

Models as Foils

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Abstract: This paper articulates a way of reasoning with economic models that, we believe, has not been sufficiently elaborated in the literature. We begin by highlighting examples of the kind of reasoning we are interested in by taking a close look at the work of Ronald Coase and economists in the Austrian school. Then we argue that current accounts of modeling in the philosophy of economics literature are unable to account for the kind of reasoning in question. We fill this gap by proposing what we call *models as foils*. The basic idea is that a model can give us insights concerning feature f of the actual world by constructing a model world in which f is not present; from here, economists draw inductive inferences concerning the role f plays in the real world by comparing the real world to the world of the f -less model.

“Even imaginary constructions which are inconceivable, self-contradictory, or unrealizable can render useful, even indispensable services in the comprehension of reality, provided the economist knows how to use them properly.”

- Ludwig von Mises, *Human Action: a Treatise on Economics*, pp. 236

1. Introduction

Economists are in the business of building models: models of markets, models of voting, models of bargaining, and so on. Philosophers of economics, on the other hand, are interested in (i) what models *are*, and (ii) what makes models *valuable* as tools of economic inquiry. Our paper takes up the second topic. Some argue that models are valuable tools of economic inquiry when they generate testable predictions that can then either be empirically verified or falsified. Others hold that models are valuable as tools of economic inquiry when they act as credible or plausible worlds that allow us to draw inductive inferences about our actual world. Of course, other answers can be found in the literature, each proposing different ways in which models gain their value as tools of economic analysis.

We – an economist and a philosopher – are pluralists about models. We believe that there are many valuable things models can do. Moreover, these functions need not compete with one another. Some models generate testable predictions, others are credible worlds, still others are used to isolate or gain insight on capacities, and so on and so forth. We are thus not interested in adjudicating between different accounts of where the value of economic modeling lies. Instead, we wish to *add* to the list. Though we do not think many will be particularly surprised at the form of reasoning highlight in this paper, we do believe that it has yet to be formally articulated within contemporary work in the philosophy of economics.¹ Of course, we do not claim that all models must be interpreted in the way we propose. Rather, we wish to highlight one more way in which models can serve as valuable tools, though we think a significant one. Indeed, as we shall see, some of the most celebrated models in economic theory gain value precisely by fulfilling the function we articulate.

Here is how we proceed. The next section highlights the kind of reasoning with models that we will take as our focus for the rest of the paper. We do this by looking to Ronald Coase’s model of a world without transaction costs from his seminal paper “The Problem of Social Cost,” as well as how those in the Austrian economics tradition – Israel Kirzner in particular – reason with competitive equilibrium models (§2). There are deep similarities here: both want to draw conclusions concerning the function some feature f of the real world plays by looking to a model world in which feature f is conspicuously absent. Though this seems to be a plausible way of reasoning in general, contemporary accounts of economic modeling, we argue, cannot account for the way in which Coase and the Austrians draw their inductive inferences (§3).

This opens the door for us to articulate a new account of how models act as valuable tools of economic inquiry, what we call *models as foils* (§4). The basic idea is that models can give us insights concerning feature f of the actual world by constructing a model world in which f is not present; from here, economists draw inductive inferences concerning the role f plays in the real world by comparing the real world to the world of the f -less model.² Though, again, we do not think many in the philosophy of economics literature will be particularly surprised by this style of

¹ There is, however, some historical precedent for it. We believe the style of reasoning we articulate is similar in many ways to John Stuart Mill’s *method of difference*. See Mill (1843/1974: 391).

² Our account of models as foils is inspired by Boettke (1997)’s insightful history of general equilibrium theory in the latter half of the twentieth century, particularly Boettke’s analysis concerning how different schools of thought interpreted the Arrow-Debreu result in diverging ways.

reasoning, we certainly *do* think that this form of reasoning fails to receive adequate attention in the literature. We hope our paper is a first step towards remedying this.

2. Induction from Absence

2.1 *Coase on Transaction Costs.*

Coase begins his 1960 paper by telling us that he is interested in “those actions of business firms which have harmful effects on others” (Coase 1960/1988: 95). That is, he is interested in externalities: costs which parties not privy to voluntary exchange pay nonetheless. It is intuitively plausible that underlying property law matters in how externalities get resolved. If Althea wants to run loud machinery on her property, and Bertha wants peace and quiet on her adjacent property, then how this dispute will be resolved will depend on the allocation of rights: does Althea have a right to run machinery, or does Bertha have a right to peace and quiet? If Althea has the right then the machinery will run; if Bertha has the right then it will not.

