

**&&Part II:                   Game Theory and the Institutions Around Us: Cultural Beliefs, Rules,  
and Organizations**

Introduction

**&Chapter 4                   Game-Theoretic Restrictions on Cultural Beliefs**

- 4.1 Self-enforcing Behavior in Static Games with Complete Information - Nash Equilibrium
- 4.2 Self-enforcing Behavior in Dynamic Games with Complete Information - Backward Induction and Subgame-Perfect Equilibrium
- 4.3 Self-enforcing Behavior in Repeated Games - SGPE and Confirming Expected Behavior
- 4.4 On the Relationships between Parameters, Structure, and Self-enforcing Behavior
- 4.5 Incomplete Information and Evolutionary Restrictions
- 4.6 Institutions-as-Equilibria: Self-enforcing Behavioral Cultural Beliefs, Social Positions, and their Regeneration
- 4.7 Common Knowledge, Internalized Cultural Beliefs, and Mental Models

**&Chapter 5                   Institutions, Trust, and Agents: The Maghribi Traders**

- 5.1 Commerce, Overseas Agents, and Efficiency
- 5.2 The Commitment Problem and Reputation-Based Community Enforcement
- 5.3 Model: The Agent Commitment Problem and Multilateral Punishment Strategy
- 5.4 The Maghribi Traders Coalition – Theory and Indirect Evidence
- 5.5 Endogenous Information Structure
- 5.6 The Merchants' Law: Rules, Coordination, and Comprehensive Contracts
- 5.7 Conclusion

**&Chapter 6                   Organizations, Beliefs, and the State: the Merchant Guild**

- 6.1 The Commitment Problem and the Role of Merchant Guilds
  - 6.1.1 Institutions and Commitment
  - 6.1.2 Evidence of the Role of Formal Organizations
  - 6.1.3 Evolution of Guild Organizations
- 6.2 The Formal Model
- 6.3 Discussion

**&Chapter 7                   Institutions as Complementary Cultural Beliefs, Rules, and Organizations**

- 7.1 Rules, Coordination, and Common Knowledge
- 7.2 The Organizational Foundations of Institutions
- 7.3 Institution as an Equilibrium: Agency, Structure, and Incentives

## **&&Part II: Game Theory and the Institutions Around Us: Beliefs, Rules, and Organizations**

Hobbes is among the many who have postulated that individuals are rational and self-interested. In its extreme formulation that is often used in economics and political analysis of institutions, individuals are motivated only by the desire to advance their material self-interest. As Hobbes has noted in the Leviathan (1660: ??), in the absence of institutions, the implications of such tendency can be rather grim because individuals will resort to violence to improve their lot. Hence, “there is no place for industry, because the fruit thereof is uncertain; and consequently no culture of the earth, no navigation, nor use of the commodities that may be imported by sea; no commodious building, no instruments of moving and removing such things as require much force; no knowledge of the face of the earth, no account of time, no arts, no letters, no society; and which is worst of all, continual fear and danger of violent death; and the life of people, solitary, poor, nasty, brutish, and short.”

Rational and self-motivated individual will thus seek to bring this situation to an end. Everyone can thus be better off by accepting a basic rules of behavior. Selfishness alone will therefore motivate each individuals to adopt a basic set of rules which will allow for a civilized community. However, these rules will ensure safety for each agent only if the rules are enforced. As selfish creatures, each of us would plunder our neighbors' property once their guards were down. Each individual would then be at risk from his neighbor. Therefore, for selfish reasons alone, we devise a means of enforcing these rules: we create institutions around us to ensure that each of us will follow the rules that are beneficial for all of us. These institutions - provided by the state - constitute the structure that guides, enables, and motivates each of us to take particular actions.

Much can be said against Hobbes' analysis of the nature of man, the origin of institution, their alleged efficiency implications, and the centrality of state sponsored institutions. Indeed, much of the empirical analysis in this work is about how private order institutions can provide the foundations for markets and about the institutional foundations of the state itself. Similarly, the next part discusses institutions within ourselves, namely, those in which motivation relies on human propensities other than materialist self-interest.

This part, however, maintains the assumption that individuals are concerned about their self-interest and materialist well being. This analysis is therefore partial but it focuses attention on institutions that are “around us.” Namely, those that influence behavior without altering individuals’ preferences. Such institutions don’t influence peoples’ behavior by shaping who they are. They influence behavior by changing the environment within which people take actions.

Central to such institutions is therefore beliefs about the relationships between past conduct and future reward. The presence of a security guard at the store may be a necessary condition to prevent shoplifting, but it is not sufficient. Stealing can be deterred only if particular beliefs regarding that guard’s action following stealing prevail. Similarly, a selfish individual would repay a loan only if he hold the belief that failing to so implies dear consequences.

As we have seen in chapter 2, however, institutional analysis has become progressively concerned with rules, organizations, and behavior to the exclusion of such motivational factors as beliefs. Game theory, however, changed this situation. It offers an analytical framework that enables us to deductively restrict the set of beliefs that can be self-enforcing and hence motivate behavior in a given situation. Such self-enforcing beliefs that influence behavior constitute an institutional element: they are exogenous to each of the interacting individuals thereby motivating each to behave in a way that others expect him to act. Because it is true for each of the interacting individuals, each individual’s behavior is sustained by the expected behavior of the others. In other words, each individual, while taking the prevailing beliefs regarding behavior and various features of situation as given, finds it optimal to behave as expected according to these beliefs. These beliefs and behavior are self-enforcing and the observed implications of the behavior that the beliefs implied contributes to regenerating these beliefs.

Most of chapter 4 provides an introduction to game theory and how it deductively restricts the set of beliefs and behavior that can be self-enforcing in a given environment, facilitates examining how beliefs and behavior would change in response to environmental changes, and exposes the causal relationships between beliefs and behavior. Because this is accomplished by restricting beliefs and behavior to those associated with a game-theoretic

equilibrium, this approach to studying beliefs and behavior is often referred to as the institutions-as-equilibria approach.

Chapters 5 and 6 demonstrate how we can harness this analytical power of game theory for a positive, empirically-oriented analysis by presenting two case studies. Both of them consider institutions that facilitated trade during the late medieval commercial revolution. One discusses an institution that governed agency relationships while the other discusses those that protected the property rights of traders abroad. These chapters demonstrate the benefit of the game theoretic approach for studying contract enforcement institutions and institutions securing property rights. Furthermore, they contribute its benefits for the study of situations in which only economic exchange is possible and situations in which the parties can also use coercive force to advance their objectives. These chapters also demonstrate an empirical methodology for applying game theory to institutional analysis. Discussion of these issues, however, is left to later parts of this book.

The empirical analyses in chapters 5 and 6 exemplify some general insights regarding the roles and nature of rules and organizations as institutional elements, and how game theory facilitates their presentation and analysis. Furthermore, these chapters highlight how game theory facilitates studying rules, organizations, and behavioral cultural beliefs as a system of complementary institutional elements. Game theory enables us to study how rules and organizations coordinate and enable particular behavioral cultural beliefs to prevail and to generate regularities of behavior in the interaction under consideration. But in game-theoretic analysis, organizations are not necessarily taken as exogenous; they and their behavior can be examined from the same perspective as that used to study institutions. The analytical framework provided by game theory allows us to study, whenever appropriate, the rules and behavioral cultural beliefs, which coordinate and motivate individuals who are members of an organization, to act in a particular manner.

In principle, therefore, game theory enables us to study how behavioral cultural beliefs, rules, and organizations generate regularities of behavior while “placing the responsibility for

social order on the individuals who are part of that order” Crawford and Ostrom (1995: 583).<sup>1</sup> Given the environment within which the relevant individuals interact and their beliefs about it, we can examine how their behavior generates an institution composed of complementary institutional elements - rules, organizations, and beliefs - that guide, enable, and motivate each of them to follow this behavior. These issues are discussed in chapter 7.

Chapters 4 and 7 present the analytical framework provided by game theory, but they do not examine the origins or dynamics of institutions. They are not concerned with the question of why one particular institution, rather than alternative one, prevails in a particular time and place. The empirical chapters (5 and 6), touch upon the origin of the institutions they examine. But a comprehensive discussion of the origin and dynamics of institutions is presented only in Parts V and VI. The current discussion concentrates only on the analytical contribution of the game theoretic analytical framework for the study of institutions as a steady-state system of institutional elements that, once established, perpetuate over time.

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<sup>1</sup> In practice, however, as discussed in part IV, we usually do take some institutional elements as exogenous to the analysis.

