International Systems and Domestic Politics: Linking Complex Interactions with Empirical Models in International Relations [1]

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Abstract

Following older debates in international relations literature which concerned the relative importance of domestic versus systemic factors, newer debates have emphasized interdependence among states and the complex interactions between systemic and domestic factors. As globalization and democratization advance, theories and empirical models of international politics have become more complicated. We make two contributions. First, we present a systematic theoretical categorization of relationships between domestic and systemic variables. We use this categorization so scholars match their theory to the appropriate empirical model and assess the degree to which systemic factors affects their arguments. Second, we present two advances at the frontier of these empirical models. In one, we combine hierarchical models of moderating relationships with spatial models of interdependence among units within a system. In the other, we provide a model for analyzing spatial interdependence that varies over time. This enables us to examine how the level of interdependence among units has evolved over time. We illustrate our categorization and new models by revisiting the recent IPE debate over the relationship between trade policy and regime type in developing countries.

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1 Introduction

International relations scholars have long debated the relative importance of systemic versus domestic influences in world politics. Waltz (1979) and Jervis (1997), for example, give explanatory priority to features of the international system, like polarity. Others, like Moravcsik (1997) and Milner (1997), prioritize domestic factors like the preferences of political actors or a country's political institutions. Most scholars, however, agree that the phenomena of interest in international relations (IR) are often outcomes resulting from complex interactions between domestic and systemic factors. As Gourevitch (1978) claimed over thirty years ago, "We all know about interaction; we all understand that international politics and domestic structures affect each other (p. 882)." The extent to which domestic versus systemic factors determine states' choices constitutes a large part of the debate in the fields of IR and comparative politics.

Globalization has increased attention to the importance of systemic factors. Some scholars have argued that increasing globalization has profoundly changed international relations such that systemic forces now exert a dominant influence on states.[2] There is little room, they assert, for individual states to maneuver given these powerful international pressures. These external pressures have led in their view to heightened interdependence among states, producing convergence toward similar domestic politics and institutions. Some argue that states are now so deeply intertwined that they exist within a complex system or network that is not decomposable into individual units. In a recent critique, Oatley (2011) argues that international political economy (IPE) researchers too often have conducted reductionist research that emphasizes domestic factors to the exclusion of systemic analysis, potentially generating incorrect conclusions in this globalized system. Subsequent authors have echoed this concern, arguing that these flaws have made IPE research "less relevant to debates about how to repair global economic governance."[3]

In contrast, others have continued to assert the primacy of states and domestic factors.[4] Many studies, however, have accepted the deep interaction of domestic and international politics, but

[2] Frieden and Rogowski (1996); Andrews (1994); Oatley (2011); Cerny (1995).
[3] Drezner and McNamara (2013).
[4] Boix (1998); Garrett (1998); Garrett and Lange (1996); Kitschelt et al. (1999); Mosley (2000, 2003).

have turned to specifying how factors like a country's economic development level or regime type moderate the degree to which systemic or domestic factors dominate.[5]

This paper makes two contributions to this debate. First, we bring together a wide variety of theoretical claims about the interaction of domestic and systemic factors and then we link each to empirical models that complement these theories. The degree to which states are constrained by systemic forces rather than domestic ones varies from one context to another. Systemic pressures are not a constant; they do not dominate all settings. Rather, the interaction of domestic and international forces varies with the situation at hand. Sometimes this relationship is straightforward and simpler models suffice. Sometimes it is very complex and developing more complex models of such interactions is the goal. We initially present a systematic theoretical categorization of relationships between domestic and systemic variables. Many existing theories conceptualize the interaction as falling into one of five categories: independence, direct system effects, indirect system effects, moderation, or interdependence. These relationships build upon one another in terms of their complexity and the generality of their assumptions.

We use this categorization to help scholars choose an empirical model that matches their particular theory and then assess the degree to which inclusion or omission of systemic forces affects their arguments. The progression of models from least to most complex shows how researchers can check that their findings are robust to alternative ways of thinking about systemic forces. Using the most complex model need not always be the most preferred option, just as ignoring complexity is not always a safe decision. Depending upon the theory and the problem at hand, simpler models may give answers that are consistent with more complex ones. Not only are simpler models easier to assess, but Occam's razor suggests simplicity over complexity when the results are consistent.[6]

[5] Adsera and Boix (2002); Rudra (2005); Wibbels (2006); Kayser (2007); Burgoon (2009); Boix (2011).

[6] In his study of complex systems, Herbert Simon (1962) points out that most social systems can be treated as nearly decomposable ones, where the interactions among the subunits are weak but not negligible, especially compared with those within subsystems. Systems vary in their degree of decomposability, but most social systems he argues are nearly decomposable. For IR, the subunits are mainly states, and as Simon notes the density of interaction is far greater within states than it is across them. As Simon discusses, such decomposability greatly simplifies the behavior of complex systems and makes them much easier to understand. Decomposability means that the short-run behavior of each of the component subsystems is approximately independent of the short-run behavior of the other components and that in the long run the behavior of any one of the components depends only in an aggregate way on the behavior of the other subsystems.

On the other hand, we also present very complex models that can capture many different types of interactions between domestic and systemic forces.

Our second contribution is methodological. We expand upon existing empirical models that emphasize systemic factors in two ways. First, we present empirical models that combine hierarchical modeling and spatial econometrics. This combination allows researchers to consider relationships where systemic and domestic variables moderate each other's effects on the outcome variable of interest, as well as situations in which the outcome of interest exhibits contagion across units within the system.

Additionally, we present an empirical model in which the nature of contagion or interdependence across units within the international system is allowed to vary over time. As the relationships among units in a system change over time, the outcome variable of interest may be positively or negatively correlated across units at different times, and these correlations may be more or less intense over time as well. These methodological advances are important because changing patterns of globalization and the deepening of international institutions create opportunities for correlations between countries' policies or behavior to change over time.

We demonstrate our arguments in a substantively important context by revisiting a recent debate over the relationship between regime type and trade policy. A number of scholars have focused on the relationship between democracy and globalization, especially the link to trade.[7] Helen Milner and Keiko Kubota (2005), in particular, argued that increased democratization among LDC's empowered workers in these labor-rich countries, curtailing the ability of capital owners to use their political power to erect protectionist barriers. Thomas Oatley (2011) claims this result is an artifact of failing to account for more complex relationships between domestic and systemic factors, i.e., reductionism.

We use this debate to walk through a series of increasingly complex relationships analyzing how, if at all, the key relationship between regime type and tariffs changes. The key substantive finding is that democracy is associated with lower tariffs, and this relationship is robust to a broad

[7] See: Adsera and Boix (2002); Ahlquist and Wibbels (2012); Eichengreen and Leblang (2008); Milner and Kubota (2005); Milner and Mukherjee (2009).

array of potential interactions between systemic and domestic factors.

Below, we first describe and categorize theories linking domestic and systemic factors and outcomes. We briefly note several of the main and more simple relationships that have been well explored in the literature: namely, the independence of domestic and systemic variables, direct system effects, and indirect system effects. It is useful to present these first in order to contrast them and their assumptions with the more complex models developed later. We then describe two more complex relationships between systemic and domestic factors that have become more prevalent in recent IR research: moderation and interdependence. In Section 3, we use our application of regime type and trade policy to illustrate a progression of increasingly complex empirical models, culminating with models that (a) combine hierarchical modeling and spatial econometrics and (b) allow for time-varying interdependence relationships. Section 4 concludes.

2 Theoretical Relationships and Empirical Models

International relations often are characterized by a set of units–frequently states–interacting in a particular system. Systems theorists highlight the homogeneity of these units, while those focused on domestic politics underline their heterogeneity. A common thread in these literatures is their concern with the variety of relationships possible between three types of variables: domestic, systemic, and outcome variables.

The outcome variable is the outcome of interest to the researcher. We refer to variables representing the outcome of interest as Y_{it}, with potential subscripts for a particular unit, i and time period t. In IPE, the outcome of interest is often the particular policy or economic conditions of a particular country at a particular time. Unit i could also be thought of as a particular dyad (or k-yad) of countries.[8] For simplicity, we will refer to "states" and "units" interchangeably from here forward, though our analysis would be the same for different conceptions of each unit.

International relations are often concerned with the effects of two types of explanatory variables, domestic and systemic, on the outcome of interest. Domestic variables usually describe a property

[8]Poast (2010).

or attribute of the unit.[9] These variables tend to vary both across countries and over time, though some country-specific characteristics may change slowly or be invariant for a long time. Perhaps the most popular example of a domestic variable is a state's regime type or level of democracy. We denote domestic variables as D_{it}.

What do we mean by systemic factors? This paper is predominantly epistemological; it is about how one can empirically examine the effects of systems and agents on outcomes in world politics. But a digression on the related ontological question of "what constitutes a system" is necessary. All systems are composed of agents and a set of relationships between them. In the social world, these agents are mostly always humans or organized groups of humans, like governments. In international politics, the main agents are governments, individuals, or non-state organizations—such as MNCs, interest groups, NGOs, IGOs, among others. Systems exist and operate because of and through the agents' actions themselves and some mechanism through which one agent affects other agents. Especially in the study of social systems, this mechanism is based on agents' beliefs. In the study of international politics, beliefs often describe agents' assessments of what action is best, from an ethical or utilitarian perspective.

These two components—agents and relationships—constitute a system because the beliefs of one agent affect its actions, which possibly affect another agent's beliefs and actions, and so on. Thomas Schelling illustrates these points nicely; he explores a wide variety of processes that constitute systems, all of which depend on human behavior and beliefs. As one example of a system, he points out that social systems "like language are the communication systems that develop out of the unmanaged behaviors of individuals—the diffusion of rumor, gossip and news...Everybody who participates in a communication system is part of the system. His participation maintains it or repairs it or transforms it, or sometimes helps to cause it to wither away or collapse."[10]

As social theorists and many economists have argued, "aggregate or macro-level patterns usually say surprisingly little about why we observe particular aggregate patterns, and our explanations therefore must focus on the micro-level processes that brought them about."[11] That is,

[9] Waltz (1979, p. 39).
[10] Schelling (1978, p. 40).
[11] Hedstrom (2005, p. 8). See also: Boudon (1981, 1986); Elster (1978, 1989); Coleman (1986, 1990).

macro-level patterns lack microfoundations. As Little (1991, p. 196) explains, "the microfoundations thesis holds that an assertion of an explanatory relationship at the social level (causal, structural or functional) must be supplemented by two things: knowledge of what it is about the local circumstances of the typical individual that leads him or her to act in such a way as to bring about this relationship and knowledge of the aggregative processes that lead from individual actions of that sort to an explanatory social relationship of this sort."[12]

The challenge for IR scholars is to use two things—theoretical knowledge about the microfoundational relationships among units and empirical data about agents' actions—to examine arguments about how agents and systems interact. The different categories of models we focus on are underlain by different characterizations of the beliefs and behavior of agents, and how relationships among them affect outcomes of interest.

