Compliance in the Fog of Law: The Impact of Institutional Change on Compliance when no one is looking

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Political leaders must seek political survival at the domestic level. This often creates powerful incentives to break commitments to international institutions. Many of these violations are unobserved as they do not generate observable responses. Thus the overall compliance with many organizations is known, at best, with great difficulty. This paper examines the influence of institutional change on this underlying compliance through the use of agent-based simulation. A simulation of the trade regime under the GATT and WTO will test the impact of changes in the international trade institutions on the behavior of political leaders within the member states. Specifically, this simulation will explore the degree to which institutional change affects the propensity of leaders to cheat on the rules of the trade regime under pressure from domestic supporters. This simulation will shed light on a presently unobservable feature of the trade regime: the underlying level of compliance with trade rules. This simulation will shed important light on the degree to which international institutional change affects compliance with international commitments in the face of strong domestic pressure to defect from such commitments.

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Compliance with international rules is an important part of contemporary global governance. At the same time, international agreements are not political suicide pacts that condemn domestic leaders to political defeat every time domestic policy pressure conflicts with international commitments. If international institutions functioned this way, no leader in their right mind would join them. International institutions must carefully balance the need for political leaders to engage in behavior aimed at domestic political survival, even if this conflicts with the rules of the institutional regime. Failure to do so will place leaders in the position of choosing between retaining power and honoring their commitments. In such cases, international commitments will lose in most cases. A key element to the success of international institutions is thus the need to incorporate design mechanisms that allow flexibility in domestic policy while maintaining overall compliance with international commitments. To design effective mechanisms of global governance, we must understand how these flexibility mechanisms work, and how changes in international design impact the domestic decision-making elements of the equation.

To understand these issues, we must look at how design elements impact the behavior of political leaders in member states. To do so, we must make observations of compliance behavior. Current models examining compliance behavior can only make observations by proxy. This limits our ability to examine compliance behavior. This paper focuses on a potential method for resolving this problem: agent based modeling. Focusing on the GATT and WTO institutions as a potential model for the study of institutional design effects, this paper outlines the challenges presented by the inability to directly observe compliance behavior and how agent based models can help us to work around this problem. The GATT/WTO framework is particularly fruitful for such endeavors due to the existence of research demonstrating institutional effects in trade disputes under the respective institutional rules. Existing studies of institutional flexibility in the trade regime have provided important insights into both the general impact of flexibility as well as the ways in which domestic and international institutions interact in the pressures applied to political leaders.

The GATT/WTO context provides an interesting avenue of research, but is limited by our ability to only observe escalations of serious disputes to the formal process. This paper suggests a means by which this obstacle can be overcome through the implementation of an agent based social simulation. While the simulation itself remains incomplete, the paper outlines the value of such a project and the ways in which the model, when complete, can add to our understanding of institutional design and ideally help scholars contribute to the policy debate over effective global governance.

Compliance with International Commitments

In an era where problems and challenges cross international borders with increasing frequency, mechanisms of global governance are an increasingly important subject of research in international relations. Global and regional governance play pivotal role in solving collective problems across national boundaries. Central to these attempts at governance are political institutions that are designed to facilitate collective management of shared problems. Recent research has greatly expanded our understanding of how institutional design elements, including institutional flexibility can contribute to the success or failure of international institutions. (Koremenos 2005, Rosendorff 2005) The goal of much of this research is focused on increasing our understanding of the impact of institutions on the behavior of member states through the
incentives these create for political leaders. At the most basic level this can be expressed as a means of how one can design institutions to increase the likelihood that political leaders will comply with their international commitments.

International institutions function in a variety of ways to constrain the behavior of national political leaders within a framework of commitments. A central problem is thus how to ensure that these leaders comply with these commitments, especially in times of crisis. While there are a range of methods for doing this, institutional designs that incorporate institutional flexibility offer significant promise for facilitating compliance. While institutional flexibility accepts short term defection for political survival, it also works to bring member states back in to eventual compliance with the rules of the system. (Koremenos 2005)

Within this institutional framework it is possible to conceive of numerous institutional design mechanisms to provide varying degrees of flexibility. As such institutions are expensive to create and to manage, some understanding of the impact of institutional design on compliance behavior is critical in order to design more effective institutions of global governance in the contemporary context. Given the complexity of institutional design, testing the impact of different institutional forms offers a particular challenge to scholars seeking to understand the institutional effect on compliance behavior.