But, Coase shows, this is not necessarily so. Coase begins his analysis by assuming that “the pricing system works smoothly (strictly this means that the operation of pricing system is without cost)” (Coase 1960/1988: 97). That is, he assumes there are zero transaction costs. From here Coase goes through examples showing us that, in such a world, (i) all disputes are resolved in an efficient manner, but more stunningly (ii) all disputes result in the *same* efficient outcome regardless what the relevant property law says: “with costless market transactions, the decision of the courts concerning liability for damage would be without effect on the allocation of resources” (Coase 1960/1988: 106). To continue our toy example from the paragraph above, if there are no transaction costs then the dispute between Althea and Bertha will be (i) resolved in an efficient manner and (ii) be resolved in the *same* manner regardless of whether Althea has a right to use noisy machinery or whether Bertha has a right to enjoy peace and quiet. In such a world, property rights are simply irrelevant.

Though it is not a mathematical model of the kind most contemporary economists build, Coase’s imaginary world is a model nonetheless.³ But, given the highly unrealistic assumption of no

³ Some have pressed on us that Coase’s imaginary world is a thought experiment, not a model. We do not think there is a substantive difference between thought experiments and models, following Gerald Gaus (2016: xvi) who holds that “when we construct a more formal model we are not really doing something fundamentally different from in our

transaction costs,⁴ what is the point of such a model? What purpose does it serve in economic inquiry? This is a controversial question. For many, the takeaway from this model is the so-called Coase Theorem – coined by George Stigler – which says that “under perfect competition private and social costs will be equal” (Stigler 1966: 113). Coase’s model is thus interpreted as another theorem of welfare economics: absent transaction costs – the typical assumptions of most general equilibrium models at the time – all externalities will be bargained to an efficient point.

Note that the Coase Theorem as articulated by Stigler tells us little about the actual world. This is puzzling, for Coase understood his model as telling us something deeply important about our actual world.⁵ He writes:

“The Problem of Social Cost,” in which these views were presented in a systematic way, has been widely cited and discussed in the economics literature. But its influence on economic analysis has been less beneficial than I had hoped. The discussion has largely been devoted to sections III and IV of the article and even here has concentrated on the so-called “Coase Theorem,” neglecting other aspects of the analysis. In sections III and IV, I examined what would happen in a world in which transaction costs were assumed to be zero. My aim in doing so was *not* to describe what life would be like in such a world but to provide a simple setting in which to develop the analysis and, what was even more important, *to make clear the fundamental role which transaction costs do, and should, play in fashioning the institutions which make up the economic system* (Coase 1988b: 13) (emphasis ours).⁶

The purpose of Coase’s model, *contra* Stigler but how we and Coase see it,⁷ is not to derive propositions concerning what would happen in the imaginary world of zero transaction costs and perfect competition. Rather, the purpose is to tell us something about our actual world, *even though* the model world departs radically from reality as we know it. In particular, the model is meant to tell us something about the role transaction costs play in the real world, even though transaction costs

informal ones; we are doing much the same thing in a more rigorous way, trying to better understand what assumptions our narrative model was making, and where our narrative actually leads.” For more on thought experiments in economics, see Reiss (2016).

⁴ The classic estimate by Wallis and North (1986) puts transaction sectors at 55% of GNP in 1970. Recent empirical work reaches the same conclusion: transaction costs are large. For one example see Libecap and Lueck (2011).

⁵ For an account of how the Coase theorem has been interpreted by economists, see Medema (2011).

⁶ For similar remarks about how Coase believed his model was misunderstood, see Coase (1988a: 174); Coase (1988b: 15).

⁷ For another who interprets Coase along the same lines as we do, see what Bertrand (2010) calls the “heuristic role” of the Coase theorem.

are conspicuously absent from the model world. We do not want to get into a fight concerning the uniquely correct way of interpreting Coase's model. Instead, we take for granted that there is some merit to Coase's interpretation of his own model, and then focus on the inductive strategy he employs in drawing the conclusions he does about the actual world.

What does Coase think his model teaches us about the actual world? Coase takes the main point of his model to be as follows:

Of course, if market transactions were costless, all that matters (questions of equity apart) is that the rights of the various parties should be well defined and the results of legal action easy to forecast. But as we have seen, the situation is quite different when market transactions are so costly as to make it difficult to change the arrangement of rights established by the law. In such cases, the courts directly influence economic activity. It would therefore seem desirable that the courts should understand the economic consequences of their decisions and should, insofar as this is possible without creating too much uncertainty about the legal position itself, take these consequences into account when making their decisions. Even when it is possible to change the legal delimitation of rights through market transactions, it is obviously desirable to reduce the need for such transactions and thus reduce the employment of resources in carrying them out (Coase 1960/1988: 119).

We interpret this passage as Coase drawing two key conclusions from his model. First: it is *precisely because* of transaction costs that different allocations of property rights result in diverging allocations of goods with differing levels of efficiency. That is, when and because transaction costs are present, the dispute between Althea and Bertha will not necessarily get resolved in the same manner depending on who has the relevant right (whether Althea has a right to use noisy machinery on her property or whether Bertha has a right to uninterrupted enjoyment of her property). Indeed, there is no reason to think that these different ways of specifying the relevant rights will lead to an efficient outcome in either case. This leads to Coase's second conclusion, which is normative: because transaction costs have massive effects on how different allocations of property rights affect economic efficiency, we should structure property law to attain the most efficient outcome possible.

