ It may be thought that the “causal exclusion” argument, advanced by Kim and others (e.g. Kim (1998); Kim (2001)) provides some reason to believe in this incompatibility, but this is not correct. The causal exclusion argument involves the incompatibility of five intuitive theses, including both a supervenience and an exclusion thesis. However, the four theses even apart from the supervenience thesis are already mutually inconsistent. (Cf. Kallestrup (2006)). Moreover, proponents of the argument diagnose it as implying the failure of one of the other four theses, since it is generally discussed in connection with mental causation, and few would deny the supervenience of the mental on the physical.

It is in fact a standard move for anti-reductionists such as Hoover to endorse supervenience claims, so as to grant the exhaustive determination of the higher-level property set by the lower-level one, while nonetheless arguing that that determination does not imply reducibility.

3. Microeconomic properties

In many ways, the crux of the issue is figuring out what the microeconomic property set is – that is, the “supervenience base” on which macroeconomic properties are taken to supervene. If the microeconomic property set is too broadly understood, then it can even be stretched so far as to trivialize any reduction claims. If it is too narrowly understood, on the other hand, then a supervenience claim will fail without being given a fair chance.

We often speak of the supervenience of a scientific field on another scientific field, such as of psychology on neurology, or chemistry on physics. To be precise, however, supervenience is a relation not between theories or sets of theories, but between sets of facts or properties and other sets of facts or properties. This becomes a complication when we deal with a field or approach or sort of theory like microeconomics, whose domain is not well specified. The task of determining whether one domain supervenes on another comes down, in large part, to the task of understanding what property set is the implicit domain of the field or approach or kind of theory.¹⁴

¹⁴ If we are interested, for instance, in assessing whether a biological property holding at time t supervenes on chemistry, then it becomes important to determine whether the facts about chemistry or the chemical properties in question include only the chemical properties of the world at t , or the chemical properties at the times preceding t as well. If biological properties are historical, as many philosophers of biology

One assumption that needs to be made is that there is a unified property set for microeconomics in the first place. Different theories and models in microeconomics will presumably involve different properties, but if we are to assess the claim that macroeconomics supervenes on microeconomics, there needs to be at least some sense in which there is one supervenience base of microeconomics. Otherwise, it is not clear even how to understand the claim of supervenience.

To determine which are the microeconomic properties, we must of course look to actual microeconomic theories, as they are built and used. The key microeconomic theories I have my eye on, in constructing this characterization, are the sorts of models I mentioned at the outset: general equilibrium models and their dynamic variants, including New Keynesian and DSGE models, and also agent-based computational models.

The distinction between surface and underlying ontologies of microeconomic models

It would be nice if we could simply survey a broad range of actual microeconomic models, and take the kinds of properties to which they explicitly refer to be the microeconomic property set. Unfortunately, this will not do. Bob Sugden, for instance, has recently discussed the fact that Schelling's model of racial segregation is considered a seminal microeconomic model, even though the entities in the model are pennies, nickels, and a chessboard.¹⁵ The explicit referents of terms involved in models do not necessarily indicate even the genuine subject-matter of the models, to say nothing of the ontology of

have taken them to be, then they clearly will require historical properties to be included in the supervenience base as well. Clarifying just what the chemical properties are is the greatest part of ascertaining whether biological properties do or do not supervene on them.

¹⁵ Sugden (2000); Schelling (1978).

microeconomics as a whole.

It is obvious that Schelling's intention is to refer to people, not pennies. But the point applies to nonmetaphorical referents of straightforward models as well. Consider the Ramsey growth model, for instance.¹⁶ Ramsey's 1928 model involves an optimization problem for an individual: how should an individual, such as a farmer, allocate his resources, so as to maximize his overall consumption over time? The more food and leisure he consumes in the present, the more his immediate payoff, but the less he has to invest for future consumption. Thus present consumption needs to be traded off with future consumption, to optimize the total.