A further problem arises in the analysis of such behavior. Direct observation of compliance behavior can be difficult. The ability to observe all instances of cheating on international commitments may be easy in some areas such as a commitment not to invade and annex neighboring states made under the UN Charter. In other areas, however, it may be impossible to observe directly the behavior that involves compliance. Compliance with the rules of the international trade regime is one such area. While we can observe violations of the trade regime that lead to formal dispute settlement cases, we cannot currently observe the actual moments of cheating behavior when they take place. In the analysis of commitments to international law, regrettably the observation problem is common.

In testing the effects of institutions, the GATT/WTO system presents challenges of observation. At the same time, it offers us a potential means of surmounting some the challenges regarding the role of institutional design in compliance behavior. The GATT/WTO system is the set of trade rules that has managed the international system since the end of the Second World War. This system has gradually evolved over time, but the core of the institutional framework underwent a significant transformation with the transition from GATT to WTO in 1995. This institutional change in the context of an ongoing body of members and a gradually evolving system of institutional rules allows us to study the impact of such a design change on the compliance behavior of member states. By studying how these institutional changes led to changes in member state behavior, we can extend our knowledge of how institutions affect compliance behavior.

As the GATT/WTO system includes mechanisms of institutional flexibility via the means of dispute settlement it is a particularly useful model. The changes in the dispute settlement mechanism were part of an effort to improve the ability of states to enforce compliance with the rules of the regime. In short, the GATT/WTO is a deliberate attempt to improve exactly the type of mechanism that is of interest to scholars seeking to understand compliance. The reforms of the regime included changes designed to make enforcement of rules more effective. In principle this should improve compliance behavior on the part of member states. Past research demonstrates that this true to some degree.
Multilevel Institutional Interactions

The GATT/WTO system is a promising context in which to test the impact of institutions on compliance. The international trade regime managed by these organizations has governed its members’ trade for most of the post WWII period. The GATT institutions governed the system from 1947 until 1994 with the WTO institutions coming into force in 1995. What the trade regime offers is a chance to examine how compliance behavior was affected by a significant institutional change at the international level. We have the same basic membership structure and the same broad range of international rules. The most significant changes came in the form of modifications to the mechanism for dispute settlement. In the study of compliance this is an important element as it allows us to observe instances where member states are sanctioned for non-compliance with the rules of the system. A change to these rules in a system that is relatively stable in other ways allows us to understand the impact of these institutional changes on the behavior of the political leaders in the member states.

Previous research on the GATT demonstrated that domestic institutions played a role in the decision by political leaders to bring disputes at the GATT. (Reinhardt 2001 and Sherman 2002) Previous research has further demonstrated that while the change from the GATT to the WTO institutions did lead to a change in the behavior of the political leaders of the member states, this change was conditional based on the type of domestic institutions present in the member state. (Dixon, G. 2007, 2009) This indicates that a two level institutional interaction is taking place in the decision making process. The domestic institutional environment conditions how the international institutional changes will be felt by political leaders.

Findings related to multilevel institutional interaction suggest that overall compliance behavior is likely to be impacted by both the domestic and international institutional frameworks. Leaders that require larger winning coalitions in order to retain power are likely to feel stronger pressure to defect from international commitments due to the larger number of interests required within the coalition and the greater probability that one or more shall be negatively affected by such commitments. The general implication is that democratic states may have a greater difficulty complying with international commitments than do anocratic or autocratic states, at least in the context of international trade.2

The GATT/WTO framework thus provides a fertile ground in which to study compliance behavior in a multilevel institutional framework. There is a demonstrated impact of domestic and international institutions on dispute propensity. This suggests that there is likely to be a similar impact on compliance behavior with the rules of the regime itself. While the trade regime is a potentially very useful focus of compliance research there are some problems inherent in the nature of trade disputes as measures of compliance.

Disputes under the GATT and WTO

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1 The trade regime has gradually expanded both in its membership and the number of issue areas covered over time, but these expansions have not correlated with increases in the number of disputes under the respective Dispute Settlement Mechanisms. The only institutional design change that led to a significant change in the frequency of disputes was the transition to the WTO in 1995. (Dixon, G 2007)

2 There are implications in the underlying logic that suggest this will extend to other issue areas as well. There is some potential that democracy may be a powerful obstacle to global governance in a number of issue areas.
It is important to emphasize that trade disputes under that GATT and WTO are a very particular kind of dispute. While the term dispute is most often used in conflict management to refer to conflicts involving the threat or use of violence, this is not the case with trade disputes. Trade disputes are formal, legal cases that involve a procedural mechanism for resolving differing interpretations of international trade law. (WTO 2003) Trade disputes are qualitatively different from other types of disputes in international politics. In trade disputes, the parties agree to formally submit their respective positions to a third party for adjudication. While the process is not precisely the same as domestic legal proceedings, it is roughly comparable.

