When Local Models Fail

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Models treating the simple properties of social groups have a common shortcoming. Typically, they focus on the local properties of group members, and on the features of the world with which group members interact. I consider economic models of bureaucratic corruption, to show that (a) even simple properties of groups are constituted by the properties of the wider population, and (b) the focus of social models is thus commonly inadequate to account even for such simple properties. Adequate models and social policies must treat certain factors that are not local to individual members of the group, even if those factors are not causally connected to those individuals.

I. Introduction

In the late 90s, the Swiss Agency for Development and Cooperation helped implement an anti-corruption program in Pakistan. One of their key moves was to raise wages in the public sector. In theory, wage increases should decrease the incentives of bureaucrats to take bribes, and so should also decrease the number of bribes solicited and taken. This prediction is made by a number of the prevailing "principal-agent" models of bureaucratic corruption, following Becker and Stigler 1974, and it is also supported by game-theoretic analysis and experiments, such as Azfar and Nelson 2004. In Pakistan, however, the reverse occurred. As wages increased, corruption did as well. Nor is Pakistan's experience unusual: similar phenomena have occurred in recent years in a number of countries. Econometric studies, using a variety of empirical data, have repeatedly shown that there is either zero or negative correlation between wage increases in part of a bureaucracy and a

reduction in corruption.[1] Where have these models gone wrong?

The obvious source of failure for a model of a property like *the incidence of bureaucratic corruption* is when it underestimates or fails to incorporate some relevant causal factor, that influences the thoughts or actions of the individuals in the group being modeled. It may be, for instance, that increasing the pay of a bureaucrat tends to make her less risk-averse, and thus has the reverse effect than was intended. Or it may be that the influence of the organizational structure of a bureaucracy overwhelms the effects of wage increases, so that small changes there more than negate any changes in wages. Or it could be that external factors are at work, such as the possibility that an increase in pay might also increase family pressure to earn still more. When a model of some property of a group of individuals fails, it seems we need a more realistic model of the psychology or preferences or other local properties of the individuals in the group, and of the causes affecting the local properties of those individuals.

In this paper I argue that many models, including models of bureaucratic corruption, suffer from a different flaw. They may actually do an adequate job capturing the factors that causally influence the people belonging to a group. Where they fail is not principally a matter of understanding causal factors or their consequences for affecting individual bureaucrats. Instead, their key trouble is in how they implicitly understand the nature of the properties they model, and in their neglect of certain logical components of those properties.

It is widely recognized that certain social properties of a group fail to supervene locally on the individualistic properties of the members of that group. This was pointed out by Currie 1984, and is discussed in particular by

[1] The SDC case and a number of studies are surveyed in Huther and Shah 2003. Van Rijckeghem and Weder 2001 provide evidence that wage increases are not correlated with short-term decreases in corruption, nor are they correlated with lowered corruption when introduced for a part of the civil service. They do find a positive correlation between increased wages and reduced corruption in countries having very high civil service wages overall, but cannot establish a causal relation between the two.

Pettit 1993 and 2003. Currie, for instance, notes that having the property *being Prime Minister* depends on what goes on in the minds and actions of more people than just Gordon Brown. Similarly, for 100 individuals to have the property *being a U.S. Senator* depends on the thoughts and actions of a wider population than those 100. It is often overlooked, however, that such dependence of social properties on people apart from those they apply to occurs even with properties that merely tabulate the psychological or behavioral properties of the members of a group. As I will discuss, even a function such as *the incidence of bureaucratic corruption*, which would seem to depend only on the aggregate actions of the small group of individuals who are bureaucrats, is instead in a sense "holistic" across the entire population. Properties and functions like this are commonly treated in the social sciences, yet models of such properties typically neglect their population-wide dependence, and thus fail to account for how they change as circumstances do.

Many group properties typically treated in the social sciences depend on factors I will call "nonlocal" with respect to a group possessing the property. Intuitively, a local factor or property is one that is spatiotemporally in the vicinity of individual members of a group, and a nonlocal factor is one that is not. Some philosophers, for instance, have traditionally taken the view that social facts are constituted by the psychological states of individual people. On such a psychologistic view, the local properties of the members of a group relevant to social facts are just the psychological states of those people, and the nonlocal properties relevant to social facts are the psychological states of people who are not members of the group. A more liberal view of properties local to a group will include certain physical and historical properties of the members of the group as well as certain relational properties among them. Still, the same intuitive distinction between local and nonlocal properties can be drawn. For instance, my psychological and physical properties will count as local to my bowling league, but Gordon Brown's psychological and

physical properties are nonlocal to my bowling league.[2]

The aim of this paper is to consider the implications, for constructing models in the social sciences, of the fact that many typical social properties of groups depend on factors that are not local to those groups. This fact implies that when we construct models of those properties, we cannot limit ourselves only to ones that treat the local properties of members of the group, or even to models of those properties that causally interact with members of the group. If we do limit ourselves in that way, we risk missing out on relevant factors that influence the holding of the social properties. In many cases, nonlocal factors are plausibly the predominant way that simple properties of groups can be modified, in policy interventions. A model that only focuses on the causes impinging on local properties, or a policy prescription that only intervenes so as to affect local properties, may neglect the key influences on the social phenomena they are designed to describe or affect.