Taken literally, the basic Ramsey model involves the determination of present consumption and production levels not only by characteristics of the present, but by characteristics of the future as well. In fact, however, this reliance on future consumption is generally regarded as a limitation or idealization of the model, rather than an indispensable part of it. The Ramsey model, that is, is commonly understood as idealizing the current knowledge possessed by the farmer. It is not the future states of the farmer that figure into the present consumption levels. Instead, the farmer in the basic model is idealized as knowing what the future will bring, so that his current consumption levels are determined by that knowledge. Although future states are explicitly referred to in the Ramsey growth model, they are being used as an idealized proxy for the farmer's beliefs, which figure into his consumption at a given time.¹⁷

¹⁶ Ramsey (1928).

¹⁷ A similar phenomenon arises in the ontology of a general equilibrium model, such as the Arrow-Debreu economy. Such an economy consists of a set of individuals, each with a preference relation, ordering

A distinction must be made, then, between what I will call the “surface” ontology of microeconomic models – that is, the entities that a reasonably literal reading of the models seem to involve, such as pennies, chessboards, auctioneers, and future states of the world – and their “underlying” ontology, i.e., the objects and properties that are the proper subject matter of the models, which the elements of the surface ontology are being employed to model. While we cannot of course disregard the literal objects referred to in actual microeconomic models in delineating the ontology of microeconomics, at the same time we cannot simply draw the underlying ontology of microeconomics from the models themselves.

Institutional and external factors in the underlying microeconomic property set

Most recent concern with microeconomic properties has focused on the dichotomy of agents and social institutions – what the properties of an agent are, and

bundles of commodities; a set of firms, with production functions; and a set of commodities, with a set of attributes. It has the advantage that it attempts to model characteristics of an entire economy, thus holding out some hope that it will capture properties that supervene globally on an economic system, even while failing to supervene locally.

But there are many obvious problems with this version of general equilibrium theory. An Arrow-Debreu economy is very idealized, and also is static, rather than capturing the dynamics of an economy over time. One way of de-idealizing the Arrow-Debreu economy is to add a theory of tâtonnement, or a process for the arrival at equilibrium. A way of doing this, following Walras, is to introduce an additional element, an auctioneer, who facilitates the setting of prices. But like the future, the auctioneer is clearly an ontological crutch to assist us in constructing an idealization. Even in constructing the model, we know that there is no auctioneer. Although it appears explicitly in microeconomic models, it should not count as part of the microeconomic property set.

whether the conditioning of individuals by institutional factors is compatible with or an obstacle to methodological individualism. From the perspective of characterizing the supervenience base of microeconomics, however, how exactly institutions fit into explanation is beside the point. Clearly, institutions and their social properties cannot be counted as part of the microeconomic supervenience base.

The problem of institutions goes back to discussions of methodological individualism in the 50s, was brought to prominence by Popper, Agassi, and others,¹⁸ and is still the key issue examined in many discussions of methodological individualism in economics, such as Arrow (1994). When Popper, Arrow, and others argue in this vein that institutions are indispensable in microeconomic modeling, however, they are making a point about explanatory methodology, not about microeconomic ontology. Both would hold that institutions are not part of the microeconomic property set, but supervene on it. The problem posed by institutions, for them, arises just from the fact that they are *not* microeconomic entities.¹⁹

¹⁸ Popper (1945); Popper (1962); Agassi (1975); Jarvie (1998); Udehn (2001).

¹⁹ Likewise, households and firms occupy a complex position in microeconomics. Households and firms are commonly treated by microeconomic theory, and microeconomic methodology can even be applied to the interactions between governments and nations as agents as well. In his book on microfoundations, Janssen (1993) in fact proposes that economic explanations in terms of households and firms ought to be counted as individualistic. Udehn (2001), however, rightly points out that this is not acceptable. For certain purposes, firms may be modeled as agents, but where this is done, the models are clearly not individualistic. If all properties of macroentities, such as nations, are included in the microeconomic supervenience base, then of course supervenience (and reduction) will be trivial, since the microeconomic property set will include the macroeconomic property set. For current purposes, I will

The troublesome area for delineating the microeconomic property set is one that most theorists pay almost no attention to: the external factors, i.e., the properties of things other than individuals. External factors are generally assumed to be very straightforward. Interestingly, some approaches to the subject-matter of economics simply ignore the world external to agents: certain methodologists, for instance, treat economic properties as simply psychological or behavioral, and model the statics or dynamics of these properties in terms only of other such properties.