The nature of trade disputes means that they are fundamentally arguments about compliance with international rules. In principle this means that they are a form of compliance enforcement under the GATT and WTO dispute settlement provisions. A member state may violate the rules, but other member states can act to force compliance through the formal process using procedures that are agreed upon by all parties.

This makes trade disputes an integral part of the flexibility mechanisms under the GATT and WTO institutions. Temporary defection is allowed, even accepted, with a mechanism through which eventual compliance can be enforced by aggrieved members. The net effect is essentially the same as allowing members to pay a fine for temporary defection, albeit via a cumbersome process. (Rosendorff 2005) This institutional flexibility has been one of the most significant features of the GATT/WTO system and a major element in its ability to survive and adapt over time.

The basic procedure for disputes under both institutions is loosely the same, although significant differences exist in the implementation of the process. Both systems require a formal notification of the initiation of the dispute (called a Request for Consultations). The Request is followed by a period of consultations between the aggrieved parties. If the parties cannot reach an agreement, the initiating party can request that a panel be formed to hear the case against the defending state. The panel will eventually render a decision addressing the issues involved and listing measures for compliance by the defendant if needed.

The GATT Dispute Settlement Mechanism (DSM) was relatively weak, especially in enforcement power. The entire GATT membership made up the panel and the GATT decision rule of consensus applied to panel rulings. A consensus was required to adopt a ruling. This gave the defendant an effective veto over negative rulings. Further there was no means of enforcing compliance with GATT rulings. In spite of these weaknesses the member states engaged in over two hundred disputes under the GATT process. The adjudication of these disputes in the absence of any real enforcement mechanism demonstrated a normative commitment to the process itself and the rules of the regime, but the practical limits of the process meant that member states faced significant uncertainty when contemplating enforcement actions.

The WTO DSM was implemented in 1995 and included significant improvements over the GATT DSM. The WTO DSM incorporated significant improvements in terms of the professionalism and impartiality of panel members. Panel members were drawn from a pool of impartial experts on international trade law. The consensus rule was changed so that the panel reports were automatically adopted unless a consensus was formed against the panel ruling. This effectively ended the ability of defendants to veto unfavorable rulings. Lastly, an enforcement

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3 Many cases end in this stage with a deal being cut by the parties with no panel formed and no formal ruling rendered.
mechanism was added in the form of retaliatory sanctions against violators that refused to adjust policy to comply with rulings.

The WTO design changes moved the process well down the path of legalization. The professionalization of the panel process in particular meant that panel rulings are less open to political interference. The WTO process reduces the uncertainty faced by member states contemplating action against non-compliant trade partners. While uncertainty is only reduced, not removed, the improvement in the WTO institutions has seen a sharp increase in the number of disputes initiated under the WTO system. (WTO 2007)

In the GATT/WTO context, disputes are a means of ensuring long-term compliance with trade rules even in the face of short-term defection. Trade disputes can thus serve as one measure of the degree to which member states comply with international commitments. A trade dispute is a clear statement by one member state that another has violated the rules of the trade system and needs to be brought back into compliance. While trade disputes are one measure of this, the nature of how trade disputes come about makes them an imperfect one.

From Creative Destruction to Policy Choice

Nation states are presently embedded in a dense network of economic ties. These ties provide a mechanism for transmitting turbulence from the system to the individual states. Complex economic and political forces send ripples through this interconnected system. The turbulence thus generated means that states participating in the international economy are subject to a constant pressure from the network itself. Citizens are constantly buffeted by market forces in complex ways. Most of this turbulence is comparatively minor and is not noticed by the majority of the population. In such turbulent conditions, however, the likelihood that some particular group will face pressures that lead to harm or even disaster in any given time period is high.