We will not be interested in Coase's normative conclusion for the rest of the paper. But we will be interested in his positive conclusion. More specifically, we will be interested in how he draws

this positive conclusion – a conclusion about the relationships between property law, allocations of goods, and efficiency *in the real world* – from a model that is radically unrealistic in its assumptions. How exactly is the model being used in economic reasoning?⁸ And, moreover, are contemporary accounts articulating the value of economic models able to capture the way Coase uses this model in his reasoning?

2.2 *The Austrians on Equilibrium.*

The last subsection highlighted a peculiar form of reasoning Coase employs with his informal model of a world without transaction costs. By looking closely at a world where these transactions costs are absent, he draws conclusions about the role transaction costs play in the actual world. We do not think Coase is alone in employing this style of reasoning with models. We now focus on how those working in the Austrian economics tradition interpreted competitive equilibrium, focusing on the work of Israel Kirzner in particular.⁹

Competitive equilibrium models are models where prices clear markets.¹⁰ While there are many features constituting these models, we highlight only one for our purposes: everyone in the model is a price-taker. There are price-taking producers which try to maximize profits and price-taking consumers which try to maximize their utility. As Kenneth Arrow and Gerard Debreu characterize it in their classic paper: “It was assumed that each consumer acts so as to maximize his utility, each producer acts so as to maximize his profit, and perfect competition prevails, in the sense that each producer and consumer regards the prices paid and received as independent of his own choices” (Arrow and Debreu 1954: 265).

We wish to argue that Kirzner draws inferences about the real world from competitive equilibrium models in a manner similar to how Coase draws inferences about the real world from his

⁸ There have been some attempts at articulating the kind of reasoning Coase employs, but we believe that the account we offer in §4 below is distinct from these. See Hsiung and Gunning (2002); Hsiung (2004).

⁹ Kirzner is not alone here. In addition to the opening quote from Mises, Hayek (1946/2014: 109; 1961/2014: 420, 425) notes that due to the absence of ignorance in equilibrium models (perfect knowledge is typically assumed) the sorts of behavior we associate with competition would not exist. But in the real world people *are* ignorant and this competitive behavior does exist. This suggests that a lack of perfect information bears some causal relation to the competitive market process: “The function of competition is here precisely to teach us *who* will serve us well” (Hayek 1946/2014: 109). See also Mises (1949/2007: 245-260) on the evenly rotating economy.

¹⁰ While there are different interpretations of perfect competition, the Arrow-Debreu general equilibrium formulation, which assumes every agent is a price-taker, dominates economics. For an alternative interpretation of perfect competition – plus commentary on Coase and the Austrian school – see Makowski and Ostroy (2001).

model of a world without transaction costs.¹¹ That is, Kirzner employs the same style of reasoning highlighted in the previous subsection. Now as we saw, Coase constructs a fictitious world with (i) a deeply unrealistic assumption (no transaction costs) and (ii) an overarching outcome that deviates from what we actually observe (all externalities are bargained to the same efficient point, regardless initial allocations of property rights). From this model world with transaction costs conspicuously absent Coase infers the relationships between transaction costs and property law in the actual world. Kirzner, we think, does something similar.

First, Kirzner notes that the outcomes of competitive equilibrium models are radically different from what we observe in the real world: namely, stylized markets as depicted in competitive equilibrium models are unable to self-correct, even though markets do in fact self-correct in the real world. Writes Kirzner:

Would-be buyers who have been returning home empty-handed (because they have not been offering sufficiently high prices) have *not* learned that it is necessary to outbid other buyers; would-be sellers who return home with unsold goods or resources (because they have been asking prices that are too high) have *not* learned that they must, if they wish to sell, be satisfied with lower prices. Buyers who have paid high prices do not discover that they could have obtained the same goods at lower prices; sellers who have sold for low prices do not discover that they could have obtained higher prices (Kirzner 1973/2013: 11).

This bizarre and highly unrealistic outcome that deviates wildly from the real world is akin to the outcome produced by Coase's informal model: property rights don't matter, and the same efficient outcome is always reached regardless the initial allocation of goods and underlying property law.