Yet models of the social properties of groups nearly always overlook this point. The way social models are typically designed means that they neglect nonlocal factors that do not interact with the members of the groups, even when those nonlocal factors are constitutive of the properties being modeled. To illustrate this, I will consider models of bureaucratic corruption. Corruption is a deeply explored and well-developed subject for economic modeling, and models of bureaucratic corruption are representative of a wide variety of approaches to model-building in economics. Nonetheless, models of corruption in general neglect nonlocal factors that figure into the incidence of bureaucratic corruption, when those factors do not interact causally with the bureaucrats themselves.

First I will describe a few models of corruption and highlight some familiar causal roles of local and nonlocal factors in these models. Then I will discuss the dependence of typical social properties on nonlocal factors, contrasting this with the dependence characteristics of typical properties

[2] I discuss the interpretation of "local" or "individualistic" properties in detail in Epstein 2007.

treated in the natural sciences. Finally, I will turn to some models that do incorporate the dependence of bureaucratic corruption on nonlocal factors to some extent, and show that there is a striking gap even in these models.

The claims of this paper, incidentally, are compatible with both psychologistic and non-psychologistic treatments of social facts. Psychologism is less widely accepted nowadays than it once was, and in fact, I argue elsewhere that not only do social facts depend on factors beyond psychological ones, but they often depend even on physical factors that do not causally affect any individuals at all.[3] I do not assume either of these points here, however.

II. Familiar treatments of nonlocal factors

Becker and Stigler, in their model of corruption, focus on the incentives of individual bureaucrats to make corrupt choices. They suggest that the cost of eliminating corruption simply be taken as part of the cost of setting up the proper incentive structure for bureaucrats acting as rational maximizers. To change incentives, they suppose that there is some degree of monitoring of bureaucrats being done, so that there is some probability that one accepting bribes will be caught. If caught, the bureaucrat is fired. Their solution is to make being fired increasingly costly for the bureaucrat, as the probability of being caught goes down. One way of doing this is with so-called "efficiency wages," i.e. increasing the wages of bureaucrats to make dismissal more costly.[4]

All of the factors affecting the incidence of bureaucratic corruption in the Becker-Stigler model are factors that impinge on the individuals directly – in particular, the salary they receive, the salary they could otherwise receive, and the probability of being caught and dismissed. To reduce aggregate corruption, the intention is to put a system of incentives in place so as to cause bureaucrats to make different choices. The choices, taken together,

[3] Ibid.

[4] Becker and Stigler 1974, pp. 7-11.

fully determine the incidence of bureaucratic corruption, while external influences, such as the choice of a salary mechanism, act as causes influencing the conditions against which a bureaucrat makes her choice.

A number of models have been proposed to take account of a variety of influences on corruption that the Becker-Stigler model neglects. To start, let us consider two categories of these models, which I shall call "local" models and "nonlocal-causal" models. I will define and mention some examples of each of these two categories briefly, and then consider how even the latter can miss out on the nonlocal dependence of social properties.

(1) Local models

Let us divide models according to which sorts of factors are treated within the models, as opposed to the factors that are treated as givens. I will put this division in terms of the distinction between *endogenous* and *exogenous* variables. A variable is endogenous to a model if the values it takes are a function of other parameters and variables in the model, and it is exogenous if the values it takes are not determined by other parameters and variables in the model, but rather takes its values from factors outside of the model.

If we are interested in modeling entities as isolated from the environment in which they reside, or if an entity is affected by its environment but does not itself affect that environment in any substantial way, then we will model nonlocal factors impinging on the entity as exogenous variables. Only local properties will be treated endogenously. A model in which only local properties are treated endogenously, I will call a "local" model.

The Becker-Stigler model falls into this category. The variables taken as endogenous in this model are simply the psychological states of the bureaucrats. Other variables, such as their wage levels, are exogenous variables in this model. Many models refining the Becker-Stigler model also continue to endogenize only local factors, but treat more local factors and in more detail. One way models often do this is by refining which external influences are taken into consideration, and how individuals respond to these influences. Some models, for instance, consider factors other than the influences of pay on the decisions of bureaucrats. Oldenburg 1987, for

instance, considers the case of farmers in Uttar Pradesh, who because of cultural and historical reasons believe that corruption levels are higher than they actually are. These externally induced beliefs about corruption levels then have an effect on the likelihood that they themselves will be involved in bribery.[5]

A different refinement of models, that still takes nonlocal factors to be exogenous, is focusing on the interactions of individuals within a bureaucracy. A number of models, for instance, treat the effects of bureaucratic hierarchy on the incidence and persistence of corruption. In the Becker-Stigler models, only the bureaucrats in the field are taken to be corruptible, while their employers and the people monitoring them are taken to be benevolent. Monitors and bosses, however, can obviously also be bribed. Levels of monitoring, therefore, may be affected by levels of corruption. A hierarchy can reinforce the persistence of corruption above a certain level, since with a higher level of corruption, the cost of being caught is likely to decline.[6] Many models of corruption therefore work to analyze the properties of complex interactive games, with multiple tiers of bureaucratic layers.