The models presented below differ in how they conceive of and treat systemic factors. In the most basic model the system plays virtually no role; some internal characteristic(s) of the agent is critical to the outcome and states can ignore the context of other states' behavior and interactions. This situation would seem to be a rare case in the modern world where communications, transport and technology have brought all states into closer contact with one another.

In other models, such as those based on direct system effects, mediation, and moderation, the system is treated as an *exogenous* factor that affects outcomes. The agents face a given system that then affects their beliefs and behavior. The systemic is treated like a variable which describes features of the world that apply to all units within a particular system, not just one particular unit. The system is seen as equivalent to a domestic influence but is simply a factor emanating from outside the country's borders. At any one point in time, the researcher can only observe one system, and that system is the same for each of the countries inhabiting it. Systemic variables vary over time, often very slowly, and they do not vary across countries who are within the system. We denote systemic variables as S_t.

This situation is most likely where states are assumed to be "small"; that is, they are unable

[12] This characterization is also echoed by scholars describing complex adaptive systems. See Lansing (2003, p. 185). Holland (2006, p. 1) also argues that "CAS [complex adaptive systems] are systems that have a large numbers of components, often called agents, that interact and adapt or learn."

to affect the system because their capabilities are not large enough to influence the system or the behavior of other states. In the direct system effects models, the outcome is influenced by both domestic and systemic factors. The context created by other states' interactions operates directly on the outcome and not through an individual states' domestic environment. For example, the system sets constraints on the set of policy options available to the agents.

In the 1970s and early 1980s, IR theory emphasized this conception of systemic factors. In Waltz's theory of IR, the most important explanatory variables to consider were systemic. This followed logically from his assumption that units within the system could safely be treated as homogeneous: if there is no variation across units (i.e., states), then domestic factors could be ignored for the purposes of explaining variation in the outcomes of interest. The Realist tradition[13] emphasizes systemic variables like the distribution of capabilities, or polarity: whether the system is unipolar, bipolar, or multipolar.

In terms of indirect systemic effects, the system operates *through* the domestic environment. Domestic factors mediate its influence; in effect, they transmit the system's effects. During the 1980s and 1990s, IR scholars explored the relationship between systemic and domestic variables in this way. Some scholars emphasized the "second image reversed" concept,[14] arguing that systemic variables affect domestic variables, which in turn, can affect the outcome of interest. Another strand of research, Liberalism, built off (and frequently criticized) the Realist model. Liberalism as a general theory for IR emphasized domestic variables like the preferences of subnational actors and the institutions within which they influenced political behavior.[15] Often, however, these domestic variables were linked back to the international economy.

In the moderating case, systemic factors transform the effect of domestic factors on the outcome; they shape the outcome by changing the context they set for individual action. Recent research has focused on the conditions under which domestic and systemic factors moderate or reinforce one another.[16] Some note that developing countries are constrained in different ways

[13]Of course, the Realist tradition is very broad. We simplify here to describe broad theoretical arguments.
[14]Gourevitch (1978).
[15]Moravcsik (1997).
[16]Adsera and Boix (2002); Rudra (2005); Wibbels (2006); Kayser (2007); Burgoon (2009); Boix (2011).

than developed ones. Others point out that autocracies face different international pressures from democracies. And some scholars note that the extent of available domestic compensation affects how publics and their governments react to globalization itself.

In the later, more complex models some component of the systemic relationship between agents is *endogenous*. More recently, there has been a push for greater focus on global macro processes, such as those describing the complex system, or network, of interdependent states.[17] Oatley (2011), for instance, emphasizes a broader conception of the system, as more than just a variable. A "complex system," for Oatley, is one in which macro processes, such as contagion or diffusion, "inhere in the system or in the relationships between individual units rather than inside domestic arenas" (313). The most important feature of this conception of the system is that the outcome of interest for one unit is interdependent with the outcomes for other units. States are assumed to be "large", that is, they have the capacity to significantly affect the system and other states' behavior. In the interdependence case, the many different ways in which all states in the system are connected and changes in those connections over time can be explored to see how they affect individual states' behaviors. The interdependence case provides a more disaggregated way to examine the structure of interactions and its effects on one particular outcome.

Our point is that, epistemologically, each category models the system in different, increasingly complex ways. Yet, ontologically, the system is the same concept in each: it is the aggregate composed of the interacting units. In other words, in each approach, there *is* a system. But in each, there is a different conception of the relationships through which it operates.

The mechanisms by which the system influences actions and outcomes are myriad. Different theories will highlight different aspects of them and propose different microfoundations. The five broad ways in which systems can affect outcomes that we sketch here can accommodate these different theories and mechanisms. For instance, Kenneth Waltz, despite his early comments about the importance of the units in a system, posits an exogenous system that seems to directly and indirectly shape agents' behavior, much like our mediation model.[18] This anarchic system forces

[17] Oatley (2011); Oatley et al. (2013); Drezner and McNamara (2013); Cohen (2008).
[18] Waltz (1979).

states, who are assumed to be like units and to have low levels of interdependence, to balance. Jervis also focuses his attention on the system level, examining how system effects intervene to prevent states from realizing their goals. While acknowledging that units and their interactions matter, he also seems to take the system as exogenous, but more in the sense of the moderation models we present.[19] Wendt has a different conception of the system; states interact with one another to create their identities and interests, and it is this interaction that generates the system endogenously, as in the interdependence model.[20] The two-level games literature focuses on a rationalist account of states' interactions; bargaining, strategic interaction, and coercion occur among states where their interdependence shapes the system, as in the interdependence model here.[21] And as a final example, Finnemore and Sikkink examine how international norms—defined as standards for the appropriate behavior of states—set the context for units but also show how norms arise from domestic settings and thus depict the interdependence of units and normative systems.[22] Diffusion models via learning, competition, coercion and dependency also tend to propose mechanisms that show how systemic influences operate on states.[23]

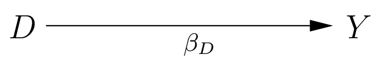
Given the breadth of approaches to these questions, our goal here is to categorize types of theories and suggest appropriate empirical models. Many existing theoretical arguments imply relationships between domestic and systemic variables that fall into one of five categories: independence, direct system effects, indirect system effects, moderation, and interdependence. We illustrate the first three categories briefly since they are well known and describe examples from existing literature. It is important to begin with these simpler models since they maintain strong assumptions that are often relaxed in more complex models. Most recent research has turned to exploring more complex relationships. In particular, two types of relationships have emerged at the frontier of this research: moderation and interdependence. We examine each of these two in greater detail below and describe our methodological contribution to these strands of research.

[19] Jervis (1997).
[20] Wendt (1999).
[21] Milner (1997); Putnam (1988).
[22] Finnemore and Sikkink (1998).
[23] Simmons and Elkins (2004).

2.1 Independence

The simplest relationship between domestic and systemic variables is one of independence. Older IR research often focused on the effects of domestic variables independently from any effects of systemic influences, a theoretical relationship graphically depicted in Figure 1. These relationships link domestic variables, D, with outcomes of interest, Y, and do not ascribe any role to systemic variables. β_D then describes the relationship between domestic factors and the outcome of interest. Much of the literature on endogenous protection in the trade area treated domestic factors as independent influences on trade policy.[24]

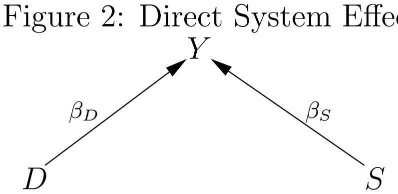
Figure 1: Independence Model



2.2 Direct Systemic Effects

Many theories in IR imply a direct role for systemic influences, as well as domestic ones, on the outcome of interest, β_S, as in Figure 2. For example, Li and Resnick (2003)'s analysis explaining foreign direct investment inflows into a country incorporates a systemic variable, the amount of world FDI inflows for a particular year.[25] Still others incorporate systemic effects by using controls for unobserved system-wide heterogeneity–e.g., year fixed effects.

Figure 2: Direct System Effects



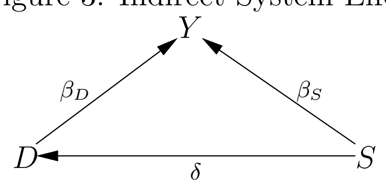
[24]E.g. Ray and Marvel (1984).

[25]For other works that emphasize systemic factors, see: Frieden (1991); Andrews (1994); Broz (1999).

2.3 Indirect System Effects

Other IR research has long considered indirect system effects, where systemic variables influence the value of domestic variables, which in turn, affects the outcome variable, as in Figure 3. Systemic variables can shape the outcome of interest directly (as in the previous theoretical category) via β_S as well as indirectly via their influence on domestic variables, represented by δ.[26] Gourevitch (1978) had this type of theoretical relationship in mind with his classic "second image reversed" analysis, in which the international system affected domestic politics, which in turn, affected the foreign policy choices of nations.

Figure 3: Indirect System Effects



These types of relationships are often referred to as "mediating" relationships.[27] A domestic variable mediates the effect of a systemic variable if the systemic variable affects the value of the domestic variable. This generates two interesting effects to estimate: the direct effect of systemic variables on the outcome variable, β_S, and the indirect effects of systemic variables through their effect on domestic variables, δ.