When faced with complex system turbulence, harmed groups cannot easily turn to international solutions to their problems. Often times the very market conditions that lead to the harm also mitigate against market solutions to their plight. Under these conditions, harmed groups have a strong incentive to turn to their domestic political leaders for redress. This frequently leads to calls for protectionist trade policies on the part of harmed groups. \(^4\) In a context in which states are bound together by international trade commitments under the GATT and WTO, these domestic calls for protection are a de facto call to political leaders to violate their commitments under international trade law. In the face of such pressures, domestic political leaders face powerful incentives to break these commitments.

The first stage of the process through which calls for protection manifest is the impact of market pressures on the citizenry of a given state. While domestic market pressure can lead to similar rent seeking on the part of constituents, purely domestic competition does not lead to trade disputes. \(^5\) International economic pressure can, and often does lead to pressure on political leaders to violate their international trade commitments. This process begins when the market pressures from global competition place pressure on domestic actors within the state. This can normally be thought of as competition within an industry, but this is not always the case.

\(^4\) Current proposals for “Buy American” provisions in the US economic stimulus package are an example, as are similar proposed provisions in most of the G20 states.

\(^5\) Such dislocations are common and create pressures that nation states frequently manage through various forms of industrial or competition policy in the framework of domestic law.
Turbulence caused by market volatility or market disruptions may also be the source of such pressures. In any case, changing market conditions create market pressures that generate winners and losers. The losers have an incentive to seek protection from their political leaders in such cases. If the losers are members of the leaders’ winning coalition, these pressures have a strong chance of being considered as potential public policy.

The domestic citizenry that is negatively impacted by market pressure will frequently attempt to pressure political leaders for protection in a variety of forms. Many policies offered as protection violate the international trade rules under the GATT and WTO and thus are potential sources of trade disputes. This is the process through which the creative destruction of the marketplace is translated into policy pressure. This pressure will be passed to political decision-makers via the domestic institutions of the state. The institutions serve as a filter that limits the extent of the pressure and the potential sources. Only political supporters required to retain power can successfully apply pressure on political leaders for policy action. At this stage, the domestic institutions become the conduit through which pressure flows to political leaders.

Political leaders faced with pressure to violate their international commitments under GATT and WTO must decide on a course of action. As political leaders gain and retain power through domestic political institutions, they have powerful incentives to violate international trade rules to secure continued domestic political survival. In the face of this pressure, political leaders weigh international commitments against domestic political concerns. Under these conditions is unlikely that leaders will seek domestic political suicide in the interests of international cooperation. If the leader faces a demand for protection from a member of the winning coalition, the leader is highly likely to accede to that demand.

Having accepted a need to violate international commitments, the leader may elect to flagrantly violate the rules, or they can attempt to hide in the fog of law. The large body of world trade law provides ample room for maneuver for political leaders seeking to provide protection. In most cases, the fog of law provides the political leader with the greatest likelihood of policy success. If the area of law is sufficiently confusing, contradictory, or complex, the difficulty of winning a case at the GATT or WTO may deter challenges entirely. Such cases increase the uncertainty of victory for the political leaders contemplating enforcement action. Depending on the specific nature of the policy, it is also likely that a victory may only be partial, limiting the benefits gained from enforcement. Even if a challenge does arise, the complexity of the process allows a period of several years to adjudicate the dispute before compliance may ultimately be demanded by harmed trade partners. In short, hiding in the fog of law allows for protection of domestic supporters within the framework of the trade regime. In the ideal case, no harmed party will want to undertake the cost of a dispute. In the worst case, the legal process

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6 This is the process though which democracy impacts how such pressures are filtered. Democratic institutions require large winning coalitions, increasing both the likelihood that leaders will face protectionist demands (Dixon, 2007) and that leaders will turn to public policy to satisfy those demands (Bueno De Mesquita, et al. 2003)

7 Such was the case with US protection of the steel industry by President Bush. The tariffs were imposed to provide time for restructuring of labor costs, notably retiree pensions and health care. This flagrant violation of WTO rules was presented as an anti-dumping action (technically legal under WTO) and was challenged by several steel producing countries. The use of anti-dumping, a notoriously complex part of the WTO provisions, was intended to extend the time required for adjudication of the dispute the US knew would follow. When the WTO was about to render its verdict declaring the tariffs illegal, the US withdrew them. The steel industry had used the eighteen months to restructure and the Bush Administration had demonstrated loyalty to an important constituency in swing states. In the end, however, the US returned to compliance with the WTO rules in the face of enforcement action.
can be dragged out for several years, allowing time for alternative means of securing a winning coalition to be implemented (or for the affected industry to adjust to changed conditions.)