But for Kirzner, what is the equivalent in competitive equilibrium models to Coase's absent transaction costs? That is, what feature is absent from the model that causes market failures to go uncorrected? According to Kirzner the issue here is the absence of *entrepreneurs*, who are *not* passive price-takers (and recall that everyone in competitive equilibrium models are price-takers), but rather players that can seek new ends to maximize and new means to introduce to maximize these new or

¹¹ Most economists do not interpret competitive equilibrium models in the manner Kirzner does. For example, Hands (2016: 34) argues that the epistemic value of Arrow-Debreu framework – particularly the work on stability elaborated in Arrow and Hahn (1971) – rose and then fell with its success as derivational robustness, which we argue below is distinct from our models as foils view (§3.4).

existing ends (Kirzner 1963/2011: 16-18). Kirzner argues for this conclusion in the following passage:

Into this imaginary world of men unable to learn from their market experience let us now introduce a group of outsiders who are themselves neither would-be sellers nor would-be buyers, but who *are* able to perceive opportunities for entrepreneurial profits; that is, they are able to see where a good can be sold at a price higher than that for which it can be bought. This group of entrepreneurs would, in our imaginary world, immediately notice profit opportunities *that exist because of the initial ignorance of the market participants* and that have persisted because of their inability to learn from experience (Kirzner 1973/2013: 11).

According to Kirzner, then, the absence of entrepreneurs in competitive equilibrium models is what causes market failures to go uncorrected, just as the absence of transaction costs in Coase's model causes all externalities to be bargained to the same efficient point. But, clearly, there are entrepreneurs present in the real world and, furthermore, markets self-correct in the real world, just as transaction costs are present in the real world and, furthermore, how externalities in the real world are resolved depends on property law.

This allows Kirzner to conclude that the presence of entrepreneurs in the real world bears some causal relation as to why markets do in fact self-correct in the real world, just as Coase concludes that the presence of transaction costs in the real world bears some causal relation to the effect on how property law influences the resolution of externalities. In short: both draw inductive inferences about the role feature *f* of the real world plays by looking to a model world in which *f* is absent. Again, we wish to highlight more formally the exact style of reasoning employed here in §4 below. But first we ask: are contemporary accounts of economic modeling able to capture the kind of reasoning both Coase and the Austrians employ?

3. Philosophical Accounts of Modeling

The last section highlighted a special kind of reasoning economists sometimes employ with their models. In building a model, the economist purposefully leaves a feature *f* of the world out of the model. This is not atypical. But what *is* atypical is that the economist then draws conclusions concerning the function this absent feature *f* actually plays in the real world by looking closely at the

world of the f -less model. With Coase the missing feature is transaction costs; with Kirzner, the missing feature is entrepreneurs. Coase then draws conclusions from the model about the role transaction costs play in the real world, Kirzner about the role of entrepreneurs. Before specifying more clearly exactly how this form of counterfactual reasoning proceeds, we wish to show in the current section that several contemporary accounts of the value of economic modeling found in the philosophical literature cannot make sense of this particular form of reasoning.¹²

Note, this is not to say that such accounts of economic modeling are flawed. As we noted in the introduction: we are pluralists about models, believing that models can do many different things and be valuable in many different ways. But insofar as current philosophical accounts of modeling cannot make sense of what Coase and the Austrians see themselves as doing, we believe that such a fact leaves open the door for us to articulate a new account of the value of economic modeling, which we offer in the paper's final section. For ease of exposition we argue (in this section) that current accounts of economic modeling cannot make sense of what Coase is doing in particular with his model of a world without transaction costs. We believe that such arguments extend, *mutatis mutandis*, to the Austrians (Kirzner in particular) as well.

3.1 Prediction.

Famously (or perhaps infamously), Milton Friedman argued that the value of a model lies in its ability to generate empirical hypotheses. According to Friedman, “viewed as a body of substantive hypotheses, theory is to be judged by its predictive power for the class of phenomena which it is intended to ‘explain’” (Friedman 1953: 8). That is, the point of modeling is to generate testable predictions that can then either be verified or falsified against the relevant empirical evidence. Now clearly this account of economic modeling cannot explain the value of Coase's model of a world without transaction costs in particular. Though perhaps one could use the model to generate testable predictions,¹³ Coase understood the model as offering explanatory insights about our actual world – in particular, insights concerning the relationship between transaction costs and

¹² Due to space constraints our overview of the literature is incomplete. For a more complete and very recent overview see Mireles-Flores (2018).

¹³ As just one example, Hoffman and Spitzer (1986) test the Coase Theorem in a laboratory.

property rights – that are not necessarily testable. Friedman’s account thus cannot make sense of the kind of reasoning Coase employs with his model.¹⁴

3.2 *Conceptual Exploration.*

Quite far from Friedman’s position, Daniel Hausman argues that building a model is “merely constructing concepts and employing mathematics and logic to explore further properties which are implied by the definitions they have offered. Such model building and theorem proving do not presuppose that one believes that the particular model is of any use in understanding the world” (Hausman 1992: 79). That is, the value of a model lies in its ability to allow the modeler to pursue conceptual exploration, where such exploration is detached (though not *always* detached) from the real world.¹⁵ Clearly, though, any such account of the value of economic modeling cannot account for the value of Coase’s model of a world without transaction costs. For Coase does not take the main lesson of his model to be an exploration of some fantastical world (although perhaps this *is* the main lesson of the model according to Stigler’s interpretation). Rather, as we saw in the lengthy cited passage that ended §2.1, Coase thinks that the model tells us something about the actual world, *contra* Hausman’s thesis that all the modeler is doing is exploring conceptual possibilities.