2.4 Moderation

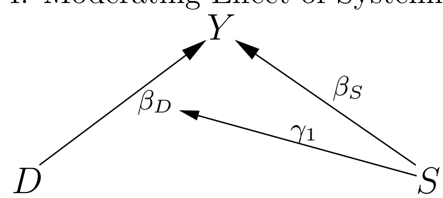
As the international environment has become complex with growing interactions among states and globalization, scholars have turned to more complicated models. One more complex interaction entails the *moderating* role of systemic variables. "Conceptually, a moderator is a variable that

[26]Note that nothing precludes analysis of a similar relationship in which domestic variables influence the value of systemic variables.

[27]Direct and indirect effects are often associated with causal analysis of mediating variables. We include this aspect of their relations but also non-causal effects. "Thus, an inferential goal is to decompose the causal effect of a treatment into the indirect effect, which represents the hypothesized causal mechanism, and the direct effect, which represents all the other mechanisms." (Imai et al., 2011, p. 768).

modifies the effect of a predictor on a response."[28] According to Baron and Kenny (1986, p. 1174), "moderator variables specify when certain effects will hold;...[they] partition a focal independent variable into subgroups that establish its domains of maximal effectiveness in regard to a given dependent variable." In this category, which is depicted in Figure 4, systemic variables alter the way in which domestic variables affect the outcome of interest; γ_1 describes how the effect of D on Y (β_D) is moderated by S. Here, we depict a relationship in which systemic variables moderate the effects of domestic variables, but we could also imagine reasons why domestic factors might moderate the effects of systemic variables.

Figure 4: Moderating Effect of Systemic Variable



Ahlquist and Wibbels (2012), for instance, examine a theory of how international pressures can moderate domestic factors to explain democratic transitions. World trade openness (a systemic variable) affects how a country's relative labor endowment shapes labor's preferences (domestic variables) and thus affects the probability of democracy (outcome variable). They expect that in labor-abundant autocracies increases in world trade openness should lead to a greater probability of democratization, while one should see the opposite or no effect in labor-scarce autocracies.

In empirical models, moderating relationships are often examined using multiplicative interaction terms. While it is less prevalent in IR, multilevel or hierarchical modeling is a powerful tool for analyzing such relationships. Multilevel modeling takes advantage of the researcher's knowledge that individual observations in the data are part of larger groups.[29] A classic example considers data on students in school systems. The students are grouped into classes; classes are grouped into schools; schools are grouped into districts, etc. Multilevel modeling acknowledges this structure and describe individual and group-level similarities and differences.

[28] Tang et al. (2009, p. 313).

[29] Beck and Katz (2007); Gelman and Hill (2007); Shor et al. (2007).

International relations scholars often consider data with a similar structure. Particular countries could be grouped regionally or temporally. For our application, it is natural to think about groupings based on the international system over time. Countries in the same time period share the common features of the international system at that time, and observations in different time periods belong to different groups because they exist in different international contexts. Multilevel modeling affords the researcher the flexibility to model relationships where, for example, systemic factors change the way that domestic factors affect outcomes. If the theory proposes a hierarchical relationship where systemic factors describe the context in which domestic factors operate, the accompanying empirical model can directly capture these features. Model 1 is a statistical representation of a moderation relationship like that in Figure 4, where the systemic variable changes the relationship between the domestic and outcome variables.

$$
\begin{aligned}
Y_{it} &= \beta_0 + \beta_{0t} + \alpha_i + \beta_{D,t} D_{it} + \epsilon_{it} && \text{(Individual/Micro-Level Model)} \\
\beta_{0t} &= \beta_S S_t + c_t && \text{(System/Macro-Level Model)} \\
\beta_{D,t} &= \gamma_0 + \gamma_1 S_t + \zeta_t && \text{(System/Macro-Level Model)}
\end{aligned}
\tag{1}
$$

The individual level of Model 1 describes relationships between country-level explanatory variables for a particular time period and the outcome of interest. At this level, both the outcome variable, Y_{it}, and the explanatory variables D_{it} vary across countries *and* over time, and values of these variables are often measured at the country-year level. β_0 is the global intercept for all observations, similar to the intercept in more familiar single-level regression models. β_{0t} is the year-specific intercept that captures the overall direct effect of the international system. α_i is the country-specific intercept, which is equivalent to the familiar country fixed effects. The domestic source of Y_{it}'s variation is from $\alpha_i + \beta_{Dt} D_{it}$, including the observed time-varying domestic factors D_{it} and the unobserved, time-invariant country-specific characteristics included in α_i. In the first system-level equation, the overall effect of the international system on the outcome, β_{0t}, is further explained by the direct effect of the observed systemic variables, S_t, and the unobserved ones left in the error term, c_t.

More importantly, Model 1 captures moderation by allowing the effect of D to vary with changes occurring in the international system over time. As in the second system-level equation, the variation of D's effect is partially explained by the systemic variable S. The unexplained part of the over-time change of $\beta_{D,t}$ is left in the error term of the third line, ζ_t. Plugging the system-level equations in the individual-level equation, we have the reduced model as follows:

$$\begin{aligned} Y_{it} &= \beta_0 + \gamma_0 D_{it} + \beta_S S_t + \gamma_1 D_{it} S_t + \alpha_i + c_t + u_{it} \\ &\text{where, } u_{it} = \zeta_t D_{it} + \epsilon_{it} \end{aligned} \tag{2}$$

This representation highlights a restricting assumption of the multiplicative interaction model (MIM) and an advantage of multilevel modeling (MLM). The two models are equivalent only if we assume there is deterministic moderation, that is $\zeta_t = 0$. In other words, the MIM assumes that the change in the effect of the domestic variable is a deterministic function of the moderator (i.e., the systemic variable), $\beta_D = f(S_t) = \gamma_0 + \gamma_1 S_t$. But if there is an omitted systemic variable (the error term ζ is a stochastic term instead of the constant number zero), then the model invites the problem of inconsistency, and all coefficients, not only γ_0 and γ_1, could be affected.[30]

If the researcher is confident that there are no omitted systemic moderators, the MIM is a legitimate choice for modeling the moderating effect of the systemic factor, S_t, on the relationship between the domestic variable and the outcome variable. However, if we suspect that not all moderators are observed, then we have to address the relationship $\beta_{D,t} = \gamma_0 + \gamma_1 S_t + \zeta_t$ and treat ζ_t as a stochastic term (an error term), in which unobserved moderators are left out. The advantage of MLM lies in the fact that ζ_t is not required to be independent of any of the observed covariates at any levels, because ζ_t is treated as a parameter and can be estimated using maximum likelihood techniques or simulation methods. The MIM can be regarded as a special case of the multilevel model with an additional (and potentially strong) restriction $\zeta_t = 0$, i.e., that there are

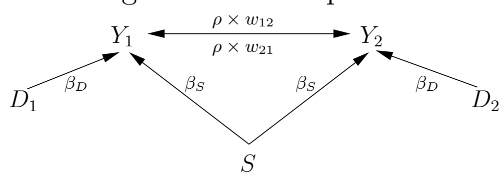
[30] Wooldridge (2001).

no omitted moderators and no unobserved shocks to the moderation relationship.

2.5 Interdependence

Our final category of systemic effects considers interdependence, which models how units within the international system interact with one another. Such relationships are depicted in Figure 5 and are often the focus of the existing literature that utilizes network theory and spatial econometrics. Both are concerned with the possibility that the outcome in one unit, Y_i, affects the outcome in another unit, Y_j .

Figure 5: Interdependence



Spatial econometrics has become an often-used tool, particularly in the study of the diffusion of national policies across countries. Spatial econometrics explicitly incorporates the notion that one country's outcome variable can be influenced by spatially and/or temporally lagged outcome variables from other countries. It is hard not to encounter analyses using these tools in virtually every context.[31] The econometric tools themselves continue to be refined by social scientists studying international relations and comparative politics.[32]

These types of relationships can be estimated using Model 3 and its matrix equivalent, Model 4.

$$Y_{it} = \rho_t W_{it} \mathbf{Y}_t + \beta_D D_{it} + \beta_S S_t + \alpha_i + c_t + \epsilon_{it} \tag{3}$$

The matrix expression of the model is:

[31] For an extensive list of studies using these approaches in CPE and more general survey of these methods, see: Franzese and Hays (2008). Graham, Shipan and Volden (2013) estimate that over 400 articles have been written in social science over the last decade that consider the diffusion of policies from one government to another.

[32] Beck, Gleditsch and Beardsley (2006); Hoff and Ward (2004); Neumayer and Plümper (2010); Plümper and Neumayer (2010); Poast (2010).

$$\mathbf{Y}_t = \rho_t W_t \mathbf{Y}_t + \beta_D \mathbf{D}_t + \beta_S S_t + \boldsymbol{\alpha} + \mathbf{c}_t + \boldsymbol{\epsilon}_t, \tag{4}$$

where $\mathbf{Y}_t = \{Y_{it}, ...Y_{nt}\}$, $\boldsymbol{\alpha} = \{\alpha_1, ..., \alpha_n\}$ and $\mathbf{c}_t = \{c_t, ..., c_t\}$. W is an $n \times n$ weighting matrix or metric, where each entry describes a measurement of the connectivity between any two units. The entry in cell w_{ij} is a measure of how connected the researcher expects units i and j to be, and the diagonal elements of the matrix are all zero.

Several features of the weight matrix W are worth highlighting. First, it is a matrix of measurements chosen by the researcher, using prior theoretical information. The spatial econometric techniques described here treat elements of this matrix (in addition to the relevant explanatory variables) as exogenous.[33] The researcher must choose some proxy, e.g., distance, amount of bilateral trade, mutual organization membership, etc., that she thinks describes the degree of connectivity between the units. The W matrix can also be time-varying, accounting for the possibility that particular units, i and j, are expected to be more or less intensely connected at different times, e.g., if cell (i, j) of W measured the amount of bilateral trade between countries i and j. Conventionally, the matrix W is row-standardized for computational reasons.[34]

The parameter ρ_t measures the strength and direction of contagion by the channels pre-specified by W. While W_t is the observed data structure, ρ is an estimated parameter. When all the elements in W_t are non-negative, positive values of ρ imply that the outcomes for the units move in the same direction in general, and vice versa.[35] Higher absolute values of ρ denote stronger contagion across the units.[36]

Because there are endogenous variables on both sides of the equation 4, this model is a simultaneous equation one in the sense that all the outcomes in the same time period are determined

[33] In the conclusion, we describe recent advances designed to treat these elements as endogenous.