## **&Chapter 4 Game-Theoretic Restrictions on Behavioral Cultural Beliefs**

For Durkheim (1950) institutions comprise all the beliefs and modes of conduct instituted by the collectivity. Old Institutionalism similarly considered beliefs as central to institutions: beliefs motivate individuals to behave in a particular manner. In sharp contrast, New Institutionalism as developed to 1990 has paid little attention to beliefs and concentrated on rules, organizations, and contractual forms. The reason has arguably been the lack of an appropriate analytical framework. To study beliefs in a manner consistent with economic methodology, there was a need for an analytical framework capable of deductively restricting arguments regarding beliefs that can prevail in a given environment and exposing the casual relationships between beliefs and behavior. During the 1990s, developments in game theory have enabled us to go some way toward constructing such a framework.

This chapter elaborates on this contribution of game theory. It begins with presenting the fundamental of game theory to insure that readers without previous knowledge of it can follow the argument. A game-theoretic analysis starts by specifying the rules of the game. These rules identify the decision-makers - the players, their possible actions, the information available to them, probability distributions over chance events, and each decision-maker's preference over outcomes.<sup>2</sup> The rules of the game are assumed to be common knowledge.<sup>3</sup> The situation can be strategic in the sense that each player's optimal action depends on the actions and characteristics of other players. (Non-strategic situations thus constitute a generic cases.)

The presentation follows a classification of games by the fundamental attributes of their rules and, to keep the discussion simple, it concentrates, without loss of generality, on two-player games. Sections 4.1 and 4.2 examine static games in which the players move simultaneously games and dynamic games in which the players move sequentially. The discussion concentrates,

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<sup>2</sup> Note that such rules can capture the impact of beliefs aside from those related to the actions of others, such as beliefs regarding reward after death and God's supposed reactions to particular behavior. I will return to this issue below.

<sup>3</sup> S is common knowledge if all players know S, all players know that all players know S, and so on ad infinitum. Lewis 1969.

in particular, on how the concepts of the Nash equilibria and subgame-perfect equilibria of classical game theory deductively restrict behavior that, if expected, will be self-enforcing in the sense that each individuals taking as given that will find and will be confirmed by observable behavior.<sup>4</sup> Section 4.3 then presents the main relevant results from repeated game theory. In repeated games, a particular stage game - either static or dynamic game - is repeated over time. The analysis of such situations is particular important for institutional analysis which is about behavior in recurrent interactions. Sections 4.4 presents a brief discussion of how the ability to use game theory to consider the relationships between the environment and self-enforcing behavior. Section 4.5 briefly presents how the analysis can be extended to situation in which information is incomplete and individuals have limited cognitive knowledge of the situation. (Readers who are knowledgeable in game theory may find it best to directly proceed to section 4.6.)

Sections 4.6 and 4.7 returns to the issue of beliefs. The first section elaborates on how the study of self-enforcing behavior provides an analytical framework to study particular beliefs: rational beliefs regarding behavior that are shared among members of a society. The particular beliefs of this nature that established themselves in a society constitute an institutional element - each individual take this beliefs as exogenous when considering how to act but these beliefs are endogenous to the group of interacting individuals. Because in most recurrent situations more than one beliefs of this nature can prevail, it seems appropriate to follow sociologists in referring to the particular beliefs that prevail in a society with respect to a particular interaction as cultural beliefs. The game theoretic analysis enables us to analytically examine such beliefs, how they relate to social positions, and behavior in a given environment. Section 4.7 completes this discussion by considering the contributions of game theory to the study of beliefs regarding the environment itself. Game theory thus enables us to study beliefs using the lens provided by equilibrium analysis. Hence, this perspective for the study of beliefs is sometimes refer to as the institutions-as-Equilibria approach.

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<sup>4</sup> For a relatively non-technical introduction to game theory, see Dixit and Nalebuff 1991; Gibbons 1992, 1997; and Watson 2002. For a more technical analysis, see Fudenberg and Tirole 1991; and Gintis 2000.

**4.1 Self-enforcing Behavior in Static Games with Complete Information - Nash Equilibrium**

Consider first static (or simultaneous move) games with complete information. Games are static when all players take actions at the same time rather than sequentially, and they have complete information when all players have the same information about the situation. To simplify the exposition, consider a two-player game but the discussion applies to larger games as well.

The structure of such games is as follows:

1. Player 1 chooses an action  $a_1$  from the set of feasible actions  $A_1$ . Simultaneously, player 2 chooses an action  $a_2$  from the set of feasible actions  $A_2$ .
2. After the players choose their actions, they receive payoffs:  $u_1(a_1, a_2)$  to player 1 and  $u_2(a_1, a_2)$  to player 2.

The Prisoners' Dilemma (PD) Game is perhaps the best known and explored static game with complete information. In it each of the two players can either Cooperate with the other or not (Defect). If both Cooperate, each player's payoff will be higher than if they both play Defect. But if one played Cooperate and the other played Defect, the latter's payoff is higher than his payoff if both played Cooperate, and the former player's payoff will be lower compared to what it would have been if he played Defect as well. Figure 4.1 presents a PD game in a matrix (or normal) form:

<b>A Prisoners' Dilemma Game</b>			
		Player 2's actions	
Player 1's		C	D
Actions	C	1, 1	-15, 5
	D	5, -15	-8, -8

The players' actions are denoted by C (Cooperate) and D (Defect). The rows (columns) represent player 1's (2's) action choices. Each cell corresponds to a pair of actions, an action



combination. The players' payoffs associated with each action combination is represented by two numbers the first (second) of which represents the payoff to player 1 (2) respectively.

In this game the best each player can do is to defect. Player 1 cannot expect player 2 to play C because no matter what player 1 does, player 2 is better off playing D. If 1 plays C, then player 2 gains 1 playing C but 5 playing D. If 1 plays D, then player 2 gains 15 playing C but only 8 playing C. The same holds with respect to player 1: He is always better off playing D. In the language of game theory, playing defect is one's dominant strategy: it is the best one can do independently of what the other is doing. Hence, the action combination (D, D) is the one that will be followed if the above game captures all aspects of the situation.

In the particular case of the PD, one's expectations about the behavior of the other do not matter when choosing an action. Playing D was the best one could do independently of the choice of actions of the other. But this is not generally the case. Consider, for example, the game presented in figure 4.2.

		Player 2's actions		
		Left	Middle	Right
Player 1's Actions	Up	3, 0	1, 4	0, 3
	Down	0, 2	0, 1	2, 0

In this game, the situation is really strategic: the action best for one player depends on the action that the other is taking. If 1 chose Down, for example, 2's optimal response is playing Left, thereby getting 2 instead of getting 1 or 0 from playing Middle or Right respectively. If 2 plays Left, however, 1 is better playing Up, getting 3 instead of the 0 that playing Down entails. This game is thus strategic in the sense that one's best play depends on the action the other player takes.

Suppose both players hold the same expectations about how the game will be played. What behavior, if expected, would indeed be followed? In other words, what expected behavior would be self-enforcing in the sense that if one player holds that the other will follow it, it is best for that player to follow it as well?

Consider first the behavior that, if expected, will not be followed. Consider, for example, the action combination (Up, Left). Would this action combination be played if each player expected the other to follow it? No. Because if 2 expects 1 to play Up, her best response is playing Middle, getting 4 instead of 0. Hence, 1 cannot hold the belief that 2 indeed will play Left. Consider similarly the action combination (Down, Left). If player 1 expects player 2 to play Left, his best response is playing Up, getting 2 instead of zero. We can continue to examine possible action combinations in this manner to find that there is only one action combination that can be expected by both players to be played. This action combination is (Up, Middle). The logic behind this conclusion is the following. If 1 expects 2 to play Middle, 1's best response is to play Up, and if 2 expects 1 to play Up, 2's best response is to play Middle.

The only action combinations that can be expected to be played, and would indeed be played, are those that are “self-enforcing” in the sense that no single player wants to deviate from his or her expected action. An action combination that satisfies this condition is called a *Nash Equilibrium* (NE).<sup>5</sup>

Clearly, a game may have multiple NE as there are in the Driving Game presented in figure 4.3.

<b>The Driving Game</b>			
		Player 2's actions	
Player 1's Actions		Left	Right
	Left	2, 2	0, 0
	Right	0, 0	2, 2

This game captures the essence of two individuals driving in opposite directions on the road and heading toward each other. Either can choose whether to drive on the left or the right side of the road. If they both choose the same side, either Right or Left, a collision is avoided

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<sup>5</sup> In static games as described above, an action combination  $(a_1^*, a_2^*)$  is a Nash Equilibrium if  $a_1^*$  is a best response for player 1 to  $a_2^*$ , and  $a_2^*$  is a best response to  $a_1^*$ . That is,  $a_1^*$  must satisfy  $u_1(a_1^*, a_2^*) \geq u_1(a_1, a_2^*)$  for every  $a_1$  in  $A_1$ , and  $u_2(a_1^*, a_2^*) \geq u_2(a_1^*, a_2)$  for every  $a_2$  in  $A_2$ .

and each gets the payoff of 2. If they choose the opposite sides, either (Right, Left) or (Left, Right) then they collide and each get the payoff of 0. In this game there are two NE, which are (Left, Left) and (Right, Right).<sup>6</sup> Indeed, each of these NE prevails in different countries.