(2) Nonlocal factors as endogenous

Other models will endogenize both local factors and certain nonlocal ones as well. If we wish to treat bidirectional interactions between an entity and features of the environment, then we treat those nonlocal features as endogenous. What I will call a "causal-nonlocal" model makes a principled distinction between the nonlocal factors that need to be endogenized and those that can be treated as exogenous variables. If there is a bidirectional causal chain between the individuals in a group and a nonlocal factor (i.e., the

[5] See also discussion in Bardhan 1997, p. 1333.

[6] This was pointed out by Cadot 1987. Among the prominent models treating bureaucratic hierarchy are Calvo and Wellicz 1979, Hillman and Katz 1987, Andvig and Moene 1990, Mookherjee and Png 1990, Gangopadhyay et al. 1991, Besley and McLaren 1993, and Bac 1996.

factor is both causally affected by and causally affects members of the group), then the factor is eligible to be treated endogenously. If a nonlocal factor is not causally affected by the individuals in the group, but only causally affects individuals in the group unidirectionally, then it is not endogenized in a causal-nonlocal model, but at most is treated as an exogenous variable.

An example of endogenizing nonlocal factors arises in discussions of social norms as an explanation for endemic corruption. A difficult problem for theorists of corruption is to explain why structurally similar economies can have enormously different levels of corruption. To account for this, a number of models have shown that there may be multiple equilibrium levels of corruption. Theorists have proposed feedback mechanisms for showing how high incidences or low incidences of corruption can be self-reinforcing toward different equilibria.[7] Modeling such a feedback mechanism often involves taking nonlocal factors, such as cultural factors, as not only causing but being caused by the properties of the bureaucrats. In order to capture the characteristics of these causal feedback loops, a model then will endogenize the nonlocal factors involved in the feedback.

III. Nonlocal dependence of simple aggregates

The incidence of bureaucratic corruption is an example of what I will call a "simple aggregate" property or function, i.e., one getting its value from tabulating the psychological or behavioral properties of the members of a group. It may seem that a complete treatment of the causal interactions between factors in the world at large and the individuals in a group must exhaust the influences on the group's simple aggregate properties. However, there is a different and more direct way nonlocal factors are involved in simple aggregates. All of the approaches to modeling corruption I have mentioned so far overlook the simple but crucial point that factors that constitute the value of a function such as *the incidence of bureaucratic corruption* are in part nonlocal.

[7] Cf. Bardhan 1997, pp. 1330-1332; Jain 2001, p. 90.

To see this, contrast the typical simple aggregate properties of social groups with typical simple aggregate properties treated in the natural sciences. Consider, for instance, the value of the function *temperature* applied to the gas in a balloon at a time. Taking the individual molecules in the gas, the temperature is exhaustively determined by their velocities. Those velocities are the only factors on which the temperature of the gas depends: if we change a property of the environment outside of that balloon, while the molecules remain indiscernible from before, the temperature of the gas does not change. The value of the function, in other words, supervenes locally on the physical properties of the gas molecules. Thus, if we wish to improve some model of the temperature of a gas, we can follow any of the modeling options I described above in connection with corruption. We can construct a better model of the characteristics of the gas molecules; we can refine our treatment of the interactions between them; or, we can better model the dynamics of the nonlocal factors causally impinging on the balloon and molecules inside it, and of their reciprocal causal influence on those nonlocal factors. Those options exhaustively cover the bases, and doing all perfectly would generate a predictively perfect model.[8]

For certain simple aggregate properties of certain kinds of systems of people, modeling them will analogously be exhausted by those approaches. Suppose we wish to model the choices of a pair of prisoners, each given certain information and certain alternatives. Then the only factors relevant to the output of the "choice" function applied to the pair of prisoners are their local characteristics, interactions, and nonlocal factors causally linked to the local ones. The same is true for the collection of people in a theater in the well-known example discussed by Schelling 1978. If we wish to explain why an audience has spontaneously organized to sit bunched together in the seats at the back of the theater, as opposed to populating the better seats, the only factors that need to be considered are again the local characteristics of the

[8] In calling these models "predictively perfect," I am bracketing such important matters as obstacles to reduction, and pragmatic considerations governing the utility of models.

individuals in that audience, together with their environmental interactions.

In the typical case, however, a simple aggregate property of a social group will fail to depend only on the local properties of the members of the group. The reason is simply that membership in the group is a component of the typical simple aggregate property. And membership does not generally depend only on an individual's local properties, whether psychological or relational, but on properties of the population as a whole. At a theoretical level, this can be seen with a local supervenience test, as was applied to the gas molecules. For instance, take membership in the Senate. Consider two worlds: the actual world, and a world in which the people who are actually U.S. Senators are physically indiscernible from the actual ones. Suppose, however, that in the second world circumstances among people other than the actual Senators are different. For instance, suppose that even though the individuals are indiscernible in the two worlds, the population as a whole has voted differently in the alternative world. Or else suppose the population had not run an election at all, so that there is no Senate. Although the actual individuals are indistinguishable between the worlds, the membership in the Senate is different. In short, *being a Senator*, the membership property, does not supervene locally on the properties of the individual Senators.[9]

Even if we understand social facts to be psychological, the psychological properties of the members of a group do not exhaust the social properties of the members of that group. Rather, the supervenience test shows that even if they reside only in the minds of individuals, social properties like *being the Senate* or *being Prime Minister* are extrinsic to the minds of the members of the group, but involve the psychological properties of other people as well. As such, the social properties of a group can change when the psychological properties of other people change, even when the psychological properties of members of the group do not.