Within the institutional constraints facing political leaders, the likely result of this process is that trade protection demands from members of the winning coalition will result in trade protection efforts within the fog of law. Given an interdependent global economy, such pressures are likely to be common. Under these conditions, political leaders should face significant, consistent pressure to violate their international commitments, but to do so in a manner that allows for adjudication under the GATT and WTO.

Looking only at the protectionist side of the equation, this would imply that there should be thousands of cases at the WTO each year. So where are all these cases? In truth only a handful of these cases actually reach the dispute settlement mechanism. States that feel the impact of such cheating often find it in their interest to resolve the issue short of an actual dispute. Formal disputes are the highest escalation of the response process, and are thus found only in a small minority of cases of violations of the trade regime. The existence of cheating seldom generates a dispute because domestic political leaders in affected states rarely have an incentive to escalate the matter that far.

When a country violates the commitment under the trade regime, this action generates a ripple effect that flows out through the network of trade relations and affects other states in the trade system. When these ripple effects impact another country in the system, they generate market turbulence in that country. Simply generating turbulence is not sufficient to generate a response. The results of the turbulence from cheating on the trade regime are subject to a filtering process similar to that in the original country. In general, the process of market dislocation is the same. The only difference is that the origin of the turbulence can be traced to the policy action of a government with which the impacted country has trade relations. If the groups affected by the turbulence generated by the protectionist policy are in the winning coalition of the affected state, they will have a strong incentive to seek redress from their political leadership.

Once pressured for action by their constituency, the political leaders face a range of policy options. Depending on the severity of the impact on the affected group, it may be less expensive to respond to protection by others with protection of your own. Matching the other state’s subsidies or providing tax incentives may offset the harm of the other state’s policies in an immediate and effective way. Further, this may be less expensive than a protracted trade dispute if the harm is small enough or if the group seeking protection is small enough. A range of other options short of a trade dispute also present themselves ranging from good old fashioned bilateral retaliation to coming to a mutual arrangement with the offender for some form of offsetting policies. In short, there are many alternatives to seeking a formal dispute. Most of these alternatives will be more attractive to political leaders than the formal dispute itself.

Only the disputes that are the most significant will rise to the point at which a formal dispute is required. While this can be due to monetary concerns, it may also be due to the

8 The author recognizes that in practice there are many, overlapping ripple effects from government policies and market forces that may render the tracing of policy effects difficult or even impossible. In cases of harm to a particular group, the natural tendency is to find a source that can be blamed for such harm. As government policies in trade are relatively transparent the likelihood that the policy will be discovered and singled out is relatively high. Further, the author would argue that the natural tendency to blame an outside force for domestic problems makes even mildly protectionist policies potential targets for trade disputes. In short, cheating is generally visible and attractive as a target for the ire of harmed parties.
symbolic power of the industry in question. This logic implies something very important about the formal trade disputes that we have observed to this point: they are likely only the tip of the proverbial iceberg when it comes to violations of international trade law. In all likelihood states are violating the trade regime with far greater frequency that the current numbers of formal disputes suggest.

**Disputes as Proxies of Compliance**

The process that leads to a trade dispute is a complex one that masks the actual amount of defection that is taking place within the trade regime. This raises a potential problem for the use of trade disputes as measures of compliance with international rules. The incidents that we observe are likely to reflect only a tiny minority of the actual cases of defection. We only observe cases of defection that meet strict standards necessary for several stages of escalation.

For some studies, having an observation that reflects only a high stakes incident is a positive. If we want to include only issues of a given minimum level of severity, having a threshold means that we know we are dealing with salient issues to both parties. On the other hand, if we are concerned with compliance behavior itself, then observing only escalations means that we could be missing a significant number of incidents. If we wish to examine the overall compliance with international rules, using escalation limits our ability to make claims based on our models. This is particularly important if we want to model behavior that takes place in the process prior to the escalation behavior that we can observe.

This is the fundamental problem in the study of compliance with international trade law: an inability to observe the underlying behavior that could measure how well states stick to their commitments. We know what the rate of escalation is: how many disputes take place each year. We do not know how large the pool of non-compliance is from which the disputes are drawn. If we are to understand how to better design institutions to promote compliance with international rules, this is a key element of what must be tested. We need a mechanism through which to test how institutional design changes impact the baseline rate of compliance. Agent based modeling (ABM) offers the possibility to do just that.