Some games do not have an action combination satisfying the mutual-best-response requirement of the NE given above. An example of such a game is the Matching Pennies Game presented in figure 4.4. In this game there is no NE as defined above. In a sense, each player tries to outguess the action of the other. If player 1 expects 2 to play Heads (Tails), his best response is to play Tails (Heads).

<b>The Matching Pennies Game</b>			
		Player 2's actions	
Player 1's Actions		Heads	Tails
	Heads	-1, 1	1, -1
	Tails	1, -1	-1, 1

It is reasonable that in such situations peoples' expectations about behavior will be probabilistic in nature. People will expect others to play Heads some of the time and Tails some of the time. Game theory defines NE in such cases as well. This is done by referring to the actions in a players action set ( $A_i$ ) as *pure strategies*, and defining a *mixed strategy* as a probability distribution over the player's pure strategies. We can then solve for NE in the mixed strategies.<sup>7</sup> In the Matching Pennies Game and in the Driving Game, for example, playing each action with a probability of .5 for each player is the NE in mixed strategy. Any game with finite number of players, each of whom has a finite number of pure strategies, has a Nash Equilibrium (possibly only in mixed strategies).

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<sup>6</sup> There is also a third, mixed-strategy NE in which each player chooses which side to drive on with probability .5. See the discussion of this notion below.

<sup>7</sup> Harsanyi provided an interpretation of this mixing as reflecting one's uncertainty about the actions that the other player will choose. For an intuitive account, see Gibbons 1997.

Game theory thus restricts the action combinations that can be expected to prevail in a given situation to those that are self-enforcing in the Nash Equilibrium sense. Game-theoretic equilibrium analysis identifies action combinations that, if expected by both players, each will find it best to follow the implied behavior. While the situations described here are very simple, the same analysis can be applied to those that are more complicated. The equilibrium notions used for more complicated situations are, by and large, refinements of the Nash. That is, they are NE that fulfill some additional conditions. The following discussion of dynamic games illustrates the nature of these refinements and the usefulness of imposing further restrictions on admissible self-enforcing behavior.

#### **4.2 Self-enforcing Behavior in Dynamic Games with Complete Information - Backward Induction and Subgame-Perfect Equilibrium**

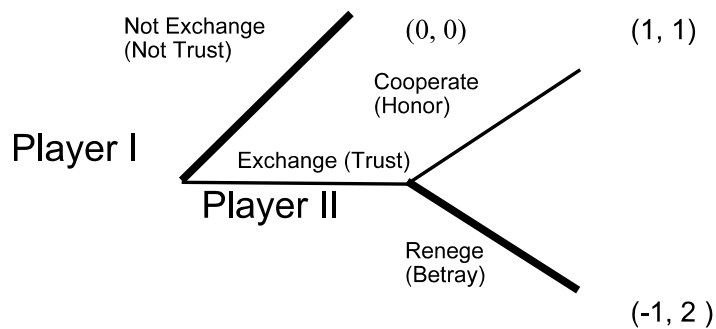
Consider a dynamic situation in which the players move sequentially rather than simultaneously. The basic structure of a dynamic game is as follows:

1. Player 1 chooses an action  $a_1$  from the set of feasible actions  $A_1$ .
2. Player 2, after observing 1's choice, chooses an action  $a_2$  from the set of feasible actions  $A_2$ .
3. After the players choose their actions, they receive payoffs:  $u_1(a_1, a_2)$  to player 1 and  $u_2(a_1, a_2)$  to player 2.

An example of such a game is the Exchange game also known as the Game of Trust or the One-sided Prisoner's Dilemma Game (OSPD). This game is of interest because it captures an important essence of all exchange relationships, whether in personal, social, economic, or political arenas. This important essence is that exchange is 'always sequential, namely, in it some time elapses between the *quid* and the *quo*' (Greif 1997a: 247-8; Greif 2000).

In this game, player 1 first chooses either to Exchange or Not Exchange with player 2. If player 1 chooses Not Exchange, their relationship terminates and the game ends. In this case, both players' payoffs are 0. If player 1 chooses to Exchange with 2, however, 2 gets to choose an action. If 2 chooses to Cooperate, both players' payoffs are 1, but if 2 chooses to Renege, 2's payoff is 2 while 1's payoff is -1. Figure 4.5 presents this game.

## The Exchange Game or Game of Trust



What behavior can be self-enforcing in this game? To find out, we can work backward through the game tree examining the optimal action of the player who supposedly moves last.<sup>8</sup> (Hence, this method is known as backward induction.) Suppose that it is 2's turn to choose an action. Player 2 will receive a payoff of 2 from choosing Renege and a payoff of 1 from choosing Cooperate. Obviously, 2's best choice is Renege. Knowing that, player 1's initial choice amounts to either Not Exchange and get 0 or Exchange and get -1. Hence, player's 1 best response is to Not Exchange. These arguments are summarized by the bold lines in the game tree.

Backward induction implies that the only self-enforcing action combination is (Not Exchange, Renege). Indeed, the (Not Exchange, Renege) action combination is a Nash Equilibrium. Player 1's best response to Renege is Not Exchange, while Player 2's best response

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<sup>8</sup> For experimental evidence indicating that people do use backward induction in choosing behavior, see the discussion in section 8.3.6. For the theoretical weaknesses of backward induction and subgame perfection, see Fudenberg and Tirole 1991: 96-100, Binmore 1997, and Hardin 1997.

to Not Exchange is Renege. In general, in dynamic games of complete information backward induction yields all NE. In the particular case of the Exchange Game, backward induction yields the only NE. This can be easily seen if we present the game in the matrix form used in the previous section. This representation is displayed in figure 4.6 and only the NE outcome is in bold face.

<b>The Exchange (Trust) Game</b>			
<b>Player 2's actions</b>			
<b>Player 1's</b>		Cooperate	Renege
<b>Actions</b>	Exchange	1, 1	-1, 2
	Not Exchange	0, 0	<b>0, 0</b>

While it is generally true that backward induction in complete information games always yields a NE, the opposite does not hold. Consider the normal form presentation of a dynamic game originally presented in a tree (or extensive) form. Not every NE in a game's normal form can necessarily be reached through backward induction in the original tree presentation. This is because using the tree (or extensive) form presentation and backward induction enables using information about the sequentiality of the moves. The benefit of using this information is that it enables eliminating "unreasonable" NE, specifically, NE that rely on noncredible threats or promises. Using a tree presentation thus further assists us to deductively restrict the set of admissible self-enforcing. To illustrate this advantage of backward induction, consider the following tree and matrix presentations of the same game.

Examination of the matrix form presentation of this game reveals that there are two NE, (L, U) and (R, D). Backward induction, however, yields only (R, D). This reflects the observation that if player 2 has to choose an action, playing D and getting 1 instead of playing U and getting 0 is best. Knowing that, player 1 would choose R and get 2 rather than choose L and get 1. Why didn't (L, U) survive backward induction? It didn't because it relied on the non-credible threat that the normal form presentation concealed. In this equilibrium player 1 is motivated to choose L because player 2 is supposed to play U, while player 2's best response to player 1 playing L is indeed choosing U. After all, given that player 1 chose L, player 2's payoff does not really depend on the selection between U and D. Neither of these actions would be taken in any case given that player 1 chose L. Hence, the equilibrium (L, U) relies on a noncredible threat **off-the-equilibrium-path**. In other words, it relies on the threat of taking an action in a situation that, if the players play according to this action combination, would never occur and hence player 2 will never have to take it. But this threat is noncredible because if the need to actually take this action arises, it would not be in the best interest of player 2. Backward induction enables us to call player's 2 bluff and restrict the set of admissible self-enforcing behavior accordingly.