[34] For a more in-depth discussion of the implications of row-standardization, see Plümper and Neumayer (2010).

[35] Neumayer and Plümper (2010) and Neumayer and Plümper (2012) also discuss extensions to this analysis, such as multiple spatial terms, heterogenous responsiveness, and spatial modeling for dyads.

[36] Researchers need also consider the parameter space of ρ such that the spatial dynamic process is stationary. In the spatial modeling literature, the convention is to impose the restriction, $|\rho| < 1$, when W is row-standardized. However, it is a sufficient but not a necessary condition for the spatial dyanmic process to be stationary. The general condition for stationarity is actually $1/\lambda_{min} < \rho < 1/\lambda_{max}$. Because the smallest eigenvalue λ_{min} of a row-standardized matrix is often greater than -1, the stationarity condition $|\rho| < 1$ is often more restrictive than the necessary condition (Elhorst, 2010).

simultaneously in the model. Therefore, denoting $\mathbf{A} = \mathbf{I} - \rho_t W_t$ where $\mathbf{I}$ is the identity matrix, the model can be written as follows:

$$\mathbf{A}\mathbf{Y}_t = \beta_D \mathbf{D}_t + \beta_S S_t + \boldsymbol{\alpha} + c_t + \boldsymbol{\epsilon}_t$$

$$\mathbf{Y}_t = \mathbf{A}^{-1}\beta_D \mathbf{D}_t + \mathbf{A}^{-1}\beta_S S_t + \mathbf{A}^{-1}\boldsymbol{\alpha} + \mathbf{A}^{-1}c_t + \mathbf{A}^{-1}\boldsymbol{\epsilon}_t,$$

The matrix form of the spatial model shows why we get inconsistent estimates if we omit interdependence. If $\rho_t \neq 0$ and $\mathbf{A} \neq \mathbf{I}$, then the error term $\mathbf{A}^{-1}\boldsymbol{\epsilon}_t$ violates the *i.i.d.* assumption. More importantly, because $\mathbf{A}^{-1}$ appears everywhere on the right hand side, including the error term and the covariate terms, there is an endogeneity problem affecting all parameters.[37]

An important advance in the model we specified above is that the spatial autoregressive coefficient ρ is allowed to vary across time. Existing spatial models assume that the direction and magnitude of contagion is constant over time. However, there are compelling reasons to believe that interdependence among states might increase or decrease over time, or be positive at some times and negative at others. For instance, Neumayer and Plümper (2010) argue that competition among capital-importing countries affects which capital-exporting countries they choose as partners for bilateral investment treaties (BITs). A capital-importer is more likely to sign a BIT with a capital-exporter if other capital-importers have also signed a BIT with that particular capital-exporter. Implicitly, they assume that this competition is equally "fierce" over time. But we could imagine competition being more fierce when the capital available from capital-exporters is scarce than when it is relatively abundant. Gleditsch and Ward (2006) conduct an analysis of whether democratic transitions spill-over to neighboring countries from 1951-1998. Given the large geopolitical changes, e.g., the end of the Cold War, that occurred in this period, it is likely that the intensity of this contagion varied over time. During the Cold War, fear of Communist dominoes or hopes for regional outbreaks of democracy abounded, while democracy promotion in the post-Cold War era was often targeted at specific countries.

[37] Franzese and Hays (2008), in the accompanying technical appendix, derive an explicit representation for the degree of omitted variable bias that arises from omitting spatial or temporal lags.

Similar stories are feasible in virtually every scenario in which researchers have theoretical reasons to suspect interdependence or contagion across units. Interdependence as a result of international bargaining may become more intense as more countries join a particular international institution. As an institution gains members and increases in its prominence, countries might increasingly use it as a bargaining forum, making the members' choices increasingly interdependent. Diffusion processes, like learning, might be more intense over time as improvements in information technology make it easier for political actors to gather precise information about one another's policies and their effects. If the degree of interdependence across units is changing over time, then this reflects important changes in the international system that researchers might be interested in.[38]

2.6 MLM and Interdependence

Additionally, researchers can develop even more complex models by considering combinations of the categories of interactions described above, as depicted in Figure 6. Researchers can develop and test theories in which virtually any combination of relationships between systemic, domestic, and outcome variables is present.

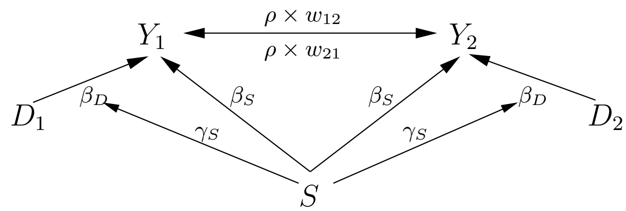
To further expand the frontier of possible models for complex systemic-domestic interactions, we could estimate a model which includes all of these potential relationships, as in Model 5.

[38] The assumption of a time-invariant ρ, which we relax in the model presented here, is also restrictive from a statistical perspective. When researchers specify a time-varying W, this is at odds with the assumption of a time-invariant ρ, since there is no reason to force ρ to be constant when the structure of connectivity among the units is changing over time. Furthermore, a time-invariant ρ should not be regarded as the average of time-specific ρ_t's. A time-invariant ρ in panel data analysis actually measures the general strength of contagion among all units in all time periods assuming that the weight of connectivity for two observations in different time periods is always zero. To illustrate this point further, consider the following model with a time-invariant ρ:

$$\mathbf{Y} = \rho \mathbf{W} \mathbf{Y} + \beta_D \mathbf{D} + \beta_S S + \boldsymbol{\alpha} + \mathbf{c} + \boldsymbol{\epsilon},$$

where $\mathbf{Y}$ is a $1 \times NT$ matrix and $\mathbf{W}$ is a $NT \times NT$ block diagonal matrix with the diagonal matrices as W_t. In this model, all observations in different time periods are actually regarded as in one "spatial" dynamic process for which ρ is the only spatial autoregressive coefficient. In contrast, models with time-varying ρ_t treat units in each time period as in a different spatial process. Therefore a constant ρ does not have an interpretation as the time average of ρ_t's. We prefer time-varying ρ to constant ρ for two reasons. First, time-varying ρ provides more information about how the direction and strength of interdependence vary over time. Secondly, treating units in different time periods as in the same spatial process is likely to incur unit root problems because spatial dynamics can change over time and putting them in a single spatial dynamic process is likely to violate the stationarity assumption.

Figure 6: Combination of Direct, Moderating Effects and Interdependence



$$
\begin{aligned}
Y_{it} &= \beta_0 + \beta_{0t} + \beta_{0i} + \rho_t W_{it} \mathbf{Y}_t + \beta_{Dt} D_{it} + \epsilon_{it} \\
\beta_{0t} &= \beta_S S_t + c_t \\
\beta_{Dt} &= \gamma_0 + \gamma_S S_t + \zeta_t
\end{aligned} \tag{5}
$$

Model 5 incorporates direct systemic effects on the outcome of interest, allows unobserved and observed systemic variation to moderate the effects of domestic variables, and estimates spatial correlation with time-varying connectivity. Model 3 and Model 5 are more complex than ordinary multilevel models or standard spatial models, so in the applications below we estimate them with a Bayesian approach using Markov Chain Monte Carlo simulation techniques.[39] Markov Chain Monte Carlo uses stochastic simulation techniques to make inferences based on the simulated distributions of the parameters given the observed data.[40] It is especially powerful for estimating complex and parameter-rich models. Using a Markov Chain Monte Carlo approach requires us to specify prior distributions of the parameters. Priors can incorporate any information the researcher has before the data are observed. In this paper, we use uninformative priors to the parameters because we want the inferences to be mainly based on the data. From a Bayesian perspective, all assumptions can be regarded as priors. Different from priors of the unknown parameters, the pre-specified weight matrix W can be interpreted as a prior on W with no uncertainty.

[39]Conditional Maximum Likelihood or Quasi Maximum Likelihood are usually used to estimate nonstandard spatial models (Liang and Zeger, 1986; Frees, 2004; Skrondal and Rabe-Hesketh, 2008).

[40]Gelman and Hill (2007); Shor et al. (2007). For the simulation algorithms for each model, see the empirical appendix.

3 Application: Regime Type and Trade Policy

Having described a set of theoretical relationships and accompanying empirical models for systemic, domestic, and outcome variables, we now apply them to a particular context: the relationship between trade policy and regime type. Trade policy and democratization in LDC's are the focus of work by Helen Milner and Keiko Kubota (2005). As unskilled labor-rich developing countries become more democratic, Milner and Kubota (MK) hypothesize, they are less likely to turn towards protectionist tariffs to garner political support. MK analyze data on the outcome variable, tariff rates, for approximately 101 LDC's for the years 1970-1999. Their central explanatory variable is domestic, measuring the regime type of country i in year t. They also collect data on a set of covariates, both domestic and systemic. Using a series of models, they find that democracy is negatively related to tariff rates.

Thomas Oatley (2011) criticizes MK's analysis for its omission of the moderating effect of systemic variables. He argues in favor of a "macro theory" that accounts for possible bargaining among countries in the WTO forum. To link this theory with the empirical evidence, he argues for a conditional hypothesis and re-estimates certain models from MK with a multiplicative interaction term between a dummy variable indicating a country's membership in the WTO and the regime type variable. He finds that democracy decreases tariffs only for WTO members and concludes that this is evidence of the biased inferences drawn from MK's analysis. Although a country's membership in the WTO is not a systemic variable, he argues that this shows the importance of systemic factors like the WTO. Because MK did not consider a possible moderating role of systemic variables, Oatley claims that their conclusions were incorrect.

This section shows how a researcher might start with a simple relationship and walk through a series of increasingly more complicated models. Moving through the progression shows whether, if at all, these assumptions affect the relationship of interest. As we move through the progression, we highlight how the relationship of interest, between regime type and tariffs, changes, and we also describe the ancillary information that comes with increasing complexity. In a sense, the simpler models make assumptions about the absence of features of the more complicated models.