3.3 *Approximations and Credible Worlds.*

Distinct from both Friedman and Hausman, Allan Gibbard and Hal R. Varian argue that models gain their value by being *approximations*, explaining some feature of economic reality by being approximately close to this reality: “an explanation by the approximate truth of a model takes the following form. First, if the assumptions of the applied model were *true*, the conclusions would be—here the proof is mathematical. Second, the assumptions in fact are sufficiently close to the truth to make the conclusions approximately true” (Gibbard and Varian 1978: 670).

¹⁴ A view far more sophisticated than (yet still related to) Friedman’s account of modeling is Alexandrova’s view of models as *open formulae*. On this account, “models are used as suggestions for developing causal hypotheses that can then be tested by experiment” (Alexandrova 2008: 396). Like before, we do not think the most fecund way of understanding Coase’s model is as a way of generating empirical hypotheses that can then either be verified or falsified.

¹⁵ Notice here we are only talking about Hausman’s account of conceptual models, compared to empirical theories. We do this because we see Coase and Kirzner as building models, not empirical theories. See Hausman (1992: 77).

In what we believe is a similar vein, Robert Sugden argues that models gain their value by being *credible worlds*. According to Sugden, a model gains its value by allowing us to draw inductive inferences about our actual world from the model world. But, as Sugden notes, “if we are to make inductive inferences from the world of a model to the real world, we must recognize some significant similarity between those two worlds” (Sugden 2000: 23). More bluntly: “I want to suggest that we can have more confidence in [our inductive inferences], the greater the extent to which we can understand the relevant model as description of how the world *could* be” (Sugden 2000 24).¹⁶ Like before, such accounts of the value of economic modeling – that models gain their value by explaining the world through, in some general sense, offering reasonably accurate depictions of the world – cannot explain the value of Coase’s model. For, as is quite clear, Coase’s model is *not* a reasonably accurate depiction of the world. Indeed, it seems to be an intentionally *inaccurate* depiction of it. It is, by no means, approximately true or a credible world.

3.4 Derivational Robustness.

On another interpretation of the value of economic models, the purpose of modeling is to allow the theorist to engage in some kind of robustness analysis, particularly derivational robustness analysis (Kuorikoski and Lehtinen 2009: 125-128; Kuorikoski *et al* 2010: 544-545). The idea here is to show that a result is constant over a changing set of assumptions; this is significant because “a result is more likely to be real or reliable if a number of different and mutually independent routes lead to the same conclusion” (Kuorikoski *et al* 2010: 544). As an example, suppose that we have a model consisting of features f_1 and f_2 that induces outcome O . How confident should we be in the model, though? According to the derivational robustness framework, we can increase our confidence in the model by changing the assumptions and showing that outcome O still obtains. So perhaps a different model with features f_1, f_2 , and f_3 induces O ; then perhaps a different model with features f_1 and f_3 induces O . This should increase our confidence in the reliability of the original model.

Now certainly considerations of robustness help explain how one can use a deeply unrealistic model of the world (or set of models) to explain some feature of the actual world. We simply note,

¹⁶ Ylikoski and Aydinonat (2014: 19) take this view further, offering what they call the *family of models thesis*, which essentially says that simplified approximately true or credible world models are not useful on their own. Rather, such models gain value “when considered in the context of a family of related models.”

however, that this is not the pattern of reasoning Coase seems to be employing with his model – that is, he is not working within the derivational robustness framework. Indeed, the assumption of no transaction costs is *not* robust under changing assumptions; once transaction costs are added back to the model, everything changes. In Coase’s words: “But as we have seen, the situation is quite different when market transactions are so costly as to make it difficult to change the arrangement of rights established by the law” (Coase 1960/1988: 119). This suggests that the derivational robustness framework cannot capture Coase’s reasoning.

3.5 *Isolation.*

Another view – advanced primarily by Uskali Mäki – says that models gain value by their ability to isolate certain features of the world (in the same way that physical experiments do)¹⁷ and, as a result, provide insight concerning the causal role these isolated features of the world play. To get a better feel for Mäki’s view, let us first get clearer on what exactly isolation entails:

In an *isolation*, something, a set X of entities, is “sealed off” from the involvement of influence of everything else, a set Y entities; together X and Y comprise the universe. The isolation of X from Y typically involves a representation of the interrelationships among the elements of X. Let us call X the *isolated field* and Y the *excluded field*. It should be obvious that any representation involves isolation: isolation is ubiquitous in human cognition (Mäki 1992: 321).