Before proceeding, it is worthwhile reflecting on the general insight that (the above and)

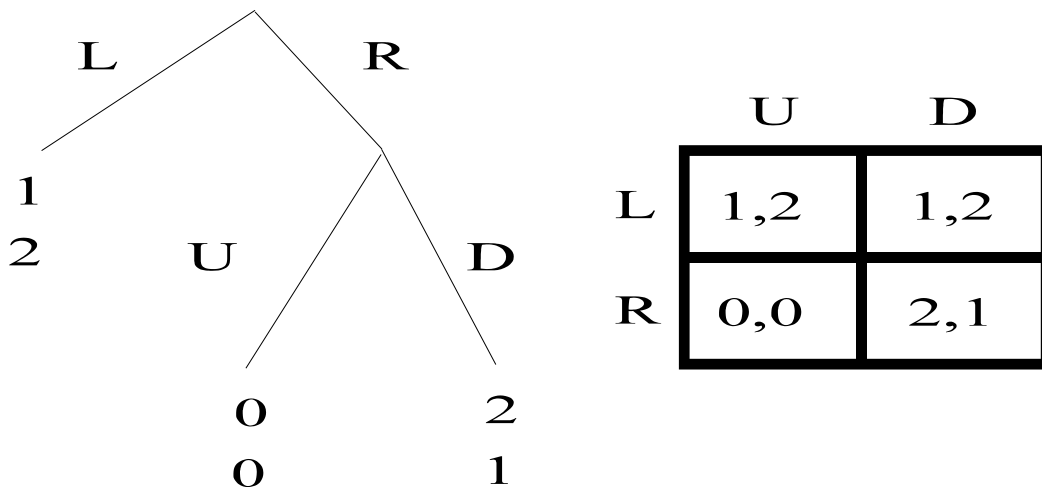
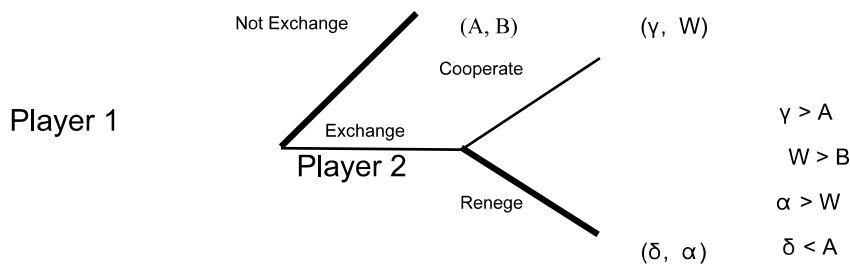


Figure 4.7

the Exchange Game highlights for the institutional analysis. The Exchange Game captures an important aspect of human relationships: one has to give in order to receive but at the point of giving, one receives only a promise for future giving by the other. But why would the other keep that promise and deliver? The Exchange Game captures the implied commitment problem. For player 1 to exchange, player 2 has to be able to commit ex-ante - prior to 1's play - that he would not renege ex-post despite the ex-post temptation to do so. Without such commitment, player 1 anticipating renegeing, would not initiate cooperation to begin with. Both players end up worse off. Much of the institutional analysis based on game-theory in the social sciences has been devoted to exploring the implications of the inability to commit and the ways in which institutions mitigate the commitment problem. The rest of this book explores these institutions.

Because of the generality of this problem, figure 4.8 presents the Exchange Game in a general, parametric form to emphasize the relationships among the parameters that give rise to the commitment problem.



Playing Exchange and Cooperate is efficient, yielding a  $\gamma > A$  for player 1 and  $W > B$  for player 2. Hence, both players can benefit from acting in this way. But if player 1 plays Exchange, player 2 can gain even more,  $\alpha > W$ , by playing Renege, leaving player 1 worse off than if he had not initiated Exchange because  $\delta < A$ . Hence, player 1 is better off, given the expected behavior of player 2 not playing Exchange to begin with.

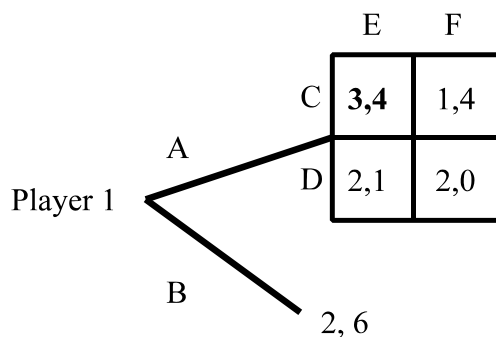
Backward induction can be applied in any finite-horizon game of complete information in which the players move sequentially and all previous moves become common knowledge



before the next action has to be chosen. In dynamic games with simultaneous moves or an infinite horizon, however, we cannot apply backward induction directly. The notion of subgame perfect equilibrium (SGPE) enables us to nevertheless restrict the set of admissible NE by eliminating those that rely on noncredible threats. Indeed, the NE that backward induction yields is a SGPE - a refinement of NE in the sense that it is a NE that satisfies an additional requirement.

To intuitively present the concept of SGPE, note that the action combinations that backward induction yields in the above two examples satisfied the Nash's mutual-best response requirement. In addition, however, it also satisfies the requirement that in the game that begins when player 2 has to choose an action, his choice of action at that point is optimal. Beginning at this decision point, backward induction restricted the admissible action of player 2 to be optimal. In dynamic games with simultaneous moves, however, we cannot, in general, follow this procedure because an optimal action depends on the action of the other player. To see why this restricts the use of backward induction, consider the following game.

The game is presented in both tree and normal forms. Player 1 moves first, choosing between A and B. If player 1 chooses B, the game is over and the payoffs are (2, 6). If player 1 chooses A, however, both players play the simultaneous move game presented in the 2 by 2 matrix. To the right of this game tree, this game is presented in a matrix form. In this game, we cannot apply backward induction by considering what is the optimal move of either player 1 or player 2 in the 2 by 2 game following player 1 choosing action A. Each player's optimal action



	E	F
AC	<b>3,4</b>	1,4
AD	2,1	2,0
BC	2,6	<b>2,6</b>
BD	2,6	<b>2,6</b>

depends on the action of the other. In other words, there is no player that moves last, as was the case in the sequential move game.

We can still, however, follow the logic of the backward induction procedure. We can find the NE in the latter part of the game (that is, the 2 by 2 game that begins after 1 chooses A). Then we can consider what 1's optimal choice is between A and B while taking the NE outcome in the later part of the game into consideration. In the above game, the NE in the game following player 1 choosing A is (CE) which yields the payoffs of (3, 4). Player 1's optimal choice between A and B is therefore A. The action combination that this procedure yields, which is a SGPE, is (ACE).

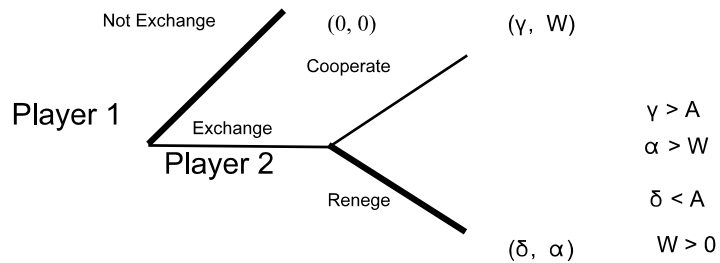
To see that this procedure eliminates NE that rely on noncredible threats, note that in the entire game there are three NE: (ACE), (BCF), and (BDF). The latter two equilibria yields the payoffs of (2, 6), making player 1 worse off and player 2 better off than in the (ACE) subgame-perfect equilibrium. Both of these equilibria, however, rely on behavior that is not a best response if the need to take it actually transpires. They rely on noncredible threats off-the-equilibrium-path. Consider (BCF). While considering the game as a whole, neither the choice of C or F influences payoffs because these actions are off-the-path-of-play. But if the need to actually take these actions had arisen, they would not have been a mutual-best response. If player 2 chooses F, player 1's best response is D, instead of C getting 2 instead of 1. Similarly, in (BDF), if player 1 chooses D, player 2's best response is choosing E instead of F, getting 1 instead of 0.

More generally, to refine a NE to be a SGPE, we apply the mutual-best response idea that is the essence of NE to other parts of the game called *subgames*. Intuitively, a subgame is part of the original game that remains to be played beginning at any point at which the complete history of how the game was played thus far is common knowledge. A Nash equilibrium (in the game as a whole) is a subgame-perfect equilibrium if the players' strategies constitute a Nash Equilibrium in every subgame. Any finite game has a SGPE.

### 4.3 Self-enforcing Behavior in Repeated Games - SGPE

The discussion so far has examined games in which the players interacted only once. Institutional analysis, however, is concerned with recurrent situations in which individuals interact repeatedly. Repeated game theory is a branch of game theory that considers behavior and outcomes in such situations. The basic structure of a repeated game is made up of a “stage game,” namely a game like the PD or the Exchange Game that is repeated every period. At the end of each period payoffs are allocated, the players observe each others’ past actions, and then they play the same stage game again. Future payoffs are discounted by some factor, say,  $\beta$ . Suppose for the moment that the game is repeated an infinite number of periods. A history in repeated games is the set of actions taken in the past; a strategy specifies actions in every stage game after every possible history.

To examine what behavior, if expected, will be followed in such games, consider a situation in which the stage game is the following simplified version of the Exchange Game. As



discussed above, if this stage game is repeated only once, the only SGPE is (Not Exchange, Renege). Exchange and Cooperation is not an equilibrium, self-enforcing behavior. A comparable SGPE equilibrium in the repeated game is that Player 1 always (namely, after any history) plays Not Exchange, and Player 2 always plays Renege. But, unlike the stage game, the

repeated game has many more SGPE.<sup>9</sup> In particular, there are SGPE in which player 1 Exchanges and player 2 Cooperates. The essence of such equilibria is that player 2 is motivated to Cooperate in the current period despite the ability to gain by playing Renege because renege implies losing the gains from future exchange. The shadow of the future sustains exchange. To illustrate the operation of this mechanism, consider the following “trigger” strategies.