3.1 Dataset

The data we use are identical to that of MK and Oatley's analyses, with a few exceptions. First, we significantly extend the time period covered by either analysis. The original analyses covered the years 1970-1999, which unfortunately, only include four years of the post-WTO period. We extend the analysis to 2008, which triples the number of WTO-period years under consideration. Since we are concerned with modeling approaches, rather than variable selection, we focus on a consistent set of 12 explanatory variables, across models. The 7 domestic and 5 systemic variables are listed in Table 1. The resulting dataset covers 39 years for 85 countries. We use multiple imputation to fill in the missing data in order to more efficiently use our information.[41]

We focus on one particular domestic variable, a country's regime type, `REGIME TYPE`, which is measured with the standard combined Polity IV scores. We also include domestic control variables measuring the natural log of a country's population, `LN POP`, and its per capita GDP, `GDP PC`. We include a dummy variable that equals 1 in years when a country experienced an economic crisis, meaning the country experienced a severe inflation or negative income shock, or a balance of payment crisis, which occurs when a country's currency reserves fall to dangerously low levels, `EC/BP CRISIS`. We include a control for the number of years that the current government has been in office, `OFFICE`. Lastly we include a dummy variable indicating membership in the GATT or WTO, `GATT`.[42]

We also focus on five systemic variables. Three are from the original MK analysis. We measure the percent of world trade that is accounted for by U.S. imports and exports, to capture the degree of U.S. hegemony in the international market, `US HEGEMONY`. We also measure the openness of capital markets in the 8 largest countries in the world, `8 OPEN`.[43] For country i in year t,

[41] We used multiple imputation to generate five complete datasets, then estimated the models using each. For each model, the results are very similar across datasets. We included third-order polynomials by setting the argument `polytime` = 3 and `intercs` = TRUE in the R function `amelia` to take care of time persistence and trends specific to each cross-sectional unit. Because of the sample size and TSCS structure, the MI was very time consuming, and we set $m = 5$ and combined the five runs into a complete dataset using the function ameliabind.

[42] The exact coding and theoretical reasons for including these variables, as well as the systemic variables, are covered in the original MK article.

[43] We thank Dennis Quinn and Carla Inclan for generously sharing their updated data on this variable, see, Quinn and Inclan (1997). This is a similar variable to the "5 Open" variable used in MK.

we calculate the average tariff level for countries other than country i, `AV. TARIFF`.[44] Lastly, we include systemic variables that measure the degree of WTO influence in the system. We choose these two variables because, unlike a country's GATT/WTO membership, which Oatley emphasizes, these are systemic, not domestic, variables. We measure the percentage of countries in the world that are members of the GATT/WTO in that year, `GLOBAL WTO MEM` (more often labeled as `WTOM` in the tables and figures).[45] We also measure the percentage of world trade that takes place between mutual-GATT/WTO member dyads in a given year, `GLOBAL WTO TRADE`.[46] These systemic variables capture variation in the overall importance of the WTO to world trade. These variables are not binary, which allows us to consider richer variation.

Table 1: Domestic and Systemic Variables

Domestic Variable	Definition	Systemic Variable	Definition
`REGIME`	Polity IV Score	`AV. TARIFF`	Average Sample Tariff Level
`LN POP`	Population	`US HEGEMONY`	The degree of U.S. hegemony in the international market
`GDP PC`	GDP per capita	`8 OPEN`	The openness of capital markets in the 8 largest countries in the world
`EC CRISIS`	Economic Crisis	`GLOBAL WTO MEM`	The percent of countries in the world that are members of the GATT/WTO
`BP CRISIS`	Balance of Payment Crisis	`GLOBAL WTO TRADE`	The percent of world trade that takes place in mutual-GATT/WTO member dyads
`OFFICE`	Number of Years in Office		
`GATT`	GATT/WTO Member State		

[44] Since the calculation excludes country i's tariff in order to avoid endogeneity, this variable does vary slightly across countries within a particular year. However, this is essentially systemic variation since no sample country influences the average very strongly.

[45] For simplicity, we refer to global WTO membership, generally, rather than GATT/WTO membership. When referencing particular time periods, we use the appropriate GATT or WTO label.

[46] We summed the exports from i to j and from j to i for dyads where i and j were both WTO members, and divided this by the sum of exports across all dyads.

3.1.1 "Baseline" Models

Before estimating multilevel and spatial models, we first establish a set of "baseline" empirical results for the relationship between regime type and tariffs. These models are similar to the original approach used by MK to analyze whether regime type directly affected tariff levels.[47] These empirical results reflect a theoretical relationship where domestic and systemic factors are separate variables that influence the outcome, such as those described in the direct systemic effects section above.

$$Y_{it} = \beta_0 + \beta_D D_{it} + \beta_S S_t + \alpha_i + \epsilon_{it} \tag{6}$$

$$Y_{it} = \beta_0 + \beta_D D_{it} + \alpha_i + \delta_t + \epsilon_{it} \tag{7}$$

Models 6 and 7 are two variations of the familiar fixed effects models. Model 6 allows for domestic and systemic variables to have direct effects on the outcome of interest, and accounts for unobserved unit-level heterogeneity, as captured by α_i, the unit-fixed effect. Model 7 allows for domestic variables to directly affect the outcome of interest, but also treats all systemic variation as unobserved, as captured by δ_t, the year fixed effects.

Table 2, Columns 5 and 6, show the results from estimating the equation in Model 6. The coefficient on regime type is [-0.238], suggesting that increased levels of democracy are associated with decreased tariffs. Table 2, Columns 3 and 4 show the results from estimating the equation in Model 7. The results are very similar to the results from Model 6, with a coefficient on regime type of [-0.212]. The first two columns in Table 2 show results from the simplest model assuming no

[47]The models are also "baseline" in the sense that they use frequently employed panel data techniques. These techniques involve their own assumptions which we will not examine here (see, Wooldridge (2001)). Additionally, we do not focus on any time-series issues such as serial correlation or models designed to capture dynamic processes generating Y_{it}, like those focused on path-dependence (Freeman and Jackson, 2012; Pierson, 2004) or structural change (Hee Park, 2010). We also do not analyze mediating relationships, in which one variable affects the outcome of interest indirectly, through its influence on another variable. For recent advances on this topic, see Imai, Keele and Yamamoto (2010); Imai and Keele (2010); Imai et al. (2011). While such topics are important, they are beyond the scope of this paper.

systemic effects at all. The estimates based on first model are notably different in the magnitude and direction from the two other models considering systemic effects, which suggests that it is incorrect to assume no systemic effects.

Table 2: Independence and Direct Effects

		Independence		Direct Effect of System			
				(Year-Fixed Effects)		(Observed S_t)	
Covariate		Estimate	SE	Estimate	SE	Estimate	SE
Domestic	REGIME	−0.329	(0.042)∗	−0.212	(0.045)∗	−0.238	(0.042)∗
	LN POP	−1.743	(0.884)∗	2.620	(1.733)∗	1.572	(0.905)
	GDP PC	−2.364	(0.470)∗	−1.842	(0.488)∗	−1.754	(0.463)∗
	BP CRISIS	1.719	(0.450)∗	0.721	(0.445)∗	0.918	(0.444)∗
	EC CRISIS	3.268	(0.942)∗	1.737	(0.927)∗	1.842	(0.925)∗
	OFFICE	0.001	(0.001)	0.002	(0.001)	0.002	(0.001)
	GATT	0.214	(0.714)	1.864	(0.705)∗	1.508	(0.706)∗
Systemic	US HEG					−10.539	(18.195)
	AV. TARIFF					0.853	(0.066)∗
	8 Open					−0.309	(0.144)∗
	WTOM					47.706	(23.877)∗
	WTOT					218.609	(197.140)
N		3315		3315		3315	
Country FE		Y		Y		Y	
Year FE		N		Y		N	
R^2		0.061		0.022		0.110	

∗ Significant at 95% level.

3.1.2 Moderation

In the context of our trade policy data, we can imagine reasons why theoretical relationships like those described in the moderation section above might be present. For instance, the extent of global WTO membership might moderate the effect of regime type. If WTO members use these organizations as fora in which to collectively bargain over mutual tariff reductions, then we might expect the effect of regime type to be strongest when more countries are members of the WTO. When fewer countries are members, the effect of regime type might be dampened.

We demonstrate and compare the MIM and MLM approach to examine whether two systemic variables, `GLOBAL WTO MEM` and `AV. TARIFF`, are likely to influence the relationship between

REGIME TYPE and trade policy. The results from these models are presented in Table 3. The first two columns show the results from the MIM, and columns 3-4 are the estimates and standard errors from the MLM.

The results for regime type are easiest to interpret graphically in terms of the substantive effect of regime type on tariffs. Figure 7 shows how REGIME TYPE affects tariffs from the MIM and MLM models. The top two panes correspond to results from the MIM, and the bottom two correspond to results from the MLM. For each (MIM and MLM), the left pane shows how the effect of REGIME TYPE on trade openness varies with GLOBAL WTO MEM, holding AV.TARIFF constant at its sample mean. The right panes show how the level of AV.TARIFF moderates the relationship between REGIME TYPE and trade openness, holding GLOBAL WTO MEM constant at its sample mean. Both the MIM and MLM show that increased WTO membership magnifies the negative effect of regime type, while higher global average tariffs have the opposite effect.

While the MIM and MLM yield similar substantive results, they are also different in that the error bounds of the effect of REGIME TYPE in MIM are systemically larger than those in MLM. This is expected because the MLM takes into account unobserved moderators while the MIM assumes that the observed moderators explain all the variation of the effect of REGIME TYPE. Since the lower graphs are about $\mathbb{E}(\beta_{regime}|\text{moderator})$, the error bounds are much smaller than their upper-panel counterparts. While the MIM does not suggest the effect of REGIME TYPE is significant except when 75% or more countries around the world are WTO members, the MLM suggests that REGIME TYPE does have a significant negative effect on tariffs with various values of the two observed moderators.