The incidence of bureaucratic corruption, analogously, does not only

[9] Some implications of this for the metaphysics of groups has been discussed by Currie 1984, Ruben 1985, Uzquiano 2003, and others.

depend on corrupt transactions being conducted, but it also depends on whether the membership property *being a bureaucrat* applies to a party to the transaction. It is therefore not just a sum over actions or behaviors of a certain sort, but is a sum over actions or behaviors that have two different properties: *being a certain kind of payment*, and the other, that at least one party to the transaction have the property *being a bureaucrat.* The latter property, *being a bureaucrat*, is nonlocally determined, just as *being a Senator* is. Correspondingly, it is not enough, if one wants to tabulate the incidence of bureaucratic corruption, to inspect only the transaction properties of individuals. It is also necessary to take into account the properties that determine which individuals have the property *being a bureaucrat.*

Another way of putting this point is to notice that the incidence of bureaucratic corruption is an extrinsic property of any set of individuals who are bureaucrats, even though it is plausibly intrinsic to the population as a whole. Whatever the causal relations in a society, the incidence of bureaucratic corruption is constituted by population-wide factors. Again, this is true even on a psychologistic interpretation of social properties: the incidence of bureaucratic corruption depends not only on the psychological states of the people who are bureaucrats, but also on the psychological states of the people who determine which individuals are bureaucrats.

Moreover, the incidence of bureaucratic corruption depends on population-wide factors even if those factors have no causal influence at all on the individuals who are, have been, or will ever be members of the bureaucracy. It is not that the incidence of bureaucratic corruption does not depend on the properties of bureaucrats; but rather, that it also depends on properties external to them.

Why don't the other functions I mentioned, like the temperature of the gas or the clustering in the theater, also involve two such components? They do: the membership property is *being part of the gas*, or *being in the auditorium.* But notice that these properties, in contrast to *being a bureaucrat*, are themselves locally determined. Whether a molecule is part of a gas depends only on what the individualistic and local relational properties

of the molecules are. Suppose we examine the molecules in some region of space – say a cubic meter a bit above my head. To determine whether a molecule within that region is part of a gas, we only have to look within that cubic meter itself. It may take more than a single molecule to determine that the property *being part of the gas* applies to it, but we do not need to consider the molecules next door, or in Paris.[10] This is why it is possible to isolate the systems to which these properties apply. For the bureaucracy, however, we can know all there is to know about the local properties of a group of individuals, and still that does not determine whether *being a bureaucrat* applies to the members of the group. It can be individuals far removed from the bureaucrats themselves on whom the applicability of that social membership property applies.

IV. *Fully nonlocal* models, and an anomaly

To articulate the implications of this point, I now want to turn to models of corruption that do take into account the issue of the membership of individuals in social groups, and therefore that at least to some extent treat the nonlocal dependence of simple aggregate properties. Examining these models leads to two key conclusions. First, the fact that there are models that treat the membership properties directly highlights the relevance of these properties to the modeling of social properties. I think a common reaction to this point about nonsupervenience and the dependence characteristics of simple aggregate properties altogether is that they are somehow beside the point for actual model construction; that is, that despite nonsupervenience, a model that considers all the local properties of individual members of a group, together with those they interact with, must be all we need for a comprehensive model of properties like its incidence of corruption. The very

[10] It is of course a social matter that we have defined the word 'gas' the way we have. Whether a property is locally or nonlocally determined does not depend on the factors that make us define it as we do, but rather, is whether given its definition, we need to consider local or nonlocal factors to determine whether it applies or not.

existence of models of simple aggregate properties of a group treating group membership properties helps defuse this, and reinforces the contrast between what must be done in a model of a typical simple aggregate property in the social sciences and a typical one in the natural sciences.

The second implication, however, is that even the existing models that have taken into account the nonlocal dependence of simple aggregate properties have a peculiar blockage as to how they treat the nonlocal determinants of simple aggregate properties. Suppose we are modeling a property that involves two logical components, a local and a nonlocal one. Then, it seems obvious that in order to build a model of that property, we should consider the predominant factors influencing the local component (local and nonlocal), and the predominant factors influencing the nonlocal component (local and nonlocal).[11] Surprisingly, though, models of bureaucratic corruption that accommodate nonlocal components of the incidence of corruption nonetheless endogenize the very same factors one would ordinarily expect to find in a causal-nonlocal model. That is, they tend only to endogenize factors that interact bidirectionally with the bureaucrats, even in modeling the nonlocal components of the property. They do not endogenize, or often even incorporate in any way, nonlocal factors that do not interact with the bureaucrats. This is a striking anomaly.