Player 1: In the first period, play Exchange. Thereafter, if all moves in all previous periods have been Exchange and Cooperate, play Exchange; otherwise, play Not Exchange.

Player 2: Play Cooperate if all moves in all previous periods have been Exchange and Cooperate; otherwise, play Renege.

Player 1’s strategy thus calls for initiating exchange in the first period, and each player’s strategy calls for exchanging and cooperating as long as the other acted in such a manner, and never exchange or cooperate again if anything had happened. Note that in the event that renege occurs, playing (Not Exchange, Renege) every subsequent period is a Nash equilibrium. After renege occurs, player 1, expecting that Player 2 will further renege, finds it best to play Not Cooperate, while Player 2's best response to Not Cooperate is indeed playing Renege. In other words, the threat of responding to renege by ceasing cooperation is credible.

Hence, player 2’s decision whether or not to cooperate in any period prior to ever renege entails comparing the net gains from cheating in the current period ( $\alpha - W$ ) and the implied loss of future gains from cooperation, namely, the net present value of future cooperation ( $\beta W / (1 - \beta)$ ). Hence, player 2’s best response is to cooperate every period if and only if the latter is smaller than the former, ( $\alpha - W \leq \beta W / (1 - \beta)$ ). Player 1's best response is to follow the above strategy and Exchange. His only possible deviation is to play Not Exchange, but given the strategy of player 2, this implies losing all gains from Exchange, ( $\delta / (1 - \beta) > 0$ ). In this equilibrium, on-the-equilibrium behavior of Exchange and Cooperate is sustained by the off-the-equilibrium-path credible threat of ceasing all cooperation if player 2 ever Reneges. The fear of losing reputation and future gains from exchange, motivate player 2 to Cooperate.

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<sup>9</sup> Experimental evidence indicates that indeed individuals understand the strategic difference between one-shot and repeated games. See section 9.3.

The discussion of the trigger strategies exemplifies how game theory facilitates identifying self-enforcing behavior in repeated situations. It also indicates that there are usually many SGPE in infinitely repeated games (as further discussed in part IV). We have seen two SGPE in the repeated Exchange Game and one can construct others as well with or without cooperation on-the-equilibrium-path. For example, a limited trigger strategy that calls for several periods of playing No exchange and Renege following player 2 choosing Renege, can also be an equilibrium with cooperation on-the-equilibrium- path.

One of the most useful results in studying repeated games is that verifying that a particular strategy combination is a SGPE is often easier than doing so with respect to a NE. Roughly speaking, in any repeated game a strategy combination is a SGPE if none of the player can gain from **one** period deviation after any history. Hence, to check if a particular strategy combination is a SGPE, it is sufficient to consider substantiate that after any history no player can gain from one period deviation after which he will return to follow the strategy.<sup>10</sup>

#### 4.4 On the Relationships between Structure and Self-enforcing Behavior

The discussion so far has concentrated on the self-enforcing behavior that can prevail in a given situation, or a game. The game itself was assumed to have a particular structure and its parameters, such as payoffs and time-discount factors, to take a particular value. But game-theoretic analysis also exposes the relationships between structure, parameters, and self-enforcing behavior. It exposes whether a particular behavior is self-enforcing if the structure or parameters of a game are changed.

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<sup>10</sup> The formal analysis is due to Abreu 1988. Definition: Consider a strategy combination  $s$  and denote the set of players by  $N$  and a player by  $i$ .  $s$  is thus combined of  $s_i$  which is the strategy for player  $i$  and  $s_{-i}$  which is the for the other players. The strategy  $s_i$  is unimprovable against  $s_{-i}$  if there is no  $t - 1$  period history (for any  $t$ ) after which  $i$  could profit by deviating from  $s_i$  in period  $t$  only (and conforming to  $s_i$  from  $t + 1$  and on). Proposition: Let the payoffs of a stage game  $G$  be bounded. In each the finitely or infinitely repeated version of the game with time discount factor  $\delta \in (0, 1)$  a strategy  $\sigma$  is a SGPE iff  $\forall i$  (that is, every player),  $\sigma_i$  is unimprovable against  $\sigma$ .

For example, in the above infinitely repeated Exchange game, the condition  $\alpha - W \leq \beta W / (1 - \beta)$  implies that the above trigger strategies would be an equilibrium only if player 2 has a sufficiently high discount value, and if player 2's per-period gain from cooperation is sufficiently large relative to the gains from playing Renege. The dependency of this condition on the structure of the game is revealed by considering alternative formulations. Consider, for example, the finitely-repeated version of the Exchange Game. In this case, the above trigger strategy is not an equilibrium.

Indeed, in finitely-repeated games with a unique equilibrium in the stage game, the only equilibrium in the repeated game is a sequence of this unique equilibrium. This is due to the so called unraveling problem. Player 2 will find it best to play Renege in the last period, implying that there is no equilibrium in which player 1 will cooperate in that period. This implies, however, that player 2 will find it best to cheat in the period before last, etc.

Such analytical results and insights facilitate positive empirical institutional analysis as we will subsequently see. The qualitative distinction between self-enforcing behavior in the infinite- and finite- horizon games, for example, draws attention to the need to examine how institutions enable cooperation based on the fear of losing future benefits from exchange despite the finite life span of humans.

#### **4.5 Incomplete Information and Evolutionary Restrictions**

The above discussion concentrated on situations in which all information was public but game theory can also be applied to examine outcomes in situations in which there is private information about past actions, players' various attributes, payoffs from various actions, etc. Analyzing such games requires more sophisticated equilibrium concepts than those presented above - concepts that capture individuals' attempts to update, reveal, hide, or manipulate information. But what should be emphasized is that, by and large, these equilibrium concepts are refinements of the Nash equilibrium. They retain the basic ideas of mutual best responses presented above. Indeed, in games of complete information these more sophisticated equilibrium concepts collapse into those discussed above. I will not elaborate on these equilibrium concepts and the many insights they provide here, but, whenever appropriate, I will discuss them further below.

Players were treated above as if they were rational decision-makers who strategically responded to the behavior and expected behavior of others. In studying institutions, this assumption is justified based on the observation that they institutions embody and transfer the knowledge accumulated in a society required for such decision making (Section 4.7). In particular, the role of socially transmitted rules such as rules-of-the-road, customs, and myth is to inform members of a society what to expect of others and what behavior will serve them best in various circumstances. (Section 7.1.) Institutions thus span the arena within which individuals can act strategically and respond to the behavior and expected behavior of others.

But there is also a rich and important line of research in game theory that considers the extent to which equilibria, such as those explored above, can reflect evolutionary or learning processes. In this approach the mix of strategies used by the player (the distribution of strategies in the population) evolves through a process of imitative learning or natural selection in stable equilibrium states. This research yields that the set of such equilibrium states is closely related to the set of Nash equilibria, and the well-behaved members of either set generally tend to belong to both.

Consider, for example, the notion of evolutionary stable strategy (ESS). A distribution of strategies in a population is a Nash equilibrium if no individual can benefit from unilaterally deviating and adopting another strategy. A distribution of strategies in the population is an EES if it is also true that no small group of individuals could gain if they deviated in the same way at the same time. Every ESS is a Nash equilibrium but not every Nash equilibrium is an ESS.<sup>11</sup>

In the evolutionary version of the rules of the Driving Game it is assumed that there is a large population of drivers and, in each period, each driver will play against another who is randomly matched with him. Note that the one-period game has three Nash equilibria: either both players play right, both play left, or both randomize with a 50-50 probability between left and right. Only the first two equilibria are ESS. Suppose that everyone randomizes; then the expected payoff is 1 (since there is a probability of .25 that both will play left and a probability

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<sup>11</sup> For a recent first-rate discussion of ESS and related concepts, see Weibull 1995. See also Samuelson 1997; Young 1998; and particularly Gintis 2000, for various relationships between outcomes in the classical and evolutionary games.

of .25 that they both will play right). Now suppose that a small group, constituted of only some small  $\epsilon$  of the total population, deviates to play right with probability one. Members of this group will do better than the rest of the population, gaining the expected payoff of  $1 + \epsilon$  every period. This is the case since a member of the deviating group does as well as non-members when playing against one of them (having a probability of .5 that they both will play right implying an expected payoff of 1). But members do better than non-members when matched with each other since in this case each gets the payoff of 2.