Figure 8 shows the *overall* expected effect of REGIME TYPE on tariff levels in each particular year, taking into account both of our moderating systemic variables.[48] REGIME TYPE has a consistently negative effect on tariff levels, though this effect is insignificant for a few years in the late 1980's. The overall effect of REGIME TYPE, when accounting for moderation from these two systemic variables, is strongest in later time periods, especially after the early 1990's. The timing

[48] This Figure uses results from the MLM presented in Model 8. This effect is calculated based on the values of the moderating systemic variables (GLOBAL WTO MEM/AV. TARIFF) from that year: $\mathrm{E}(\beta_t) = \gamma_0 + \gamma_1 \texttt{GLOBAL WTO MEM}_t + \gamma_2 \texttt{AV. TARIFF}_t$.

Table 3: Moderation Models: MIM and MLM

		MIM		MLM	
		Estimate	SD	Estimate	SD
Domestic	REGIME TYPE	−0.253	(0.294)	−0.326	(0.231)
	LN POP	1.832	(0.906)∗	2.367	(0.267)∗
	GDP PC	−1.632	(0.464)∗	−1.772	(0.332)∗
	BP CRISIS	0.898	(0.443)∗	0.839	(0.430)∗
	EC CRISIS	1.563	(0.926)	1.596	(0.918)
	OFFICE	0.002	(0.001)	0.002	(0.001)
	GATT	1.739	(0.708)∗	2.375	(0.602)∗
Systemic	US HEG	−7.967	(18.175)	−5.931	(21.432)
	AV.TARIFF	0.834	(0.066)∗	0.851	(0.076)∗
	8 OPEN	−0.294	(0.145)∗	−0.052	(0.054)
	GLOBAL WTO MEM	39.908	(23.934)	16.103	(8.360)∗
	GLOBAL WTO TRADE	210.979	(197.390)	28.323	(113.647)
Moder.	REG. TYPE× GLOB.WTO MEM	−0.767	(0.379)∗	−0.690	(0.349)∗
	REG.TYPE× AV.TARIFF	0.028	(0.009)∗	0.030	(0.009)∗
R^2 / *log* Likel.		0.114		−12578	
N		3315		3315	

∗ Significant at 95% level.

of this effect is unlikely to be accidental: the GATT regime officially transitioned to the WTO regime in January of 1994. Since the WTO regime is thought to be stronger in many ways than its predecessor, it is possible that the new regime magnified the tariff-dampening effects of `REGIME TYPE`.

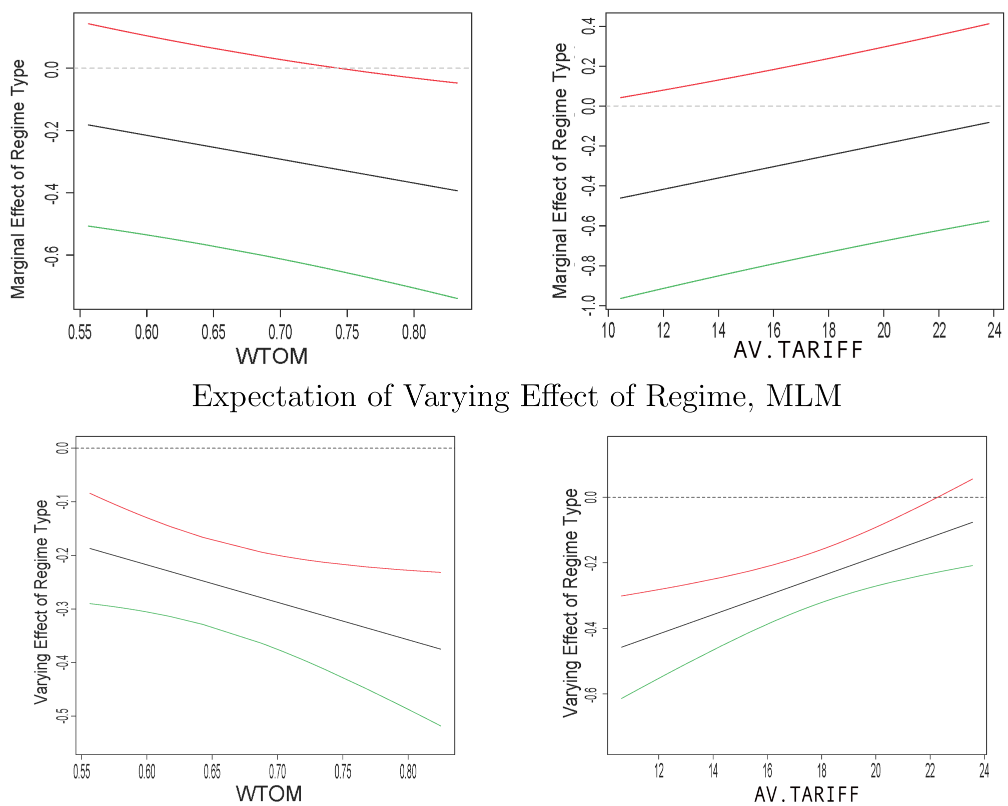
As for other explanatory variables, most of the results of the MLM are similar to those based on the MIM, but there are some differences. For example, `8 Open` is important in the MIM but not significant in the MLM. In addition, although `GATT` is significant in both models, the magnitude of the estimate is much larger in the multilevel model than in the interaction term model.

3.1.3 Interdependence

Theoretically, a researcher might be interested in whether mutual WTO membership helps countries negotiate reciprocal tariff reductions. Tariffs could therefore be positively correlated across units: if one WTO member lowered their tariffs, then another WTO member might be more in-

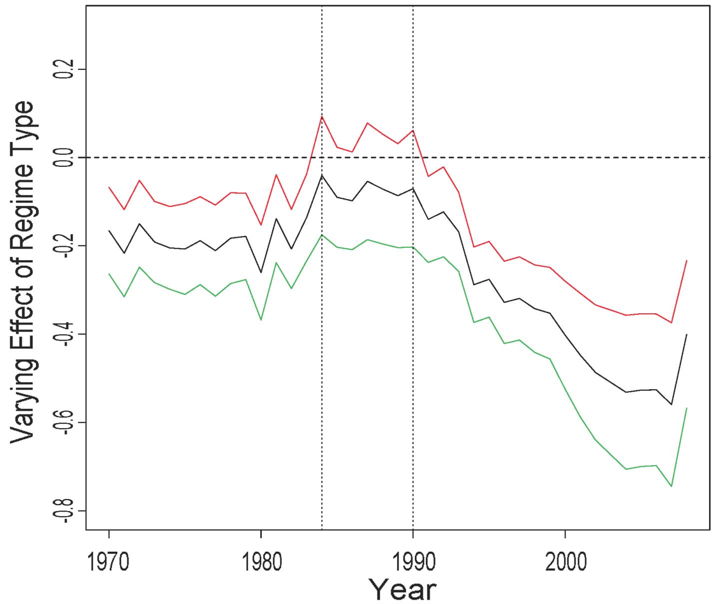
Figure 7: Varying-Effect of Regime Type Moderated by `GLOBAL WTO MEM` and `AV. TARIFF`

Marginal Effect of Regime, MIM



In the graphs, the middle line represents the mean estimate of the effect of `REGIME` on `TARIFF`, and the other two lines are the upper and lower bounds of a 95% confidence interval of the estimate.

Figure 8: System-Specific/Time-Specific Effect of Regime



clined to do the same as they bargain over mutual or reciprocal reductions. In Oatley's criticism of Milner and Kubota, he argues that the WTO "provides a forum in which each government can exchange domestic tariff reductions for foreign tariff reductions" (2011, 320). This is exactly the type of relationship that models described in the interdependence section above are intended to capture.

To test these types of predictions, we code a time-varying weighting matrix that indicates whether two countries are both WTO members. We construct W_t, where entry (ij) for the year t equals 1 if countries i and j are both members of the WTO in year t and is zero otherwise. W_t varies over time, since countries may join the GATT/WTO regime in different years in our sample. This matrix captures one specific interdependence mechanism —bargaining among WTO members— similar to the "macro theory" that Oatley proposed.

If bargaining processes are at work, and countries' tariff levels affect one another when both countries are WTO members, then we should expect ρ to be positive and significant. A positive ρ means that tariff levels are positively correlated across WTO members: when one WTO member lowers their tariffs, other WTO members tend to lower theirs as well. A negative ρ would suggest negative correlation across WTO members: when one WTO member lowers their tariffs, other WTO members tend to raise theirs. Since our model allows us to estimate ρ for each year, we will be able to describe the degree to which tariffs are correlated across WTO members over time, and whether this correlation is positive or negative.

These results are reported in Table 4.[49] For comparison, the first two columns show the results from a model in which ρ is *not* time-varying, and the second two columns show results from the time-varying ρ model described in this paper.[50]

The negative relationship between regime type and tariffs obtains even when accounting for the possibility of interdependence among LDCs. In both versions of the interdependence model, the estimated coefficient for `REGIME TYPE` is negative and significant, suggesting that the original results for `REGIME TYPE` are robust to models including spatial correlation. Our results for some systemic variables, however, do change. After interdependence is incorporated, `AV. TARIFF` is no longer significant, but `GLOBAL WTO MEM` still has a direct effect on `TARIFF`.

In addition to further examining the relationship between regime type and tariffs, these models provide information about the nature of interdependence of tariffs among LDCs. The last row in Table 4 reports the mean and standard error for the ρ term in the time-invariant ρ model, which is positive [0.949] and significant. This seemingly suggests that tariff levels are positively correlated across units, as one country raises or lowers its tariffs, its fellow WTO members tend to do the same. However, the standard error of ρ is as small as [0.043] which raises concerns about a unit root.[51]

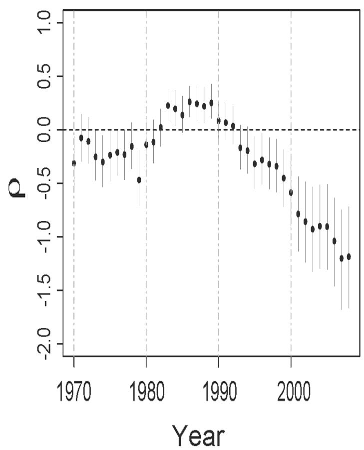
[49] To diagnose the possibility of nonconvergence, we used the `R` functions in the `coda` package, and both graphical and formal diagnostics (Plummer et al., 2006). We did not find evidence that the MCMC draws were not from the posterior distributions. The chains for the lower-level parameters in the multilevel analysis converge much more slowly than those upper-level parameters. Because partial convergence is not convergence, we let the all chains to run long enough that each chain passed all the diagnostics we conducted. See empirical appendix for details.