**ABM Estimation of Compliance Behavior**

The problem we face in using the GATT/WTO compliance for examining institutional design is that the compliance behavior is presently beyond our ability to directly observe in the real world. While we cannot directly observe this in the real world, we can approximate this using agent based simulation. Agent based models are simulation models based on the use of individually programmable actors known as agents. (Epstein and Axtell 1996, Gilbert and Troitzsch 2005) These agents interact with each other within the parameters of the model. ABM allows the modeler to control the environment in which the agents act, as well as the behavior of the agents themselves. The use of ABM permits the design of a model of compliance behavior in the trade regime that allows the testing of multiple institutional forms under a variety of conditions.

ABM has several advantages. The first is that the modeler controls the parameters of the world. All elements are known because they are programmed into the model. The modeler

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9 States may also seek disputes as a means of setting a precedent for future cases. While the WTO system is not formally based on precedent, in practice precedent is seen as growing importance as the process of legalization progresses.
controls the number of agents, the parameters of their interactions, and the general structure of
the world in which they are interacting. A wide range of institutional designs and agent
behaviors can be tested in this context. Such models are also extensible, allowing for the
increasing complexity of the model over time as new information becomes available. (Epstein
and Axtell 1996)

The second is that the ABM context allows for the observation of emergent properties
from the model run. Conventional statistics ultimately examine relationships in a context
constrained by the limitation of a basically linear structure. ABM offers the examination of
properties that emerge from network interactions over time. The ABM context also allows the
testing of multiple network structures within the model framework.

A third advantage is that a wide range of variation in agent behaviors and institutional
mechanisms can be tested in a relatively compressed time frame. Complex interactions can be
modeled in days or weeks rather than waiting years for the real world to progress. The range of
potential applications is wide.

A pitfall of ABM is that great care must be taken in model design. Poorly designed
models easily become self-fulfilling prophecies that provide little or not real information for
researchers. It is very easy in such models to program in agent behavior and environmental
conditions that produce exactly the desired results. To avoid this, the modeler must take great
care to incorporate elements to prevent positive feedback loops from forming, as well as
mechanisms to avoid deterministic elements in the model. (Gilbert and Troitzsch 2005)

ABM offers a useful means of testing otherwise untestable hypotheses regarding
international phenomena. Most importantly, ABM offers a potential means of exploring the
questions regarding institutional design and compliance behavior at the GATT and WTO that
move beyond the limits of current research. A properly designed model can provide useful data
on the impact of varying compliance mechanisms. Further, such a model can incorporate and
potentially test a range of assumptions about the behavior of political leaders within its
framework.

One advantage of the ABM framework in the trade context is that the escalation behavior
of the member states has been tested using conventional statistics in previous research. (Dixon
2007, Reinhardt 2001, Sherman 2002) Further, the WTO has been the subject of addition
research in the context of institutional flexibility. (Koremenos 2005, Rosendorff 2005) The
existing models based on observed data will allow comparisons to the model results. Models
that produce results near to those observed in existing research can be used with greater
confidence in their results than could models created in the abstract.

The ABM framework thus offers an excellent method for testing international
institutional design elements.

**An ABM Model for Trade System Compliance Behavior**

The model that is described below is a work in progress. While the author’s intent was to
have a working version of the model included in the paper, this goal proved overly ambitious.
The model described in the section that follows is the outline of the model in progress. As the
project progressed it became clear that several elements were required that were not anticipated
in the original proposal. The complexity of the model has greatly increased and has brought with
it a much longer than anticipated learning curve. While the author regrets that the model was not
working in time for the completion of this paper, the resulting model that emerges from the process will be a significant improvement over the model originally proposed.\footnote{The author originally began working with NetLogo software (http://ccl.northwestern.edu/netlogo/) to implement the model, but has shifted to the Repast Symphony Platform due to its ability to handle more complex network interactions.}

There are several key components in the model.
- The environment in which the agents interact
- The agents themselves (leaders, citizens, and global trade institutions)
- The trade network

The environment:

The environment in which the agents interact is a simple grid model. The grid is based on a 10 x 20 unit of squares. Each square represents a country in the “world” that is thus created. This world is not literally a physical world, but a framework on which the agents can interact within the model. Distance is basically meaningless in this world as the relationships between countries take place within a trade network that sits on top of the world.

Each of the countries is endowed with several characteristics:
- GDP – basically a measure of total wealth
- Trade – the number of trade partners
- Trade Dependence – a measure of how dependent the economy is on trade
- Regime Type – This is the democracy score of the country

The agents:

Agents are the actors who will engage in the interactions in the game. They are programmable individuals that perform specified tasks as the model runs.