Hence, in terms of the qualitative nature of the admissible equilibria, there is not much tension between the “evolutionary” and the “classical” approaches regarding the attributes of possible equilibria. Indeed, a main goal of the evolutionary and learning game-theoretic research agenda was to verify that under reasonable conditions of rationality and selection, individuals will end up behaving in a way that is consistent with the intuitively appealing logic of the Nash equilibrium. Their main differences are regarding the process through which a particular equilibrium was selected, an issue to which I will return later.

Similarly, classical and evolutionary game theory supplement each other in evaluating the robustness of self-enforcing behavior - namely, the extent to which a particular self-enforcing behavior will continue to prevail despite small changes in the parameters of the game and the existence of deviants. Classical game theory, as we have seen, indicates the parameter range for which particular equilibrium behavior can prevail in a particular game.<sup>12</sup> Furthermore, all equilibrium concepts employed in classical game theory are robust to deviations by one individual, and some also examine group deviations.<sup>13</sup> Robustness, with respect to group deviations of a particular game, is at the center of evolutionary game theory.

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<sup>12</sup> Game theory, however, does not highlight why equilibrium behavior will prevail if the situation changes. See discussion in part 4.

<sup>13</sup> See, for example, the discussion of strong and coalition-proof equilibria in Fudenberg and Tirole 1991.



#### **4.6 Institutions-as-Equilibria: Behavioral Cultural Beliefs, Social Positions, and their Regeneration**

Sociologists and anthropologists have emphasized for a long time the importance of cultural beliefs in motivating behavior. Cultural beliefs are the ideas and thoughts common to several individuals that govern interaction – between these people, and between them, their gods, and other groups – and that differ from knowledge in that they are not empirically discovered or analytically proven. In general, cultural beliefs become identical and commonly known through the socialization process in which culture is unified, maintained, and communicated.<sup>14</sup>

Cultural beliefs regarding others' behavior in various situations are an institutional element. These are common and shared beliefs among members of the society regarding behavior in recurrent situations. Each individual takes these beliefs regarding what others will do as given in deciding how to act. Hence, these beliefs are a non-technological factor which is endogenous to the society and exogenous to each individual whose behavior they influence.

Analytically examining even this restricted set of cultural beliefs, however, is challenging. As noted by Greif (1994a: 915) “that cultural beliefs economic outcomes is intuitive, but formal examination of the relations between cultural beliefs and societal organization is subtle. If we arbitrarily define cultural beliefs, a variety of phenomena can be generated. How should cultural beliefs be restricted and what are their sources? Should they be considered rational?” The game theoretic framework presented above contributes to the study of cultural beliefs that capture individuals' expectations regarding actions that others will take in various contingencies. In addition, it reaffirms how important beliefs are to institutional analysis: Generally, in strategic and repeated situations different pairs of beliefs and behavior can prevail.

Game-theoretic equilibrium analysis is concerned with identifying the behavior that, if expected, will be self-enforcing on- and off-the-path-of-play. This behavior is self enforcing in the sense that each decision-maker, expecting others to follow it, will not deviate from his or her expected behavior. For a given structure - the rules of the game - game theory enables using

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<sup>14</sup> E.g., Davis 1949 (in particular pp. 52 ff., 192 ff.) and Bandura 1971.

various equilibrium notions to specify the set of self-enforcing behavior on- and off-the-path-of-play. Game theory thus enables examining both self-enforcing behavior that transpires (namely, on-the-equilibrium-path), behavior that does not transpire (namely, that which is off-the-equilibrium-path), and the inter-relationships among the two. In the Exchange Game, for example, considering the trigger strategy enabled us to understand why player 1 cooperated and why player 2 refrained from renegeing, and how this enabled player 2 to credibly commit ex ante to Cooperate ex post.

By deductively restricting the set of behavior that, if expected, will be followed, game theory restricts the set of beliefs about behavior that can be held by members of the society and influences their behavior. In other words, game theory deductively restricts the set of admissible cultural beliefs by imposing on it a necessary condition: Cultural beliefs must correspond to self-enforcing, equilibrium behavior. Game theory restricts beliefs that are common knowledge among members of a society to those which correspond to self-enforcing behavior.<sup>15</sup>

More specifically, game theory facilitates examining “rational cultural beliefs that capture individuals' expectations with respect to actions that others will take in various contingencies. Since cultural beliefs are identical and commonly known, when each player plays his best response to these cultural beliefs, the set of permissible cultural beliefs is restricted to those that are self-enforcing. Hence this specific subset of cultural beliefs can be formalized as a set of probability distributions over an equilibrium strategy combination. Each probability distribution reflects the expectation of a player with respect to the actions that would be taken on- and off-the-path-of-play” (Greif 1994a: 915).<sup>16</sup> In other words, game-theoretic analysis

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<sup>15</sup> The assumption that these beliefs are common knowledge is crucial to the argument. If beliefs are not common knowledge - if every individual develops beliefs based on observed behavior - then the set of possible beliefs is one of self-confirming beliefs - those that are not refuted by the outcomes that one observes. See Fudenberg and Levine 1998.

<sup>16</sup> Formally: In a complete-information, extensive-form game, denote by  $P$  a path of play, and define  $S(P)$  to be the set of all strategy combinations for which the path of play is  $P$ . Denote the cultural beliefs of player  $i$  by  $CB_i(S(P))$ , defined as a probability distribution over  $S(P)$ . Note

deductively restricts the set of permissible cultural beliefs to those associated with an equilibrium strategy combination.

Furthermore, a game-theoretic analysis also enables deductively restricting the set of admissible social positions. A particular conditioning of behavior on one's socially constructed characteristic - social position - is admissible only if the equilibrium behavior and expected behavior correspond to it. A meaningful social position is one on which, given the equilibrium strategy, individuals condition their behavior. Any other social position is meaningless in terms of its behavioral implications. Similarly, it is the expected equilibrium behavior that differentiate between various social positions. Both a police officer and the criminal may have the same action set, such as getting and using a gun. Yet each of them represent distinct social position because the behavior and expected behavior of other members of the society toward each for the same observable action is different.

By highlighting the self-enforcing nature of cultural beliefs, game theory reveals a mechanism which contributes to the regeneration or propagation of the associated behavior over time. Once particular self-enforcing beliefs and behavior established themselves in a society, the actual observed behavior confirms the beliefs that this behavior would be followed. (Lewis 1969.) Once a particular self-enforcing cultural belief has established itself members of a society follow the associated behavior. That this behavior is followed, however, feeds back into individuals' beliefs that this behavior will indeed be followed. Hence, self-enforcing cultural beliefs and the associated self-enforcing behavior are mutually supportive. Observing an Australian highway, one cannot maintain the belief that people in Australia drive on the right.

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that the diverse cultural beliefs differ only in terms of expectations concerning behavior off-the-path-of-play. When it is common knowledge that  $CB_i(S(P)) = \{\text{Prob}(s^*(P) = 1)\} \forall i$  for some  $s^*(P)$  and  $U_i(s_i^*(P), CB_i(S(P))) \geq U_i(s_i, CB_i(P(S))) \forall i$  and  $\forall s_i \in S_i$ , then  $s^*$  is a Nash Equilibrium. Hence  $s^*(P)$  is an equilibrium, and the associated cultural beliefs are self-enforcing.

Arguably, this is an aspect of the process that sociologists have long referred to as institutionalization.<sup>17</sup>

To explicitly consider this issue requires exploring how individuals form beliefs about others' strategies based on observed behavior, an issue which goes beyond the game-theoretic analysis presented above. It is explored in the theory of learning in games. This theory studies, among other issues, the conditions under which such learning processes will lead individuals to expect that a NE will be played. (E.g., Fudenberg and Levine 1998.) But to keep matters simple, I will not present this analysis formally. What is important to note, however, is that because game theory makes the relationships between behavior, expected behavior, and outcomes explicit, it enables us to explore what expected behavior will indeed be confirmed by actual behavior.

The cultural beliefs that game theory facilitates deductively examining are institutional elements. One's beliefs regarding the behavior that others will take is exogenous to him or her. It is taken as given in deciding what behavior to follow. Hence, it is an institutional element - it is a man-made, non-technological factor exogenous to each of the decision-makers whose behavior it influences but endogenous to all of them. Cultural beliefs are an institutional element that motivates individuals to follow a particular behavior. In the US one is provided with an incentive to drive on the right by the expectation that other drivers will do likewise and thus it is safer.

The only cultural beliefs that can be held, acted upon, and not be refuted by this behavior and its implications are those that correspond to self-enforcing behavior and are confirmed by their observed implications. Each member of the society, taking these cultural beliefs as given in considering the best behavior to assume, finds it optimal to act in a way that conforms to these beliefs, and thereby leads others to act in the same way and further reaffirm or reproduce these beliefs.