[50] In both models, the prior distribution of ρ and ρ_t are a uniform distribution $\rho \sim \mathcal{U}(1/\lambda_{min},\ 1)$. For the preceding models, which were estimated via maximum likelihood, we reported conventional model fit statistics. Bayesian model comparison or goodness-of-fit method is based on the Bayes factor, which is, unfortunately, difficult to compute and sensitive to prior specifications (Kass and Raftery, 1995; Aitkin, 1997; Han and Carlin, 2001; Alston et al., 2005). Chib and Jeliazkov (2001) and Chib (1995) developed the marginal likelihood method to estimate the Bayes factor, but for models with many random-coefficients and nuisance parameters, their methods are very sensitive to prior choices.

[51] If the spatial process is not stationary, the model will give spurious results. This appears to be the case with this time-invariant ρ model. We did simulations without restricting the parameter space of ρ and the Markov chain of ρ quickly went out of the stationarity space and took on values greater than 1 most of the simulation time. See

Table 4: Spatial Modeling: Constant ρ and Time-Varying ρ

	Time-Invariant ρ		Time-Varying ρ		
Covariate	Estimate	SD	Estimate	SD	Estimate of ρ_t
`Domestic`					
`REGIME`	-0.208	(0.038)$*$	-0.191	(0.039)$*$	
`LN POP`	2.313	(0.261)$*$	2.298	(0.261)$*$	
`GDP PC`	-1.962	(0.332)$*$	-1.708	(0.331)$*$	
`BP CRISIS`	0.372	(0.437)	0.542	(0.430)	
`EC CRISIS`	1.730	(0.937)$*$	1.808	(0.918)$*$	
`OFFICE`	0.000	(0.001)	0.002	(0.001)	
`GATT`	-14.335	(0.972)$*$	4.171	(1.744)$*$	
`Systemic`					
`US HEG`	6.342	(14.360)	4.665	(15.856)	
`AV. TARIFF`	0.010	(0.076)	$-0.3.29$	(0.175)	
`8 Open`	-0.073	(0.047)	-0.059	(0.047)	
`WTOM`	16.310	(7.191)$*$	15.246	(7.186)$*$	
`WTOT`	-0.421	(19.570)	-2.364	(19.431)	
ρ	0.949	(0.043)$*$			
N	3315		3315		



$*$ Significant at 95% level.

Returning to the time-varying ρ model, the graph in Table 4 shows that ρ has a distinct temporal trend.[52] For early years, ρ is largely indistinguishable from zero, with tariffs not strongly correlated through mutual GATT membership. In the middle years, ρ is positive and significant, as predicted. In later years, and contrary to the findings from the time-invariant ρ model, ρ is strongly negative and significant, meaning that mutual WTO membership actually made members' tariff levels inversely correlated.[53]

The time-invariant model generated an optimistic result regarding WTO membership: dyads where both parties were members tended to lower their tariffs in tandem. The time-varying model generated a very different result. In some periods, like the 1980s, the GATT appears to have had

empirical appendix for more details.

[52]The posteriors of ρ_t's do not have the unit root problem. The smallest eigenvalues of all the weight matrices are much greater than -1, the lower bound of ρ_t is much smaller than -1, though the upper bound is always 1.

[53]It is important to note that the the time constant and time varying ρ's are not directly comparable, because the time-constant ρ model implicitly regards all observations, even those in different time periods, as part of the same spatial dynamic process, while the time-varying ρ measures the strength of connectivity of the units only in the same time period. Because the two types of ρ's are associated with different spatial dynamic process, it is not surprising that the estimates of the two are different in both magnitude and direction. This is also why the time constant ρ cannot be interpreted as the time average of all ρ_t's.

this effect. Yet for other periods of time, WTO membership appears not to have had this effect, or even had the opposite effect.

A negative value for ρ in this context is puzzling, and suggests the need for improvements in our theoretical arguments for how WTO membership affects members' tariffs directly and through contagion across members. This result could arise from the order in which countries joined the WTO. We might expect interdependence in the earlier and middle years to have more positive diffusion effects, ρ's, as countries most willing and able to benefit from GATT membership joined and negotiated tariff reductions. The late-joining countries could be "hold-outs" with the strongest political pressures to maintain higher tariffs. Since countries historically have not left the WTO, the membership in later years has been comprised more of protectionist hold-outs and pre-existing members who have already negotiated lower tariffs. However, Allee and Scalera (2012) argue that most of the so-called "automatic" accessions, where countries joined the GATT quickly without making meaningful tariff concessions, occurred during earlier time periods (1960-1967) with decolonization. Additionally, many countries used this process in the early 1990s, right before this option was taken away by the new WTO regime. On the other hand, many "rigorous" accessions, where joiners made substantial tariff cuts as a prerequisite to joining, took place during 1980s. While other important rigorous accessions took place during the WTO era (e.g., China), changing accession patterns could explain shifting patterns of interdependence or contagion among members' tariff levels. The results from the two models demonstrate that the nature of interdependence can change in substantively important ways that are only uncovered when allowing the degree of interdependence, i.e., ρ, to vary over time.

3.1.4 Combining MLM and Interdependence

What if both moderation and interdependence are present, as in Figure 6? For illustration with our trade policy data, we estimate the following model:

$$
\begin{aligned}
Y_{it} &= \beta_0 + \beta_{0t} + \beta_{0i} + \rho_t W_{it} \mathbf{Y}_t + \beta_{Dt} D_{it} + \epsilon_{it} \\
\beta_{0t} &= \beta_S S_t + c_t \\
\beta_{Dt} &= \gamma_0 + \zeta_t
\end{aligned}
\tag{8}
$$

We do not have a theory suggesting that the observed four systemic variables would change the mechanisms through which the domestic variables affect trade openness, but there may be unobserved systemic variables that exert such moderating effects. The third line of the model reflects our consideration of moderation effects. Model 8 incorporates direct systemic effects (in the second line), allows unobserved system variation to moderate the effects of domestic variables (in the third line), and estimates spatial correlations with time-varying connectivity (in the spatial lag term in the first line).[54]

In general, the results are similar to those above. `REGIME TYPE` has a negative and significant effect. The left pane of Figure 9 shows the estimated coefficient for `REGIME TYPE` by year, accounting for unobserved systemic shocks. In almost all years, the coefficient is negative, and is often significant, similar to the moderation results displayed in Figure 7. The right pane shows the estimated interdependence or ρ over time, and the trend is again similar to the results from the interdependence model displayed in Table 4.

Given that we have presented a plethora of models intended to capture different possible domestic and systemic relationships, it is helpful to compare the similarities and differences across models with regard to our main question: how does regime type affect tariffs? Figure 10 shows the interesting consistencies and differences between models that incorporate domestic and systemic theories in particular ways. On the one hand, democracy is robustly and negatively related to tariff levels in every model. On the other hand, the effect of regime type differs in potentially

[54] Note that we exclude some features described above because they do not produce interesting results. For example, when accounting for interdependence, systemic variables are no longer significant moderators of the effects of regime type. Results for these models are available.

Table 5: Moderation and Interdependence: Time-Varying W and ρ

Type of Variable	Name	Estimate	SD
Domestic	`REGIME`	−0.192	(0.051)∗
	`LN POP`	2.305	(0.266)∗
	`GDP PC`	−1.741	(0.330)∗
	`BP CRISIS`	0.570	(0.433)
	`EC CRISIS`	1.740	(0.922)∗
	`OFFICE`	−0.000	(0.001)
	`GATT`	2.342	(1.699)
Systemic	`US HEG`	5.702	(16.151)
	`AV. TARIFF`	−0.307	(0.189)
	`8 Open`	−0.056	(0.049)
	`WTOM`	15.016	(7.369)∗
	`WTOT`	−2.714	(19.991)

∗Significant at 95% level.

meaningful ways across the models. In some models, the coefficient on regime type is as large as [−0.329], and in others as small as [−0.191]. It should be noted that the simplest and most complicated models provide consistent answers to the question about regime type's effect on trade liberalization: more democracy is positively and significantly associated with more liberalization. Using simple empirical models does not necessarily distort results. It can provide a baseline to evaluate the robustness of the impact of domestic politics on outcomes before taking into account the more complex nature of linkages to the international system. In this case and perhaps others, simple models perform well. This may reflect the persistent fact that linkages and interactions within countries remain much denser than those across countries' borders.