After one has separated the isolated field X from the excluded field Y, one can then get a better grasp on the causal impact of the isolated field X on certain outcomes. This is made possible by “sealing off” all those features in the set Y, in the same way that experiments control for certain variables: by sealing off other variables, we can then know for certain that it is those features in the isolated set X driving the results.

Coase, we have seen, wants to draw conclusions concerning the causal impact between property rights and transaction costs: when transaction costs are present, different schemes of property rights will result in different allocations of goods, some or all of which may be inefficient. Transaction costs, in other words, are why property law matters. The problem here is that

¹⁷ On this direct comparison between models and experiments see Mäki (2005).

transaction costs are intentionally omitted from Coase's model, meaning that (according to Mäki's framework) they are best understood as being part of the excluded field (the set Y). But according to Mäki's framework, the purpose of a model is to draw inferences about the causal powers of those things included in the isolated field (the set X); we are allowed to do this, recall, precisely because they are sealed off from those things in the excluded field Y. In other words, understanding models as isolations says that we gain insight on some feature of the world f by including it in the set X that is excluded from the sealed-off set Y, and then seeing what sorts of outcomes the set X produces. But Coase's model gains insight on some feature of the world f not by including it in the set X, but rather by excluding it in the sealed-off set Y, and then seeing what sorts of outcomes the set X (importantly, *not* the set Y) produces. For this reason, we do not think Mäki's account of models as isolations can make sense of the kind of reasoning Coase employs with his model.¹⁸

3.6 *Capacities.*

Similar to the isolations account of models is Nancy Cartwright's position that models (when constructed properly) reveal capacities. For Cartwright, a *capacity* associated with a feature or property of the world f is the power systems with f have to produce a specific result characteristic of that capacity. As an example she gives, aspirins have the capacity to cure headaches: "the property of being an aspirin carries with it the capacity to cure headaches" (Cartwright 1989: 141). Much of science and social science, according to Cartwright, is about trying to figure out which properties or features of the world are associated with which capacities.

This is where the value of modeling comes in: "Models that are simple in just the right ways... can be good for exhibiting characteristic effects of a capacity by showing what the capacity does 'on its own,' without effects of other 'confounding' factors" (Cartwright 2009: 46). That is, the purpose of a model is to see which features of the world are associated with which capacities. This is accomplished by mimicking a "Galilean experiment," where a "Galilean experiment" is "one that isolates the cause under study so that it operates 'without impediment.' What happens in the

¹⁸ Indeed, Mäki has written on Coase (and transaction costs more generally) using his framework of models as isolations. Mäki's interpretation of Coase and his model is distinct from the one we offer which, we believe, is evidence that understanding models as isolations is inconsistent with the account of modeling we develop in the next section. See Mäki (1998); Mäki (2004).

experiment then is the exercise of that capacity and of that capacity alone” (Cartwright 2009: 47).¹⁹ So the general idea is that if we want to get clear on the capacities feature of the world f is associated with, we need to isolate f from other features, so we can be sure that it is not these other features that have the relevant capacities we are interested in.

Notice how close Cartwright’s capacities view is to Mäki’s isolation view.²⁰ Indeed, when describing what models do (quoted in the paragraph above), Cartwright makes essential reference to the idea of isolation. But this just means that, for similar reasons as given above, Cartwright’s account of the value of modeling cannot explain the value of Coase’s model of a world without transaction costs in particular. For on Cartwright’s account, if we wanted to get clearer on the capacities associated with transaction costs then we would perform a Galilean idealization and focus in on the transaction costs themselves. But as we have seen, Coase does almost the exact opposite: he gets clear on the capacities of transaction costs by, essentially, idealizing or throwing them away. Coase’s approach, we think, is inconsistent with the idea of Galilean idealization, and thus Cartwright’s view that models reveal capacities through such idealizations.

3.7 *Cased-Based Reasoning.*

In a relatively recent piece Itzhak Gilboa, Andrew Postlewaite, Larry Samuelson, and David Schmeidler advance a new way of understanding the value of economic modeling. To get a hold on what their view is we need to understand the distinction between *rule-based reasoning* and *cased-based reasoning*. Write the authors:

In everyday as well as professional life, people use both rule-based reasoning and case-based reasoning for making predictions, classifications, diagnostics and for making ethical and legal judgments. Rule-based reasoning, in which the reasoner formulates general rules or theories, was formally introduced by the ancient Greeks, in the development of logic. In case-based (or, equivalently, analogical) reasoning, in contrast, the reasoner identifies similar past cases and uses those cases to guide the prediction (or classification, diagnosis, or ethical or legal judgment) in the current case (Gilboa *et al* 2015: F516-517).

¹⁹ For more on Galilean idealization see McMullin (1985).