Other methodologists, such as Arrow and Boland, have said that nonpsychological factors should be treated with exogenous variables in microeconomic models, while psychological factors are endogenous.²⁰ It is a mistake, however, to see the distinction between endogenous and exogenous variables to line up with an important distinction in the underlying ontology of microeconomics. Properties are treated with exogenous variables when they are outside the scope of a particular model, not apart from the properties being modeled. A general equilibrium model, for instance, takes individual preferences to be exogenously determined, and models the economy with those fixed. In reality, of course, these can be affected by economic transactions that take place in the economy. The fact that preference determination is exogenous in most individualistic models does not mean that it is outside the causal mechanism that is the subject-matter of microeconomics.

Furthermore, it is not the case that external factors are exogenous in most

take it that supervenience claims and microfoundations projects are meant to found macroeconomics on a microeconomic base that is centered on individual people.

²⁰ Arrow (1968 [1951]); Boland (1982).

microeconomic models. Consider how general equilibrium theory treats commodities. The commodities composing individual endowments are as central to the Arrow-Debreu economy as are the individuals. Commodities are in fact modeled in detail in general equilibrium theory. Arrow-Debreu commodities are understood as vectors of properties, toward which individuals have preferences. Arrow-Debreu commodities, for instance, include not only the characteristics of a good itself, but also the future delivery date and the state of the world at that time. The commodity *an umbrella on the seventh of October in case of rain*, for instance, is different from the commodity *an umbrella on the seventh of October in case of sunshine*. I will suggest that not every feature of Arrow-Debreu commodities are part of the underlying microeconomic property set. However, the properties of commodities cannot be excluded altogether from the set, and in any case they are an endogenous part of standard general equilibrium models.

Proposal

What non-psychological and non-behavioral properties should be included in the microeconomic property set? I will simply make a positive proposal, that I think is in accord with the goals and the practice of microeconomics. To delineate the microeconomic property set, it is important not to lose sight of the fact that microeconomics is after all centered on explanations of individual action in terms of the causes directly impinging on those individuals. Even though the microeconomic property set can incorporate properties that are not the properties of individuals, such as the properties of commodities, nonetheless it is delimited by the causal stream in which individuals are involved. This excludes from the microeconomic property set those properties that are *not* in the network of direct causes leading to and from individual

people.

To see this, consider the moves taken in making crude models more refined. More sophisticated versions of the Ramsey growth model, for instance, make it clear that their intention is to describe direct causal mechanisms. Lucas and Stokey (1989), for instance, apply expected utility theory and branching future states to eliminate the assumption of omniscience from the Ramsey model.²¹ From a “surface” perspective, his moving from a determinate future to a future state space is simply an addition to the ontology, and does not eliminate but increases reliance on the future. But the idea behind adding this sort of feature to a model is clearly not to approximate the metaphysics of futurity. Instead, the idea is to set up a structure within which we can generate an approximation of the attitudes and expectations of the agent. The probabilities of future states are understood as epistemic or informational properties of individuals. Implicitly, the model is built so as to model current decisions as functions of current beliefs about the future.

The reason for doing all this refinement is that it is the current states of agents that have causal influence at a time. This is already understood in the choice to introduce such features as spaces of future states. The kinds of interpretations and refinements we see in the movement from simple Ramsey models and general equilibrium models to more refined DSGE models reflect that these models aim to approximate the properties of direct causal mechanisms, even when the earlier versions are built as atemporal

²¹ Lucas, Stokey et al. (1989).

idealizations.²²

Understanding the brand of explanation peculiar to microeconomics, I suggest, is the basis for constructing a picture of the underlying microeconomic property set. I propose that the microeconomic property set should be delineated by considering the network of direct causes interacting unidirectionally or bidirectionally with individual people.

Microeconomics, in short, is designed to model changes in the properties of individual people, as well as features of the world that trigger those changes. If a property of the world does not figure into a chain of direct causes leading to or from changes in the properties of individuals, it is irrelevant to a microeconomic model.