4 Conclusion

One of the most important and enduring debates in IR and IPE has concerned the relative weight of systemic versus domestic factors in explaining outcomes. A central issue in the older "isms" debate among realists and liberals revolved around whether domestic factors or systemic ones can best explain international relations. In more recent IPE work, the main source of contention over the impact of globalization has also related to this issue: the question has been to what extent will

Figure 9: Time-Varying Effect of Regime Type and ρ_t

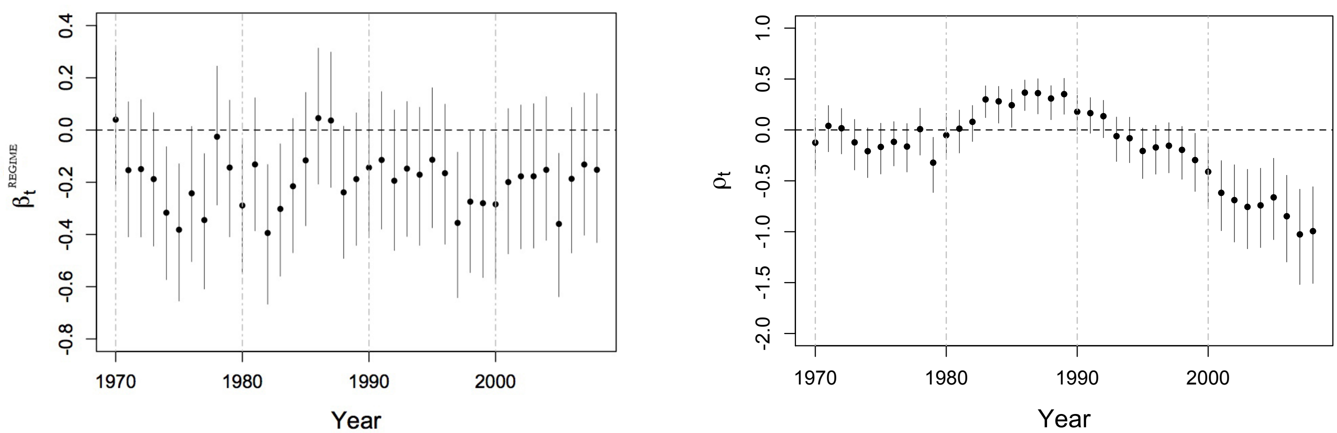
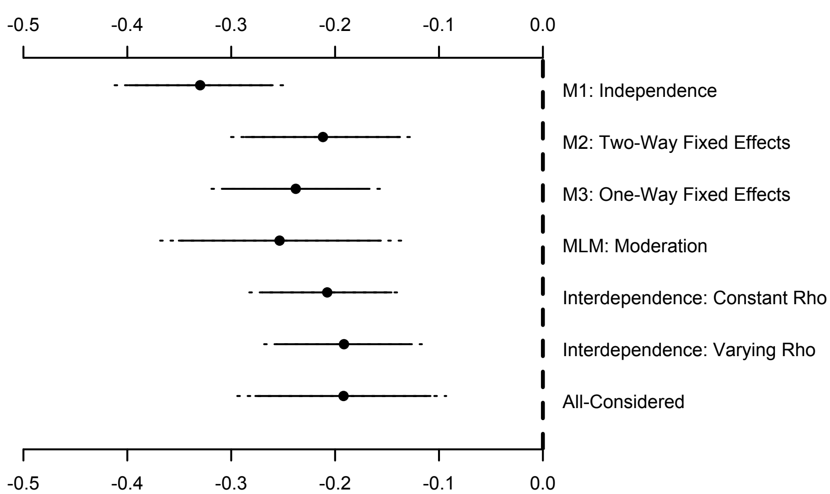


Figure 10: Effect of Regime Type: Different Types of Interaction Considered



Reported above are the means and 95% confidence intervals of the effect of `REGIME TYPE` estimated from the models considering different ypes of interactions. When there are multiple specifications for one type of interaction, we choose the one that most appropriately captures the interaction and the data structure.

global economic forces overwhelm domestic institutions in this new era. As a recent study about the global race to the bottom points out, "Defying zero-sum predictions, the race to the bottom does not signify the end of domestic politics, and national differences are far from extinct. Current LDC welfare policies therefore reflect both external market pressures and domestic institutional arrangements."[55] This debate shows little sign of waning. Most scholars believe that both sets of factors are important, and that the interaction of domestic and international variables is the new normal. The big question is what this interaction looks like and how much weight each set of factors carries.

To help provide a road map for this research, we have drawn from an array of literature to set forth five of the most common models of that interaction. Thomas Oatley (2011) concluded his challenge to IPE scholars by arguing in favor of "[embedding] distinct approaches within a common overarching framework." We view this paper as taking concrete steps towards that goal. If the theoretical argument being employed views systemic or domestic factors as one of many influences that determine outcomes, then the simpler models we present may suffice. If the theory focuses on the interplay between systemic and domestic factors and how they moderate one another, then multilevel models can help describe that hierarchy. If the theory prioritizes strategic interaction, interdependence, or contagion of outcomes across units, then the later spatial models are more appropriate. The most complex models incorporate all of these different forms of systemic influences.

The appropriate approach also depends on the researcher's theoretical knowledge about the microfoundational relationships among units in the system and what this implies for the role of the system. The first model, involving independence of units from system effects, does not seem particularly robust in our modern world. Such models are rare in the literature in CPE/IPE. The harder task is distinguishing whether to use one of the other earlier approaches involving direct, indirect, or moderating effects or the latter approaches involving interdependence. The difference between the two sets of approaches does *not* lie in whether they incorporate a system in some way. None of them considers units as isolated from one another in a completely decomposed system.

[55] Rudra (2008, p. 213).

The difference between the two sets of approaches instead lies in how each conceives of the system and its effects. The first set of models allows units to affect one another through *exogenous* interaction effects. The systemic channels through which agents can affect each other are not created through the endogenously modeled choices that agents make. The system posited therein affects the agents, but the agents' actions do not change the system within the scope of these models. For these less complex models (i.e., direct, indirect and moderating system effects), the influence of the system, shown by the coefficients β_S, operates on the agents and does not feedback to the system level.

Such models are appropriate if the researcher thinks that units within a system are connected, but that they are connected through mechanisms other than the outcome variables of interest. For example, countries could be connected with one another systemically and affected by exposure to common, exogenous shocks. Or the units could be affected by exposure to system-wide trends which affect the context in which the units make decisions.

The interdependence models consider the system to be a set of *endogenous* interaction effects. The system in the interdependence model is determined by the exogenous structure of dependence (W), the endogenous outcomes chosen by all the agents (Y), and the endogenous interaction process (modeled by ρ). In the interdependence models, there is feedback, where agents affect the international system through their actions or choices, and the system in turn affects all agents. The system affects the agents by providing channels for complicated and iterative spillover effects between agents. These spillover effects can be "local;" one agent's action affects another agent through the channel specified by the weighting matrix. Spillover effects are also "global;" as one agent affects another, which affects another, etc., like ripples on a pond.[56] The interdependence model may be better understood as a simultaneous equation model to mutually constitute the system and agents. The unknown parameter ρ and the exogenous structure W are how the agents and the system interact as well as how the agents interact among themselves. The effects of the agents on the evolution of the system in the interdependence model derive from the fact that interactions of the agents change the level of connectivity of the system over time, thus altering the

[56] LeSage and Pace (2009, 2011).

previous equilibrium state reached through complicated strategic interactions among the agents.

Hence one should choose the interdependence model when one believes that the system is evolving along with the agents, and the evolutions of the system and the agents are (at least partially) mutually determined by the actions of the units. This is most likely the case when the units or states are "large" in the sense that they have enough capability to shape the system and other states' beliefs or behavior. If the units are almost all "small", that is, they lack the capabilities to affect the system and other states, then the first models we propose are more useful. As we saw in our trade policy example above, when looking at the developing countries it is not clear that they—or the vast majority of them—are "large" enough to affect the system, and perhaps that is why we are seeing small interdependence effects in this case.

In sum, using the interdependence model allows one to examine these more complex spillovers through mechanisms such as learning, diffusion, or competition. The agents in effect change themselves and one another by changing the system. In the previous models the agents do not change the system since it is exogenous. If the researcher thought that individual agents did not or could not have important effects on the overall system, then the earlier, less complex models may be appropriate.

Recent iterations of the agent-structure debate characterize existing research as falling into one of two extremes: either the research models networks and systemic connectedness between units or the research treats units as completely separate from one another. And since (as the argument goes) it is uncontroversial that units are connected in some way in today's globalized world, it follows that the latter type of research is indefensible, and that the conclusions drawn are likely to be biased so that researchers should deemphasize the search for law-like empirical regularities altogether.[57] Our roadmap shows that this argument is based on a false dichotomy. A researcher need not choose between assuming that everything (or nothing) is connected. There is a wide array of approaches that fall somewhere in between. What empirical model to choose depends on what type of relationship operates between the units, i.e., on the microfoundations. If it is through exogenous systemic shocks or the overall context, then our first four models are

[57] Oatley 2011, 335.

more appropriate. If it is through endogenous actions or feedback, then the interdependence type of model is most appropriate.

Beyond describing where a researcher might start, the road map also provides guidance for where to end. Which model best explains an outcome is likely to vary with the issue at hand. Employing the most complex model of interaction is not necessarily the best path to take, especially as an initial step. It may be much more informative to start simply and then see if the addition of complex interactions changes the explanation substantially. In the case of the role of democracy in promoting trade liberalization in the developing countries in the past few decades, which we analyzed extensively here, it is not clear how much explanatory power is gained from using highly complex models of systemic-domestic interaction. As we have shown here, simpler models may capture the essence of the explanation well. Occam's razor and the principle of parsimony make us aware that simpler explanations may be preferable. When systems are nearly decomposable as Simon points out, starting from simpler models still makes a good deal of sense.

We have also contributed to the development of more complex models by putting renewed attention on multilevel models and adding to diffusion studies. Multilevel models may be a preferable way of conceiving of the impact of systemic factors. In these models a natural hierarchy of effects is assumed: systemic pressures in effect cast a shadow over all domestic influences. This is but one way to conceive of the interaction of domestic and systemic factors, but it is a powerful and important one.[58]

In addition, we developed a model in which the nature of contagion and interdependence among units in the system is allowed to change over time. Adding an element of time to studies of how global processes diffuse is an important step. While diffusion may proceed over time in a uniform and unchanging way, it may also take on time-varying forms that are novel to study. Hence the two new modeling ideas we present add to the stock of complex models of systemic-domestic interaction that one can envision.

We view these contributions as complimentary to other recent advances in which the system is conceived as the result of interdependence among the units caused by processes like international

[58] On hierarchy, see Lake (1988).

bargaining, diffusion, or competition. We have taken one particular approach, associated with spatial econometrics, that treats the nature of connections between units as exogenous and then models how outcomes across units affected one another. Other approaches treat behavior and outcomes of units as exogenous, and endogenously model or describe the nature of connections between units.[59] Some research has begun to focus on modeling both the behavior and connectivity of units, with the goal of describing the evolution of networks or feedback processes.[60] As this research progresses theoretically and empirically, it will enable future work to push even further beyond the categorizations and methodological advances we have provided here.

[59] Oatley et al. (2013); Cao (2012).

[60] Franzese, Hays and Kachi (2012); Ward, Ahlquist and Rozenas (2012).

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