²⁰ Indeed, Mäki’s and Cartwright’s views are often lumped together. See Grüne-Yanoff (2009: 1-2); Knuuttila (2009: 60-61).

As an example of rule-based reasoning, we might have a hard rule we employ every time we are in a situation relevant to the rule: for instance, always tip twenty percent. As an example of case-based reasoning, when we are in novel situations we can decide what to do by looking at similar situations confronted by us or others in the past. If a student makes a particularly strange request, we might remember a story of a colleague who dealt with a similar situation years ago; we can then handle this case as they did before.

The general thesis the authors advance is that (i) reasoning about the economic world is an instance of case-based reasoning rather than rule-based reasoning,²¹ and (ii) the relevant cases we use in our reasoning are models. So, when we confront an interesting case in reality – what, for instance, will happen to unemployment if policy *p* is implemented? – we think about this in terms of cases which, really, are just models. We select the model that most closely resembles the situation at hand, and then make our prediction.

So on this view Coase's model is but one we can appeal to in our case-based reasoning: when we confront an economic situation that resembles closely enough Coase's model of a world absent transaction costs then we use this model to form our predictions about what will happen. Now this is certainly a plausible way to use Coase's model. Yet the place for Coase's work on the current account of the value of economic modeling is a small one indeed. For the set of economic situations we might encounter in the real world that resemble the world of Coase's model is quite a small set: rarely, if ever, will zero transaction costs or even low transaction costs be encountered. As such, Coase's model has a marginal place in economic theorizing if the point of modeling is to add to a toolbox of cases for the purpose of case-based reasoning. This, of course, stands in stark contrast to the stunning number of citations and Nobel prize awarded to Coase for his work. Understanding the value of modeling as adding to a toolbox we can use in our case-based reasoning, we believe, fails to account for the tremendous value that Coase's model intuitively has.

3.8 *How-Possibly.*

²¹ As an interesting aside, Mary Morgan's (2012: 1-2) work in the history of economic thought shows how economics shifted from a law-based science to a model-based science in the mid-twentieth century, mirroring the authors' claim that economic inquiry is essentially case-based reasoning, *not* rule-based reasoning (though perhaps it *used* to consist of rule-based reasoning).

As the final view we consider, some argue that models gain value by offering *how-possibly* explanations. In contrast to an actual explanation of some phenomenon – which requires “the identification of true (sufficient parts of) causes that brought about the explanandum” – how-possibly explanations “identify elements of possible causes for an explanandum” (Grüne-Yanoff 2013: 854). As an example, if model M containing features f_1, f_2 , and f_3 were to act as an actual explanation of outcome O , then it must be the case that features f_1, f_2 , and f_3 were the actual cause of outcome O in the real world. But, if we understand M as giving us a how-possibly explanation, then it need only be the case that features f_1, f_2 , and f_3 could have been the cause of outcome O .

But how does a how-possibly explanation help us learn about the world? According to Till Grüne-Yanoff (2013: §4) there are at least five ways in which this can happen. First (i) how-possibly explanations can show us how an explanation of an outcome we thought was impossible is not, in fact, impossible; second (ii) if there are multiple possible mechanisms hypothesized to cause an outcome, how-possibly explanations can change our distribution of credences across which of these mechanisms is the correct explanation; third (iii) how-possibly explanations can show that certain kinds of causal mechanisms *simply cannot* produce certain kinds of outcomes; fourth (iv) how-possibly explanations can show that systems with certain properties are capable of producing outcomes with certain properties; and fifth (v) how-possibly explanations can offer explanations for an outcome that was either unexplained or explained differently.

We think these are all valuable ways of learning from models. But we also think that they do not track Coase’s reasoning. The purpose of Coase’s model is to show that it is *precisely because* of transaction costs that different allocations of property rights result in diverging allocations of goods with differing levels of efficiency. He is (i) not trying to show that something once thought impossible is actually possible; he is not (ii) adjudicating between different existing hypotheses; he is not (iii) showing that certain kinds of mechanisms simply cannot produce certain kinds of outcomes; he is not (iv) showing that all systems harboring a property can produce certain outcomes; nor is he (v) trying to offer a new explanation for some outcome that is unexplained or explained differently. Because of this, we do not think the how-possibly framework can adequately capture the way in which Coase reasons with his model.

4. Models as Foils

Intuitively it appears that Coase's informal model of a world without transactions costs as well as Kirzner's use of equilibrium models are incredibly valuable as tools of economic inquiry. Both, we think, teach us important things about our world. But our best philosophical accounts of economic modeling cannot accommodate this intuition. We now remedy this failing by sketching a new account of the value of modeling that we call *models as foils*. As we said in the introduction, we do not claim that this is the only way models gain value as tools of economic analysis. Indeed, many models are valuable precisely because they produce testable hypotheses, are credible worlds, induce isolations, and so on and so forth. We merely wish to lay out one way in which models can be valuable as tools of economic inquiry that, we think, has yet to be carefully articulated.