There are several interesting groups of models that illustrate these two points.[12] Here I will briefly discuss one model, in Wade 1985, for the market

[11] It is often entirely reasonable, in modeling a local property, to build a fully local or nonlocal exogenous model. The reason is that local properties will be most directly affected by other properties in that system. So we can plausibly expect that even if there are nonlocal causes, or feedback mechanisms, that those will be second-order rather than first-order influences, and hence will not be the predominant ones. But for a nonlocal factor, it is not at all clear why we should ever find a model that only considers the local factors and the causal factors affecting the local entity.

[12] Other models that treat, implicitly or explicitly, the membership component of the incidence of corruption include a group of general equilibrium models described by Acemoğlu and Verdier 1998 and 2000; a different model of the market for bureaucratic jobs by Hillman and Katz 1987; and models of political corruption, such as those

for bureaucratic jobs. Wade presents a fascinating and detailed profile of governmental organizations in South India. He focuses in particular on the mechanisms by which bureaucrats are transferred from post to post. Wade starts with the presumption that some posts are desirable and some undesirable, based on their locations, amenities, and the amount of illicit revenue that the post will enable the holder to collect. He then proposes that offices are allocated to the highest bidder, and that bureaucrats act so as to maximize revenue. Bureaucrats are, however, constrained by how many complaints their extortions result in. If a bureaucrat extracts too much from his post, that triggers a high level of complaints, which in turn can induce a different bureaucrat to take action against him. Then a game ensues in which the corrupt bureaucrat can react by attempting to have the complaining bureaucrat in turn transferred. With this mechanism, even low level corruption cascades upward into higher level organizations, and in particular to officials or politicians who have "transfer-sanctioning authority."

In Wade's model, the complaints induced by corruption levels, as well as the interests of transfer-sanctioning authorities, are nonlocal causes affecting the incidence of corruption. But it is only in virtue of taking the property *being a bureaucrat* as depending on characteristics of the appointing authorities that these nonlocal causes become germane in the first place. The causes that play the largest role in these models, such as complaint levels, would not even appear in a model that did not regard the membership property as a nonlocal component of the incidence of bureaucratic corruption. In this sense, this model takes into account the very nonlocal aspect of the incidence of bureaucratic corruption that the other models leave out. And it shows that taking this into account can materially change the hypotheses as to the causal factors to be modeled.

As with any model, this one has serious limitations. Wade's model in

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described by Barro 1973, Rose-Ackerman 1978, Ferejohn 1985, and others. In treating the property *being a bureaucrat*, they help illustrate that the factors affecting that property may easily be the predominant factors for determining and hence for modeling the incidence of bureaucratic corruption.

particular is very informal, and does not propose relationships between levels of corruption and the triggering of actions, or what levels of bribes would need to be passed upward in the game between officials, or how competition occurs for offices among the different categories of desirability.

The shortcoming I want to discuss, however, is different. In this model, whether or not an individual counts as a bureaucrat depends on the sanctioning of the transferring authority. That is, being a member of the bureaucracy depends on factors apart from the decisions of that individual. This is a positive feature of the model. However, the factors influencing that sanctioning, in the model, are only the strategic interactions between the individual and the people that individual interacts with, including the complainers, the other official, and the transfer-sanctioning authority. Even in modeling the nonlocally determined membership property, the only factors Wade endogenizes are those that the bureaucrats personally interact with.

This is a natural tendency for a model of a property of a group, even one that takes group membership as relevant. *Being a bureaucrat* is a property of an individual, albeit a very extrinsic one, and so it is entirely reasonable to consider the influence that the individual has on whether or not the property holds of her. However, the holding of these membership properties may, in perfectly normal situations, be largely beyond the influence of the individuals themselves. Wade actually mentions a good example of this at one point. He briefly cites a distinction made by Scott 1972 between market-driven corruption in allocating offices and so-called "parochial" corruption. Parochial corruption involves the assignment of bureaucratic posts along lines of solidarity, such as class or ethnicity. Wade's model treats the market-based allocation of transfers, but he puts aside parochial influences.[13] If as Scott suggests, however, parochial influences are significant for certain bureaucratic systems, then the determination of membership in the bureaucracy and therefore the incidence of corruption may be governed in large part by factors that are only remotely connected to the interests or

[13] Wade 1985, fn. 60, p. 494.

motivations or actions of the actual bureaucrats. Rather, they may be predominantly governed by the interests and actions of other members of the solidarity group to which they belong.

A complete model of the nonlocal constituents of membership in the bureaucracy will involve all the factors that affect it, whether or not they are affected by characteristics of the individuals in the group. The dominant factors in determining membership in the bureaucracy can easily be ones that have minimal or even no causal connection to bureaucrats. It would be unusual if there were no causal connection at all, but is certainly possible. And it can be quite common that the causal connection is tenuous, as in many cases of parochial corruption.