²² This point also pertains to synchronic factors as well, which do not figure into the direct causes affecting individuals. Consider another aspect of commodities in general equilibrium theory. The individuation of Arrow-Debreu commodities depends on the properties of the economy as a whole: commodities are individuated just as finely as it takes for trading to stop. Samsonite umbrellas may be distinct from Totes umbrellas, but not gray ones from black ones, if preference orderings of gray and black umbrellas do not change the distribution of goods in that economy in equilibrium. Why not individuate them more finely? Why are certain real features of commodities deemed irrelevant to the construction of a general equilibrium model?

It may be that this model of commodities is simply an idealization, and chooses to neglect certain actual properties. But there is good reason for individuating Arrow-Debreu commodities only so finely. The reason they are no more fine grained than is required for trading is simply that microeconomics is in the business of giving a causal account of changes in individuals, employing the factors that directly figure into those changes. If trading has stopped, that is sufficient for a microeconomic model to consider. Microeconomic models are designed to capture the characteristics of things up to the point that they govern individual economic behavior.

This is a broad construal of microeconomic ontology. It is centered on individuals, but not restricted to properties that can be attributed to individuals. It will seem to many that this set is inclusive enough that macroeconomics will rather trivially supervene on it. Now let us show that even this microeconomic property set nonetheless falls short of determining the macroeconomic properties.

4. Nonsupervenience of macroeconomics

It is commonly assumed that macroeconomic properties are simply aggregated properties of individuals, measured in some way or other. If this were the case, then supervenience on the property set I described above would immediately follow. This assumption, however, is mistaken. Considering actual macroeconomic properties, it can be shown that they are individuated in part by factors that are neither the properties of individuals, even widely conceived, nor that figure into direct causal chains leading to or from individuals.

To highlight this, and assess supervenience for a specifically macroeconomic property, let us employ the standard supervenience test. That is, set up two artificial situations in which the supervenience base is identical, and that differ in only one factor outside the supervenience base.

The following case is extremely simple, and is but one of any number of examples that could be constructed for common macrovariables. Consider a simplified economy for a small country in some storm-prone region, where the main responsibility of the government is to protect individuals from catastrophic storm damage. To keep expenditures under control, the government discriminates different levels of its responsibility for different types of storms. It enacts a policy that it will compensate

individuals at two different rates:

1. For ordinary storm damage, the government pays \$10,000 per affected household
2. For damage from severe storms – defined as category 2 hurricanes or stronger – it pays \$50,000 per household.

To set up the supervenience test, consider two different situations in which the storms causally affecting individuals and their possessions are indiscernible, yet where the storm is different.

Case A: The country is hit by a storm that is not a hurricane, and 1000 households are damaged.

Case B: the country is hit by a Category 2 hurricane, and 1000 households are still damaged, to exactly the same extent as in case A.

In case A, the government accrues a \$10MM obligation, while in B, it accrues a \$50MM obligation. Notice that this obligation is simply a legislated fact. Whether this fact obtains involves a physical criterion that is separate from the epistemic or other states of the individuals in the population. In case B, the presence of a hurricane sets government obligations at a higher level than they are set in case A, whether or not there are causal consequences for the individuals.

The obligations that the government incurs are a function in part of the impact the storm has on the population, that is, of the households that are damaged by the storm. However, they are also a function of the kind of storm it is, regardless of whether or not that difference has a causal effect on individuals. Putting the epistemology aside, and only considering the facts in the cases, in case A, the government has one level of

obligation, and in case B, it has a different one. The government obligations accrue differently in the situations, based on factors that do not impinge on individuals. Thus a supervenience base that includes only the causal factors directly impinging on individuals will not determine the difference between these situations.²³

This is an artificial case, designed to show the metaphysical point. There are two natural reactions one might have. One is that this is not the way macroeconomic properties work: there is no possibility of a gap between the metaphysics and the epistemology of social facts. A different but related reaction is that even if there is such a difference, it is entirely irrelevant from a practical perspective. Whether or not a storm is a category 2 hurricane only has a practical effect inasmuch as it does affect individuals, and so where external facts fall outside the causal stream affecting individuals, they also fall outside of the practical scope of macroeconomics.