Let us begin by recalling the structure of Coase's reasoning. Coase begins by constructing a highly unrealistic model of a world without transaction costs. He shows that in such a world (i) all externalities will be bargained to an efficient point and (ii) these externalities will be bargained to the *same* efficient point regardless the initial allocation of property rights. From this result, we saw, Coase wishes to draw the following conclusion: it is *precisely because* of transaction costs that different allocations of property rights result in diverging allocations of goods with differing levels of efficiency. We go from the model world – in which the absence of feature *f* of the world causes outcome *O* – to an inference about the real world – that feature *f* of the world bears some causal relation to outcome *O'*, which is distinct from outcome *O*.

Here, we believe, is a more general articulation of how this inductive inference is made:

- (1) The absence of feature *f* in model *M* causes outcome *O*.
 - (2) Feature *f* is present in the real world.
 - (3) Outcome *O'*, which is distinct from and incompatible with *O*, obtains in the real world.
- Because of (1)-(3), we have some reason to believe that
- (4) Feature *f* bears some causal relation to outcome *O'*.

Let us walk through these steps as this is the heart of our argument. One begins by constructing a model *M*. In doing so one leaves out an important feature of the world *f*. Moreover, one must show that it is the *absence* of feature *f* that causes outcome *O*.²² Of course, almost by definition, models leave out many features of the real world in their effort to simplify. Coase's model, for instance,

²² For an overview of how omissions – the absence of some feature of the world – can be causally efficacious, see Bernstein (2015).

leaves out the fact that the sky is blue. From this alone one cannot conclude that the absence of the fact that the sky is blue in model M causes all externalities to be bargained to the same point on the Pareto frontier. The feature f is not missing because it is a distraction or because its absence is irrelevant. The absence of f is key to the model. As such, successfully completing step (1) requires more than just modeling a world without feature f that produces outcome O . One must do this, *and then* give some reason for us to believe that it is precisely because f was absent that O obtained. We believe Coase successfully does this.

Step (1) is more difficult to achieve than it might initially seem. But suppose one successfully accomplishes (1). From here one observes that feature f – intentionally excluded from model M and the absence of which, the modeler has argued, causes outcome O – is present in the real world. This is step (2). After doing this one observes that outcome O – the outcome of model M caused by the absence of feature f – does not obtain in the real world. Instead, a distinct outcome O' , incompatible with O , obtains. This is step (3). From these three observations we conclude – not deductively and thus definitively but rather inductively and defeasibly – that feature f bears some causal relation to outcome O' in our actual world. We can tentatively conclude this because, when reflecting on a world in which f was absent, the very absence of f was causally efficacious in producing an outcome. Not only was it causally efficacious, but its absence produced an outcome quite foreign to the one we observe in the real world. This gives us some reason to think that the very presence f in our actual world has some causal efficacy in producing the outcome we actually do observe.

Let us fill in this general pattern of reasoning with Coase's reasoning about his model specifically. It goes something as follows:

- (1) The absence of transaction costs in model M causes all externalities to be bargained to the same efficient point regardless the initial allocation of property rights.
- (2) Transaction costs are present in the real world.
- (3) Different allocations of property rights result in different distributions in the real world (some or all of which may be inefficient).

Because of (1)-(3), we have some reason to believe that

- (4) Transaction costs bear some causal relation to the fact that different allocations of property rights result in different distributions in the real world (some or all of which may be inefficient).

We believe this is a faithful articulation of Coase's reasoning. To put it more informally and less clumsily: because property rights wouldn't matter in a world without transaction costs – precisely because these costs are absent – but because we live in a world where both transaction costs are present and property rights *do* matter, we have some reason to believe that transaction costs are the reason why these property rights do in fact matter.

In §2.2 we argued that Kirzner along with other Austrians reasons in a similar manner with competitive equilibrium models to how Coase does with his model of a world without transaction costs. That is, Kirzner is using competitive equilibrium models as foils. This being the case, we should be able to fit Kirzner's reasoning into the more general format explicated above. Such runs roughly as follows:

(1) The absence of entrepreneurs in competitive equilibrium models causes the market's inability to self-correct.

(2) Entrepreneurs are present in the real world.

(3) Markets self-correct in the real world.

Because of (1)-(3), we have some reason to believe that

(4) Entrepreneurs bear some causal relation as to why markets self-correct in the real world.

But this, of course, is the same style of reasoning employed by Coase to draw inductive inferences about the world from his model of a world without transaction costs. We believe Kirzner and other Austrians do the same thing: they draw inductive inferences about the relationship between entrepreneurs and market failures in the real world by looking to models that *do not* include entrepreneurs and the resulting states of affairs these models produce. In other words, they draw these inductive inferences by using *models as foils*.

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