There are three kinds of agents:
- Leaders – the political leaders of the country
- Citizens – a group of citizens in the country
- Trade Regime – an agent with no geographic location that holds the values for the regime’s institutions

The trade network:

This is basically a web of network interactions. It is the mechanism through which shock events and policy decisions ripple through the model. Countries are randomly linked to each other in the start of the model within the network. The network represents trade relations between the countries. The network is the mechanism through which leader policy choices are transmitted to other countries citizens.

The Model:

The model initially assigns values to the characteristics of the countries and the agents based on randomly generated numbers within the assigned range. Most characteristics are assigned thermometer values (1 – 100) for simplicity sake. Policy preferences are also set at random, but from a three point scale corresponding to the policy preference of the agent in question. The leaders are assigned a policy preference based on the policy preference of the
citizens in the first turn. The trade linkages are also randomly generated within the trade network.

Each turn of the model consists of two steps.

- The Network Effects Step
- The Update Step

Every fifth turn there is an Election Step

The Network Effects Step
A series of effects ripple through the network:

- Random shocks: Countries are selected at random to shock events that cause citizens to shift their preferences in response
- Protection effects: Countries feel the impact of trade protection by other countries linked to them via the trade network. Protection in the previous turn affects the citizenry and may generate a demand for retaliation. The retaliation decision is a function of trade dependence, regime type, and the Trade Regime.

The Update Step
Agents update their information
Leaders update their estimate of the Citizens’ trade preferences (protection, liberalize) based on the last turn’s preference with a random observation error. Leaders also update their utility based on whether or not their preference last round matched the citizens’ preference in the last round. Citizens update their preferences (protection, hedge, liberalize) based on the network effects (including the impact of retaliation) and a random parameter.

The Election Step
If the Leader’s policy choice does not match that of a percentage of the population equal to the country’s democracy score, the leader “dies” and is replaced by a leader with the winning policy preference. Death reduces the leader’s utility to 0.

Model outputs:
This model will generate a dataset that provides the characteristics of each of the agents and countries each turn as well as the policy preferences for each agent in the turn. It will also produce graphical data representing the number of Leaders selecting protection each turn. A characteristic of the trade regime will be a parameter that increases or decreases the likelihood of retaliation for protection. This dataset can be used to analyze the impact of various characteristics on the rate of cheating in the model.

Obstacles to the implementation of the model:
The need for predictive behavior on the part of the Leaders creates a serious issue. Leaders must be able to look into the future and make predictions in order to make the utility estimates function as desired. In the absence of predictive behavior, leaders simply follow the citizens blindly each turn based on the last turn. Ideally this could include the ability of the agents to incorporate algorithms that would allow them to learn from past behavior and make judgments about the future. It is possible to model such behavior in the simulation, but it is beyond the technical capabilities of the author at the moment.
The major obstacle to achieving a working model is time. When initially proposed, the author expected a simple model to be a workable way of implementing an ABM solution to the problem of unobserved behavior. As the work progressed it became clear that this would not be the case and that a significantly more complex model would be required. Unfortunately the calendar ran out on the process.

**Conclusion**

The design of international institutions to promote compliance behavior is an important area of research in contemporary international relations. Improvements in the understanding of the impact of institutional design allow us to design more effective means of solving problems of global governance. It will also allow the tailoring of institutional arrangements to fit the needs of the relevant issue areas with greater precision. Study of the GATT/WTO system allows us to examine the impact of a major institutional change at the international level. While there are limits to the applicability of the institutions of the trade regime, the lessons learned from studying how institutional flexibility contributes to compliance are valuable.

A major obstacle to our analysis of the impact of institutional design is the inability to directly observe compliance behavior. In the absence of such direct observations, we must depend on proxies. While this is useful and common in social science research, there is reason to believe that this may mask significant problems with compliance in the GATT/WTO context. Agent based modeling offers researchers a means of simulating the behavior that cannot be directly observed. A properly constructed model can test various institutional design characteristics in the model framework to determine their likely impact in the real world. This will allow researchers to test a wide range of institutional forms in the context of a wide range of behavior on the part of the agents.

The model outlined here is incomplete and not yet operational, but it gives some sense of the potential that such models have for contributing to the research on institutional design and flexibility.
Works Cited