To respond to these reactions, let us put aside intuitions about the metaphysics of social facts, and turn instead to the very practical business of accounting. Constructing a simple balance sheet for the government over time will show that a difference in the “metaphysical status” of a government obligation at time *t* can have a practical impact,

²³ It is of course true that the hurricane causally affects individuals, and that the hurricane causes damage to individual houses. To delineate the microeconomic supervenience base, however, I have suggested that direct or narrow causes affecting individuals be distinguished from wide causes. Presuming that there is wide causation, this means that not all entities that figure into causal chains of any sort will count as microeconomic ones. That is, while the hurricane does causally affect individuals, the storm as a whole is outside the microeconomic supervenience base, just as a thought can causally affect a neuron, even while the thought is outside the supervenience base delineated by neurology. This is a point I discuss further below.

even if it has absolutely no epistemic effect at that time at all.

To perform this accounting exercise, let us consider the government balances over time, leaving the facts as they are in the first few years, and then adding to the case that eventually the inhabitants of the storm-prone country do learn of the difference between the situations, a couple of years following the storm.

The following table shows the economic effects of situation A.

Table 1:

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----------------------------------|--------|-------|------|-----------------|---------------------|--------|--------|--------|
| Event | Normal | Storm | Calm | Initial payment | Acquire information | Normal | Normal | Normal |
| Interest rate | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% |
| Government obligations (\$MM) | 0.0 | 10.0 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tax levied and collected (\$MM) | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Government disbursements (\$MM) | 0.0 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Current surplus (Deficit) (\$MM) | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Productivity growth | 3% | 2% | 2% | 4% | 3% | 3% | 3% | 3% |

In year 1, there is a storm, which generates \$10MM of government obligations. In year 2, \$10.4MM of taxes are levied, to take into account interest on the obligations, and payments are made to the households in year 3, again adjusting for interest. In year 4, the weather committee returns with the results that it was indeed a tropical storm rather than a hurricane, and so that is the end of the story, and productivity growth, which had a temporary hit and small surge from years 1 and 2 to year 3, subsequently returns to its normal 3%.

Table 2 shows the sequence of events for situation B. Here, there is a hurricane in year 1, so the government accrues \$50MM in obligations, but the individuals are in the same epistemic state as in case A. Thus until year 4, taxes and disbursements are the same as in situation A. In the meantime, however, the obligation has kept growing, and then in years 5 and 6, upon receiving the information that the storm had been a hurricane, it levies additional taxes to pay its obligations, and then pays them in year 6, with interest

accruing all the time. Its total disbursements, then, are \$10.8MM in year 2 and \$46.8MM in year 6.

Table 2:

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----------------------------------|--------|-------|-----------------|-----------------|---------------------|-----------------|--------------------|--------|
| Event | Normal | Storm | Collect revenue | Initial payment | Acquire information | Collect revenue | Reconcile payments | Normal |
| Interest rate | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% |
| Government obligations (\$MM) | 0.0 | 50.0 | 52.0 | 43.3 | 45.0 | 46.8 | 0.0 | 0.0 |
| Tax levied and collected (\$MM) | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | 46.8 | 0.0 | 0.0 |
| Government disbursements (\$MM) | 0.0 | 0.0 | 0.0 | 10.8 | 0.0 | 0.0 | 48.7 | 0.0 |
| Current surplus (Deficit) (\$MM) | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | 46.8 | 0.0 | 0.0 |
| Productivity growth | 3% | 2% | 2% | 4% | 3% | 1% | 4% | 3% |

This is the natural way for accounting for what has happened over this period. It is not irrelevant, for the determination of government disbursement over the time period, what the government obligations are in each year. In year 6, government obligations are \$46.8MM because the obligation did not begin in the 6th year, but rather was being accrued from year 1. The metaphysical fact of the value of the macrovariable – i.e., the actual value of the government obligation – is precisely what matters in determining what the subsequent payment schedule is.

This is a simplified case, and deals with a simple obligation of a government, rather than the more complicated macroproperties that are part of macroeconomic theory. But this sort of determination of the value of macrovariables occurs at all levels throughout the economy. The same principles can be applied to the properties of entities at many levels, from households and firms to agencies, governments, nations, and global markets.

To be sure, microeconomics is fully capable (in principle) of accounting for the actions of individuals, the disbursements, and so on, described here. The point is that microeconomics is simply not in the business of generating models that make use of the same extrinsic properties that macroeconomic models do.