Yet if each player expects others to play a self-enforcing and hence an equilibrium strategy, is there any analytical benefit from distinguishing between strategies and cultural

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<sup>17</sup> "Institutionalization" is the process whereby social practices become sufficiently regular and continuous to be described as institutions. Abercrombie, et. al., 1994: 216.

beliefs? An important contribution of distinguishing between strategies and cultural beliefs is that it highlights the distinction between strategies - plans of actions - and beliefs about what actions others will take. The institutions-as-rules approach concentrate on the former. But it is the latter, beliefs about others' behavior that motivate individuals to either follow or ignore a particular rule of behavior. Game theory highlights the centrality of beliefs in institutional analysis: identifying institutions with rules - rules of behavior or rules of the game - is usually insufficient for comprehending patterns of behavior.

An important benefit of distinguishing between equilibrium behavior and cultural beliefs is for the study of institutional dynamics. (Part VI.) While strategies that are properties of games, cultural beliefs are properties of individuals in the sense that they once they were crystallized with respect to specific game they would affected decisions in historically subsequent strategic situations. Past cultural beliefs, for example, provide focal points and coordinate expectations, thereby influencing the trajectory of institutional development.

In sum, game theory equilibrium analysis enables us to explore behavior and beliefs behavior that can prevail as self-enforcing outcomes. This institutions-as-equilibria perspective helps us study how behavior, beliefs, and social positions are generated endogenously by restricting them to be associated with an equilibrium. Each individual's behavior is the best he or she can do given the behavior and expected behavior of others. If members of a society share the belief that a particular equilibrium behavior will be followed, each of them is thereby motivated to follow it as well. Equilibrium analysis thus captures the interdependencies between one's optimal behavior and the behavior and expected behavior of the other players. In equilibrium, only beliefs that lead to self-enforcing behavior can prevail (Greif 1993, 1994a; Calvert 1995; Aoki 2001).

Calvert (1995: 59) has nicely phrased the idea: "In the institutions-as-equilibria approach, ... the game is just a description of underlying physical realities: if people behave in a certain combination of ways, nature responds with certain goods or conditions. Any additional structure "instituted by the collectivity" must be described as the behavior patterns of individuals and their expectations about the behavior of others. These patterns of behavior and expectation must be consistent with utility maximization by each individual." If "the underlying game (that is, nature) does not set apart any individual players as having special opportunities or powers

[that is, a social position], then such role differentiation can be maintained only as part of an equilibrium.”

#### **4.7 Common Knowledge, Internalized Cultural Beliefs, and Mental Models**

The point of departure for (classical) game theory is that the rules of the game are common knowledge and it is common knowledge that the players will choose their best responses.<sup>18</sup> This common knowledge assumption is often considered central to the consistency of the game-theoretic analysis. If it is not common knowledge that the other player is rational, how can one anticipate his course of action? This assertion, however, is misleading. Outcomes consistent with game-theoretic analysis have been observed in interactions among animals and were found in simulations of interactions among machines programmed to be non-rational. Analytically, a sufficient condition for players' choices to constitute a Nash equilibrium is often that each player is rational (in the sense of choosing a best response), knows his own payoff function, and knows the strategy choices of the other players.<sup>19</sup>

In any case, game theory highlights the importance of knowledge in decision-making. Equilibrium outcomes are very sensitive to the details of a situation, and hence to what people know or think they know about it, and to what each believes the other believes about it. The relevant knowledge here is about the structure of the game, such as who the players are or what the set of feasible actions is, as well as knowledge about the magnitude of various parameters, such as time-discount factors and outside options.

What people know and believe is true about a situation can thus have an important influence on possible outcomes. How do people acquire such beliefs? Hayek (1960: 69) has noted that institutions embody and provide individuals with the knowledge required for making choices. Institutions are “devices to cope with our constitutional ignorance.” They reflect,

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<sup>18</sup> S is common knowledge if all players know S, all players know that all players know S, and so on ad infinitum. Lewis 1969.

<sup>19</sup> For the original statements regarding the importance of common knowledge, see Aumann 1987. For a later analysis, see Aumann and Brandenburger 1995.

embody, and distribute a society's knowledge and cognition. This knowledge, using the terminology of section 3.2.1, is embodied in a particular institutional element - internalized cultural beliefs. These are beliefs shared among members of a society about the structure of various situations and the relationship between actions and outcomes that do not depend on the behavior or expected behavior of others.

In cognitive science such belief systems are often referred to as shared mental models (e.g., Denzau and North 1994; Eysenck and Keane 1995). Mental models constitute a person's understanding of the causal nature of a system and are used by that person to predict events and the relationship between actions and outcomes. Such models are usually incomplete and may even be ad hoc. When studying a strategic situation, a relevant mental model would be one's knowledge of, and beliefs about, the structure of the game. This knowledge may differ from the objective rules of the game: one may not understand the possibilities or implications of taking certain actions. Furthermore, one may believe some subjective rules to be true, even though their relevance to the situation at hand cannot be proven scientifically or demonstrated by experience. Religious beliefs and myths are examples of these kinds of rules.

Where do such beliefs or mental models come from and how do they become shared knowledge in a society? What is the contribution of game theory to deductively restrict such beliefs and mental models?

As discussed in chapter 3, research and common sense indicate the importance of a particular institutional element: rules. Socially transmitted rules contain, transmit, and propagate knowledge among members of a society, thereby leading its members to hold particular beliefs about the world around them. While further discussion of this role of rules is presented in chapter 7, the discussion here is concerned with the contribution of game theory to the study of shared beliefs about a situation. How does game theory facilitate studying internalized beliefs and their implications?

Game theory enables us to formally incorporate internalized beliefs or mental models in the presentation of a strategic situation as a game. It provides a formal framework capturing what people believe regarding the fundamentals of a strategic situation by incorporating these beliefs into the rules of the game relevant to their decision-making. (Which may differ from the "real" or objective rules of the game.) Furthermore, game theory enables us to study the

implications of such beliefs by restricting the set of admissible behavior cultural beliefs and behavior to those that are self-enforcing given these internalized beliefs. Note that such an analysis implies that we can restrict the set of admissible internalized beliefs to those that are not refuted by the behavior they imply. We can impose **consistency** between beliefs that are incorporated into the rules of the game, self-enforcing beliefs and behavior that can prevail within the implied rules of the game, and the new information and knowledge that this behavior implies.

In economics, such an analysis is conducted within the framework provided by evolutionary and learning game-theoretic models.<sup>20</sup> In these analyses it is postulated that there is an objective reality - an environment - within which individuals interact. Each of these individuals, however, has only a limited perception of the situation and accordingly behaves as if the game corresponds to their beliefs. Furthermore, these individuals have an ability, although limited, to learn, adapt, experiment, or evolve in response to observable outcomes. Some individuals or their offspring will change their beliefs regarding the situation or their behavior to improve their lot, given the information revealed during the progression of the game. Hence, the beliefs and behavior of these individuals change over time based on their experiments, learning, mutations, and imitations.

This analytical framework enables us, in principle, to evaluate consistency by examining the extent to which decision-makers with limited knowledge of the rules of the game are able to either learn about the actual structure of the game or act as if they really know the game. The result of this research agenda has been that under a wide set of conditions, evolutionary and learning models result in the individuals' behavior which corresponds to an equilibrium in the classical game-theoretic sense. In other words, in the steady-state of the system - when the learning or evolutionary processes ceased yielding changes in beliefs and behavior - individuals

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<sup>20</sup> See the seminal works by Kandori, Mailath, and Rob 1993; Young 1998. For recent surveys, books, and contributions, see Dosi et al. 1996; Marimon 1997; Fudenberg and Levine 1998; Samuelson 1997; Weibull 1995; Hart 2001. For survey of related experimental results, see Hagel and Roth 1995. But see Kurz 1994 regarding the process and indeterminacy of mental models and Ellison 1993 regarding their possibly slow rate of convergence.



either learned the relevant aspects of the situation or evolved to act as if they did. Furthermore, their behavior corresponds to an equilibrium play.<sup>21</sup>

Evolutionary and learning models assume that an objective reality exists and study the ability of individuals to learn about and respond to the actual rules of the game. But humans have the capacity to construct subjective notions of a situation. An example of such a subjective construction of games is belief in God and in the afterlife response to various actions one has taken in this world. The game-theoretic framework as described so far, places a mild restriction on the set of such subjective beliefs. The set of admissible beliefs is restricted to those that cannot be refuted by information revealed during the play of the game. Recently, deductive game theory (Matsui et al. 1998) and subjective game theory (Aoki 2001) have begun trying to use game theory to further restrict the set of admissible beliefs but so far without reaching any general results.

The next two chapters illustrate the usefulness of this analytical framework for a positive, empirically-oriented institutional analysis.

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<sup>21</sup> Game-theoretic models and evolutionary and learning models are complementary theoretical frameworks as is evident from the use of the latter to evaluate the appropriateness of the Nash equilibrium concept.