V. Illustrating the limits of causal-nonlocal models

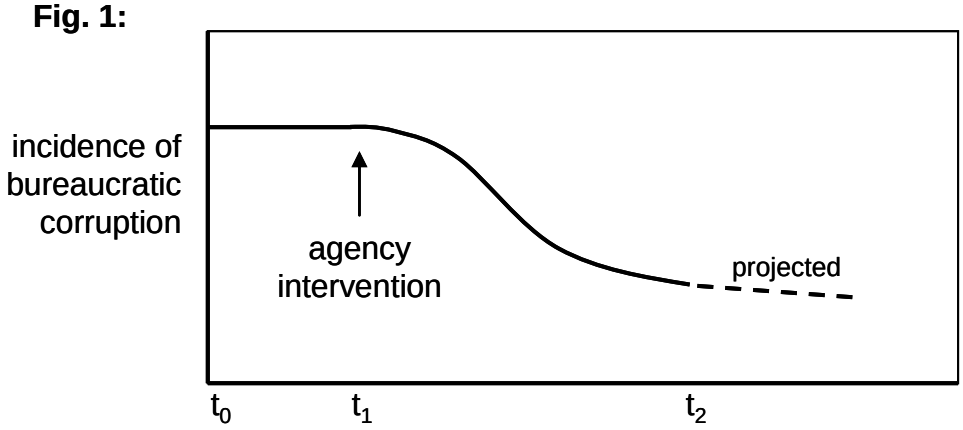
A simplified example can help bring the shortcomings of causal-nonlocal models into relief. Consider a system in which nonlocal factors that are unaffected by the local bureaucracy nonetheless are dominant in determining the incidence of bureaucratic corruption. Suppose that there is a country with a large population, that is heterogeneous in terms of its susceptibility to corrupt behavior. The country is run by an oligarchy, consisting of members of different ethnic groups, and the oligarchy has the power to appoint bureaucrats. Historically, the country has been very corrupt, so an international agency has been brought in to reduce levels of corruption. They experiment with different programs, and land upon a moral education program, which actually does successfully change preferences and reduce the likelihood of individuals to be corrupt, and hence promises to reduce the incidence of bureaucratic corruption overall.

At first, the oligarchy is stable, making a set of bureaucratic appointments and sticking with that set of individuals as bureaucrats. The efforts of the agency are rapidly effective, and the incidence of bureaucratic corruption drops. At times, however, the political situation in the country becomes tenuous, the oligarchy strains under ethnic conflict, and the bureaucracy is repeatedly turned over, replacing old bureaucrats with new ones. This negates the efforts of the agency, as a new set of corruptible bureaucrats

supplants the morally educated ones.

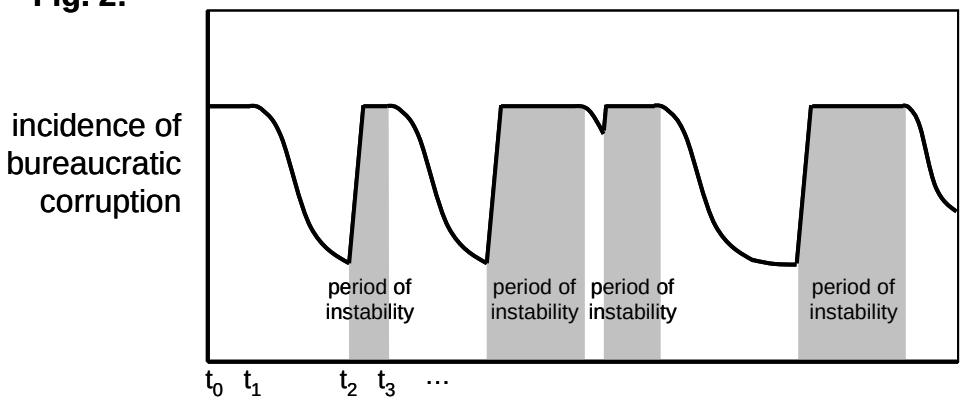
If we graph the incidence of bureaucratic corruption over the initial period, it reflects the dynamics of the interaction between the anti-corruption agency and the bureaucrats:

Fig. 1:



Considering a longer time span, however, the stability characteristics of the oligarchy predominate in the determination of the incidence of bureaucratic corruption:

Fig. 2:



As depicted in figure 2, even though the agency continues to do its work during periods of instability, the continuous replacement of members of the bureaucracy during those periods makes bureaucratic corruption jump back up to, and remain at, the initial levels. To model the incidence of bureaucratic

corruption over time, the local influences on the bureaucrats, including such things as their wage levels and their moral preferences, cannot be neglected. Still, at many times the incidence of corruption is predominantly driven by the churn of the membership of the bureaucracy. This in turn is a function of the factors determining the stability of the oligarchy. What drives these factors, however, is not a cascade of causes arising from the interaction of the oligarchy with the incentives of the bureaucrats, such as upward payment transfers or authority hierarchies that change their incentives and hence their decisions. Rather, the factors affecting the oligarchy plausibly have little to do with the characteristics of the bureaucrats, or the bureaucrats' causal interactions with the oligarchy at all.

The casual relation between the oligarchy and the bureaucrats in this example is at most unidirectional. The oligarchs may choose the bureaucrats to fill positions at random, or they may choose on the basis of parochial considerations, just specifying that whoever has certain characteristics is to be appointed or dismissed. Whether and how membership in the bureaucracy churns is not a function of anything the bureaucrats do, but simply results from the effects on the oligarchs of factors nonlocal to the bureaucrats.