Consider how a microeconomic model of the described situations would be constructed. Only factors directly causally impinging on individuals would be employed, so there will not be a “government obligation” variable that changed according to the facts about the storm in year 1. The model would not reflect any difference between the cases until at least year 4. Once the knowledge of the status of the storm reached the population, then it could model the effects of that knowledge on the actions taken by the government. It would do so not by getting the changing value of the macrovariable correct, however. Rather, it would introduce a new set of proxy variables to indicate the epistemic states that change in year 4.²⁴

In the accounting case I have described, the macroproperties of situations A and B diverge in year 1, while the microeconomic properties diverge only in year 4 and afterwards. A microeconomic model need not account for any difference between the situations before year 4, since individual psychology and behavior coincides until then.

²⁴ Christian List has pointed out that certain versions of game theory would admit “moves” of nature as part of an account of these situations. What is admissible in game theory in general, however, is not necessarily part of an individual-centered microeconomic supervenience base. For instance, game theory models the strategic interaction among nations, governments, firms, etc., as freely as it does of individuals. In the case of the “natural move,” the properties of game theoretic agents can involve extrinsic properties that are not direct causes affecting individuals. For the theorist wanting to use game theory as a way of delineating a supervenience base for microeconomics, it will not do to sanction just any extraindividualistic factor. Otherwise she risks trivializing the distinction between macroeconomics and microeconomics. The game theorist must delineate an appropriate “deep” supervenience base, just as the other microfoundations theorists must.

But a model that tracks the macroproperties will reflect their change in the first year.²⁵

The mistake that microfoundationalists seem to make is to assume that macroeconomic properties are either simple or gerrymandered aggregates of microeconomic ones. On scrutiny, there is no good reason why this should be so. Macroeconomic properties, such as the government having such-and-such an obligation, are extrinsic to the entities that are the subject matter of microeconomics, just as the aesthetic properties of a painting are extrinsic to the chemical properties of a canvas, or species membership is extrinsic to the properties that anatomists concern themselves with.

Divergent sets of properties and corresponding types of explanation like this are also familiar in discussions of psychological explanation. Wide attitudes are perfectly usable for explaining individual behavior. In fact, attitudes are individuated widely for a good reason. They allow us to systematize behavior in ways we cannot, if we stick to the intrinsic properties of an individual mind. But that does not mean that a complete narrative cannot be given in terms of the intrinsic properties.²⁶ This is what microeconomics does, in the economic sphere.

²⁵ One strategy for rescuing supervenience is to insist that in the accounting case I have described, the macroproperties change in year 1 in virtue of the change in microproperties in year 4; and if the fact of the matter about the storm had never been discovered (as in the pure case I described earlier), there would have been no difference in the macroproperties. This strategy is rather desperate. It is unlikely that any such attempt to impose an epistemic criterion on the obtaining of macroeconomic facts will be coherent.

²⁶ Cynthia MacDonald has pointed out that Tyler Burge gives an argument along these lines in Burge (1995).

5. Some concerns

I want to address three potential concerns:

(1) Does the wide individuation of macroeconomic properties mean that they are causally ineffective? And if they are causally ineffective, then why should they figure into any body of scientific theory?

(2) Should wide properties not be included in the microeconomic property set as well? And if they were, would macroeconomics then supervene on this property set?

(3) How should we understand the causal criterion for delineating the microeconomic property set, if wide properties are causally effective?

In response to (1), the issues raised here mirror certain problems in the individuation and supervenience of mental properties. Jerry Fodor, for instance, has argued for internalism in psychological explanation, on the basis that only intrinsic properties of the mind are causally effective. This argument involves both the claim that scientific properties are causally individuated, and that there is no wide causation. I regard neither of these claims as correct, but what is important here is the latter one, the denial of wide causation. Stephen Yablo, for instance, has persuasively argued for wide causation with respect to mental properties.²⁷ In fact, properties extrinsic to a system commonly play a role in causal explanations of changes in the system.

In response to (2): The inclusion of wide properties of individuals in microeconomics is in opposition to the practice of microeconomics, and I propose it is in opposition to the spirit of microeconomics as well. Moreover, there is reason to think that even incorporating wide properties into microeconomics will nonetheless

²⁷ Yablo (1997)

underdetermine the macroeconomic properties.