For the incidence of bureaucratic corruption to be governed by characteristics of the oligarchy in this way, it is moreover not necessary that there be even any causal chain from the oligarchs to the bureaucrats whatsoever. From a strict perspective, the high incidence of bureaucratic corruption during periods of instability does not need to be reflected in any behavioral changes by the local population at all, because of course *being a bureaucrat* is an extrinsic property of individuals, determined by the oligarchs rather than the local population. Changes in the choices of the oligarchy alone are sufficient to generate churn in the official incidence of bureaucratic corruption. In practice, however, it would be highly unusual and counterintuitive for the appointers to be entirely disconnected from the individuals they appoint. Nonetheless, it is not unusual for there to be some degree of causal disconnection between an appointing authority and the bureaucrats they appoint. There may, for instance, be substantial delays

between the time a status is assigned or changed by the oligarchy and the time the individual in question is informed. The oligarchy might find it advantageous to inform people immediately of their appointment, but not let them know of their dismissal until two months after it has taken effect. Or there may be occasional losses of casual information altogether: bureaucrats in far-flung regions may never learn that they have been dismissed and lost their status as bureaucrats. Rumor has it, for instance, that there are still draft-dodgers from the Vietnam War living in the wilds of Canada, unaware that they were pardoned by Carter back in 1977. Even if there are a hundred such people, their unawareness does not change the fact that the number of criminal draft-dodgers is zero, not 100. Though this example of ignorance is rather extreme, it is nevertheless the norm for there to be at least some lags and drops, in the causal connection between a status-granting authority and the bearers of the status. Equally, it is the norm for the decisions made by a bureaucrat-appointing authority to have a delayed effect, or occasionally no effect, on potential behavior by the bureaucrats.

In spite of causal hiccups, the true incidence of bureaucratic corruption, rather than the local incidence of payments of a certain sort, often remains the property of social and explanatory importance. Governmental agencies, for instance, have differential legal authority over individuals having different legal statuses. Thus the activity levels of such enforcement agencies will appropriately be keyed off of the true incidence of bureaucratic corruption, even if local behavior is sometimes at variance with it. The same is the case for systems of penalty and reward, international assessments, national corruption statistics, and so on. Even if it were practical, it would not do to substitute the quantity depicted in figure 2 with one such as “the incidence of illicit payments among those individuals who think they are bureaucrats.”

From these observations, it can be seen that there are a number of shortcomings to causal-nonlocal models of the incidence of bureaucratic corruption, both in principle and in practice. One issue, as I have mentioned, is that it is common to ignore altogether nonlocal factors that do not interact bidirectionally with the individuals in the group, even those factors that have

a unidirectional effect on the individuals. Causal-nonlocal models, such as Wade's model, endogenize those nonlocal factors that interact bidirectionally with the local group of individuals. Wade considers the strategic game between the appointers and the bureaucrats, and endogenizes the characteristics of the appointers that bear on the game. However, Wade like many others simply ignores or treats as constants all unidirectionally-impinging nonlocal factors. If that approach were taken in the oligarchy case, the resulting model would not even come close to the incidence depicted in figure 2, since the oligarchy only has a unidirectional effect on the bureaucracy and hence its changing characteristics over time would be neglected.

A second issue, however, arises even when a causal-nonlocal model does accommodate nonlocal factors that unidirectionally causally affect the members of the group. Because the appointment choices made by the oligarchs do not interact bidirectionally with the bureaucracy, these choices are treated as exogenous variables. The fact that a variable is exogenous in a model does not limit the values it may take; but taken as exogenous, such a variable is not itself modeled, and instead is taken as a given in the model. If we presume that at least one purpose of a model of bureaucratic corruption is to be able to identify the dominant drivers of corruption, for instance so as to be changed though policy, then this counters the efficacy of the model. To construct a useful model of the incidence of corruption as depicted in figure 2, for instance, it will not suffice to treat the directives of the oligarchy as givens, and to construct a detailed model only of the factors with which bureaucrats bidirectionally interact. Instead, it is likely that the most effective levers for countering corruption will be precisely those that minimize or eliminate the periods of instability, and that thus change the oligarchs' directives. Yet those levers are not modeled in a causal-nonlocal model. By employing causal-nonlocal models, we may preclude ourselves from modeling the crucial factors determining the values of a variable, whose variations may be the principal determinant of the value of the property we are intending to model. Any model that fails to endogenize even

unidirectionally interacting properties will ignore potentially critical factors in determining the incidence of bureaucratic corruption.

A third shortcoming is the problem of disconnected factors: the value of a simple aggregate property may change even when there is a lack of causal connection altogether between certain local and nonlocal factors, or where there is a causal gap or lag, as in the case of delays in informing individuals of their status as bureaucrats. A causal-nonlocal model will simply neglect those factors, treating them as neither endogenous nor exogenous. Inasmuch as such factors are at work in determining the incidence of bureaucratic corruption, a causal-nonlocal model will fail to capture them altogether.

To construct an adequate model of *the incidence of bureaucratic corruption,* in short, it is necessary to consider all the factors on which that function depends, including the key determinants of *being a bureaucrat*, whether or not those determinants causally interact with the bureaucrats, have indirect or direct causal effects on them, or do not have any causal connection with them at all.