Let me just give one indication as to why I take these to be the case. It was to illustrate the alienness of wide factors in microeconomics that I raised the points about the Lucas refinement of Ramsey and the individuation of Arrow-Debreu commodities, to show that the incorporation of wide factors is regarded as a shortcoming of a microeconomic model.

It is true that a number of complications arise, with respect to delineating the microeconomic property set, if we endorse externalism with regard to mental states. In the end, it may be necessary to make the Hobson's choice of (a) denying externalism, or (b) insisting on the coherence of narrow content, which is in dispute in the philosophy of mind, or (c) disallowing many psychological properties into microeconomic explanations. But we should not ignore the toll that would be incurred by allowing all wide factors involved in the individuation of attitudes, on an externalist picture, into the microeconomic property set. It certainly is not how microeconomists have conceived of the properties with which models are constructed, and it likely would mean that many of the projects that have been seen as key improvements in microeconomic models, like the ones I have mentioned, have been pointless.

Moreover, there is reason to think that even including these wide factors in the microeconomic property set, that the set will still underdetermine the macroeconomic properties. This is related to some issues I have discussed in a recent paper on ontological individualism.²⁸

In response to (3), in distinguishing microeconomics from macroeconomics, I am

²⁸ [Author]

not taking a strong stand on whether the properties of either or both are causally individuated. I hypothesize that microeconomic properties can be understood in terms of networks of “direct” causes impinging on individuals, but do not propose an account of “direct” causation. It may be that we want to use something like Dretske’s notion of a triggering cause,²⁹ or it may be that it should be cashed out in terms of microphysical causation. The important point is that from the perspective of the networks of direct causes to which they are applied, the microeconomic properties are narrow or intrinsic, while the macroeconomic properties may be either narrow or wide.

6. Conclusion

In the end, it is of course the burden of the supervenience theorist to clarify just what the supervenience claim is supposed to be, and hence to delineate the microeconomic property set. It is somewhat surprising that more attention has not been paid to the task. Here I have suggested one conception of microeconomics, which I think is consistent with the intentions and modeling of actual microeconomic theory. If this is the case, then it is simply built to solve a different problem than to found macroeconomics.

As for macroeconomics, it is entirely normal to make use of extrinsic properties of a causal context in certain property sets. The fact that a sequence of events or even a wide variety of sequences of events can be fully characterized with both higher and lower level property sets does not entail, or even normally mean, that the higher level property set supervenes on the lower-level one. In light of this, the failure of macroeconomics to supervene on microeconomics is not particularly mysterious.

²⁹ Dretske (1988)

With the failure of supervenience, *a fortiori* there is no complete microeconomic explanation of all the macroeconomic phenomena, since the microeconomic properties do not even determine the macroproperties. Moreover, it is unlikely to be a straightforward matter to supplement the ontology of microeconomics such that it will exhaustively determine macroproperties and yet remain basically individualistic. All we can say is that macroproperties supervene globally on all the physical properties, not that there is a natural alignment of macroeconomic properties with individualistic ones plus some supplement. The extra-microeconomic properties can crop up at any intermediate level between raw physical properties and fully macroeconomic ones, so a supervenience base for macroeconomics at a higher level than just basic physics will have to be quite heterogeneous.

Inasmuch as microeconomics is individualistic, macroeconomics fails to supervene on it. That does not, however, preclude the supervenience of macroeconomics on a supervenience base that includes more heterogeneous building blocks and is still short of physics as a whole. Included in that supervenience base, however, needs to be the factors that figure into the individuation of a heterogeneous set of social entities, including such things as corporations, contracts, laws, enforcement systems, banks, money, and so on.

Thus the failure of supervenience creates equal difficulties for current agent-based computational economics (ACE) models as it does for analytic ones, such as DSGE models. A good ACE model of a phenomenon will have to decide if it fundamentally wants to operate with a microeconomic ontology or not. Inasmuch as it does, it may successfully simulate the actions of agents, but it will not suffice for generating the

values of macroeconomic properties. Inasmuch as the generation of macroeconomic properties is the goal, on the other hand, a computer model will not be simply agent-based.

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