Acknowledging this point in model construction can have clear effects on policy choices for taking action against corruption. We can intervene with bureaucrats, perfect their incentives, monitor their interactions, or modify whatever factors change their individual corruption behavior, and have only minimal effect on corruption, if those factors are resistant to change. Yet all interventions at an individual level may pale in comparison with a slight tweaking of the solidarity characteristics of a set of people entirely distinct from the bureaucrats themselves, inasmuch as those tweaks have a substantial effect on the property *being a bureaucrat*. In the case of the oligarchy, the intervening agency will find that local interventions will fail to take hold, as will any nonlocal intervention designed to have a causal effect on the individual bureaucrats in the interest of reinforcing the agency's interventions. Paradoxically, to change the incidence of bureaucratic corruption, they may do best to ignore the bureaucrats.

Similarly, to change the incidence of political corruption, it may be preferable to ignore the incentives of politicians, and rather change the

attitudes of the electorate, i.e., the people who determine the property *being a political office-holder*. This, arguably, is one of the principal benefits of governmental transparency and a free press. As is suggested by models of electoral control,[14] it may be that these do have an effect on the likelihood that an individual politician will find it in her interest to be corrupt, and thus change the attitudes or incentives of politicians. But it may be, on the other hand, that the principal effect of transparency is simply that it enables the populace to replace corrupt officials, even if there are no negative consequences whatsoever for the officials who are dismissed for corruption. Whereas models of electoral control assess the value of changes in the electoral system for their effects on the incentives of the individuals elected, it is not necessary for such a change to have any effect on individual incentives in order for it to have a significant effect on the actions of the office-holders. Supposing only that the pool of potential office-holders is heterogeneous, the electorate can impose changes in the behavior of the office-holders by changing the set of individuals holding office, without changing their incentives at all.

VI. Conclusion

No doubt, it is somewhat counterintuitive that the best model of the incidence of bureaucratic or political corruption might do well to concentrate on factors that do not involve the individual bureaucrats or politicians themselves. This counterintuitiveness, I suggest, has led to erroneous principles driving the generation of models, and driving conceptions of what an ideal or complete model consists in.

Causal-nonlocal models implicitly divide the factors to be modeled according to whether they interact causally, causally affect unidirectionally, or have no causal relation to, the members of a group. To many modelers, it seems not only reasonable, but necessary, that centering a model on the members of a group suffices for the design of models of the simple aggregate

[14] E.g. Barro 1973; Ferejohn 1985.

properties of the group. But in fact, conforming to this pattern may condemn a model to inadequacy right at the outset.

Corruption, of course, is not the only property to which these observations apply. In fact, much of the reason I have chosen to speak of models of corruption is that existing models are extremely sophisticated, particularly as compared to models of a variety of other areas in economics and social theory, which focus even more on local individualistic modeling methods. Descriptively, I have pointed out that there are some models that do to an extent treat nonlocal factors in determining simple aggregate properties of social groups. Normatively, the observations here suggest that, in modeling even simple social properties, we ought to correct the fact that even causal global models strongly bias the choice of factors to be taken as relevant.

Modelers in the social sciences can thus be misled by patterning models too closely on those typically employed in the natural sciences. The simple supervenience differences between typical properties modeled in the social sciences and those modeled in the natural sciences yield differences in how modeling them ought to be approached. There is not a sharp distinction between the two in this regard: I have been careful to speak only of "typical properties" for each, since there are some nonlocally supervening properties treated in natural sciences, and as I have discussed, some locally supervening ones treated in the social sciences. Still, the typical difference is important to notice, particularly since modeling methods have largely been designed with a presumption of local supervenience.

Finally, I want to note a connection between this discussion and a different set of issues in the philosophy of social science. A number of philosophers have recently renewed longstanding debates over whether there are in-principle obstacles to the reductive explanation of macrophenomena in the social sciences, in terms of the properties of individuals.[15] While many philosophers of social science are rightly skeptical about microreduction in

[15] E.g., Sawyer 2002, Zahle 2003, and van Bouwel 2004.

social science, or what is sometimes called "explanatory individualism," it is commonly assumed in those discussions that social properties at least ontologically depend exhaustively on the local properties of individual persons. This thesis, known as "ontological individualism," is commonly regarded as a truism. In other work, I argue that far from being a truism, ontological individualism is in fact false.[16] In the present discussion, the particular population-wide holism I discuss in connection with simple aggregate properties is not nonindividualistic. It is entirely compatible with an individualistic (and even psychologistic) approach to social explanation, so long as the individuals in question are not limited to the members of the social group being modeled. Some of the same errors underlying the failure to recognize the nonlocality of simple aggregate social properties, however, seem to me also to be the source of the mistaken assumptions underlying ontological individualism. Among the reasons that some philosophers of social science have failed to see this is, I believe, because of a misleading analogy commonly made between physical properties and relations as the building-blocks of the natural sciences, and individualistic properties and relations as the basic building-blocks of social science. Part of my intention here in highlighting some differences between the dependence characteristics of simple aggregate properties typically treated in the social sciences versus those in the natural sciences is to motivate the examination of disanalogies between social and natural properties in thinking about ontological individualism as well.

[16] Epstein 2007.

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