## **&Chapter 5 Institutions, Trust, and Agency: the Maghribi Traders**

Without the ability to exchange, the potential for growth is rather limited. Indeed, the historical process of European economic growth is marked by ever-expanding exchange relations. The contribution of an enhanced ability to exchange went beyond its direct economic impacts as, for example, the late Medieval European commercial revolution from the eleventh to the fourteenth centuries led to fundamental social and political changes. (E.g., Lopez 1976, Pirenne 1939, 1956). Yet not much is known about the historical institutional developments that enabled exchange relations to expand, even though such knowledge can shed light on the nature and evolution of modern institutions and facilitate the understanding of the institutional transitions that developing economies still face.

Few studies have attempted to examine analytically various aspects of the pre-modern institutions that supported exchange during the late medieval commercial revolution and this book reviews most of these studies. This chapter, in particular, is concerned with an institution that surmounted a commitment problem intrinsic in the relations between merchants and their overseas agents. In pre-modern trade, a merchant had to organize the supply of the services required for the handling of his goods abroad. He could either travel along with his merchandise between trade centers or hire **overseas** agents to supply the services. Employing agents was efficient, since it enabled the merchant to save the time and risk of traveling, to diversify his sales across trade centers, and so forth. Without supporting institutions, agency relations are not likely to be established since the agents can act opportunistically and embezzle the merchant's goods. Anticipating this behavior, a merchant will not hire agents, and efficient cooperation is not initiated. The importance of this organizational problem for pre-modern trade efficiency is reflected in the fact that merchant-agent relations are present in all the main forms of business association employed during that time.

This chapter examines the institution that enabled eleventh century Mediterranean traders to overcome this commitment problem.<sup>22</sup> An historical source found in Fustat (Old Cairo) known as the *geniza* ("deposit place" in Hebrew), contains about a thousand contracts, price lists, traders' letters, accounts, and so forth, that reflect eleventh century trade in the Muslim

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<sup>22</sup> This chapter based on Greif 1989, 1993.

Mediterranean.<sup>23</sup> These documents were written by Jewish traders, known as the Maghribi traders (the Maghrib is the Muslim world's West), who operated mainly, but not exclusively, in the western basin of the Mediterranean. The Maghribi traders had the custom of depositing in the *geniza* of a Fustatian synagogue every document that was written in Hebrew characters. Since they conducted their commercial correspondence in Judaeo-Arabic – an Arabic dialect written in Hebrew characters – it is reasonable to conjecture that the documents found in the *geniza* contain a representative sample of their commercial correspondence.<sup>24</sup>

The hypothesis advanced in this chapter is that agency relations among the Maghribi traders were governed by an institution that might be called a coalition, a social network within which a multilateral reputation mechanism was at work. Particular cultural beliefs, code of conduct, and a specific information-transmission mechanism endogenous to the group but exogenous to each of its members motivated and enabled each trader to act in a particular way. In particular, they supported the operation of a reputation mechanism that enabled the Maghribis to overcome the commitment problem associated with the operating through overseas agents. This reputation mechanism, in turn, reinforced the beliefs on which the coalition was based, motivated traders to adhere to their code of conduct, and led to entry and exit barriers which ensured the sustainability of the coalition, the organizational structure within which each trader operated. An examination of this coalition casts light on several related issues in this historical episode such as the determinants of business practices, the interactions between social and economic institutions, the nature of the Merchants' Law, and the role of history in institutional evolution.

Historical documents rarely lend themselves to institutional analysis, and the *geniza* is no exception. Furthermore, due to its nature, the type of institutional analysis conducted here is not likely to generate hypotheses that can be verified statistically. (See discussion in Part IV.)

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<sup>23</sup> For an introduction to the *geniza*, see Shelomo Dov Goitein 1967a, introduction. For the system of reference to a *geniza* document, see Goitein 1967a or Moshe Gil 1983b, or Greif 198

<sup>24</sup> Goitein 1967a, p. 149. On Judaeo-Arabic, see Joshua Blau 1961, 1965.

Accordingly, this study employs the historical documents to evaluate the importance and attributes of the agents' commitment problem, and then uses this information to construct an explicit game theoretical model that captures the essence of this problem. The combined analysis of this model and the historical records yields an hypothesis regarding the relevance of particular cultural beliefs. Once these are recognized, the model is extended to generate predictions about facts other than those assumed in the model that are reflected in the historical records. Confronting these predictions with the historical evidence supports the accuracy of the conjectures about the nature of the coalition and provides additional insights.

The rest of this chapter is organized as follows: The first section provides the general background concerning trade and business associations among the Maghribi traders. The second section discusses the commitment problem that curtailed agency relations and the role of the reputation mechanism in circumventing this problem. The third section models the commitment problem and examines the efficiency of the strategies used by the Maghribi traders and whether they constitute an equilibrium. The fourth section presents the coalition and employs the model to generate predictions that substantiate the claim that agency relations were governed by the coalition and highlights different aspects of it. The fifth section presents the endogenous information structure within the network. The sixth section discusses the role of the Merchants' Law as coordinating behavior among the Maghribi traders. Conclusions follow.

## **5.1 Commerce, Overseas Agents, and Efficiency**

The *geniza* indicates that eleventh century Mediterranean trade was free, private, and competitive, with no official restrictions fettering migration or the transfer of raw materials, finished goods, or money across the Mediterranean.<sup>25</sup> Within each trade center commercial transactions were conducted competitively. In bazaars and storehouses buyers and sellers negotiated and competed over prices using brokers, open bid auctions, and direct negotiation. (Goitein 1967a: 157, 187, 192 ff.) However, trade was characterized by uncertainty. Prices, for example, were subject to large variations as a result of the production and communication

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<sup>25</sup> See Gil 1983b, vol. 1: 257-58; Goitein 1967a: 29-35, 266-72; Lewis 1951: 189 ff..

technologies of the period.<sup>26</sup> Commercial relations between different regions also contributed to price fluctuations, since all the countries around the Mediterranean constituted one trade region connected by sea and land caravans. Thus, changes affecting business in one country were felt abroad. However, price fluctuations were not the only factor that contributed to commercial uncertainty. It resulted also from uncertainty with respect to the duration of the ship's voyage, whether the ship would reach its destination, the condition in which the goods would arrive, the cost of storage, and so forth.<sup>27</sup>

Eleventh century trade is reflected in the *geniza* through documents written by the Maghribi traders. These were the descendants of Jewish traders who left the increasingly politically insecure surroundings of Baghdad and emigrated to North Africa during the tenth century. Each of the several dozen traders mentioned in the documents invested in merchandise worth several hundred to several thousand dinars - substantial sums considering that the monthly expenses of a middle class family in Fustat were between two and three dinars.<sup>28</sup> To cope with the uncertainty and complexity of trade, the Maghribi traders operated through **overseas agents**. An overseas agent is anyone who supplies the services required for a commercial venture while the capital, profit, or both are shared with a merchant located in a different trade center. (Henceforth the term "merchant" will be used to denote an individual who receives the residual revenue after the agent receives his compensation. The term "trader" will refer to both agents and merchants.)

Agents provided merchants with many trade related services which included loading and unloading the ship; paying the customs, bribes and transportation fee; storing the goods; transferring the goods to the market; and deciding when, how, and to whom to sell the goods and at what price and at which credit terms. (Goitein 1967a: 166.) Agency relations among the

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<sup>26</sup> See, for example, Dropsie 389, a, ll. 4-5, b, ll. 27-28, Moshe Gil 1983a: 113-25. See also Goitein 1967a: 301 ff. And Greif 1985: 92.

<sup>27</sup> See Goitein 1967a: 148 ff. 200-1, 273 ff.; Greif 1985: 3, 69-78; Stillman 1970: 70 ff..

<sup>28</sup> Goitein 1967a: 214 ff.; Gil 1983b, vol. 1: 200 ff.; Greif 1985: 73-76. For expenses, see Goitein 1967a: 46; Gil 1983a: 91.

Maghribis were extremely flexible, as merchants operated through several agents at the same time and even at the same trade center, and seem to have been at ease initiating and canceling agency relations following the needs of their complex and uncertain occupation (e.g., Stillman 1970; Greif 1985).

Agency relations enabled the Maghribi traders to reduce the cost of trade by better allocating risk through diversification, by benefitting from agents' expertise, and by shifting trade activities across trade centers, goods, and time. Agency relations enabled merchants to operate as sedentary traders, thus saving the cost and risk of the sea journey, and enabled traveling merchants to gain from relying on agents to handle their affairs in their absence. (Greif 1985, 1989, Goitein 1967a).

The efficiency gain from operating through agents is impossible to assess quantitatively. However, the superiority of pre-modern trade systems in which cooperation through overseas agents prevailed over those in which it did not has been recognized by many scholars.<sup>29</sup> Furthermore, the Maghribi traders themselves perceived that operating through agents was crucial for business success. This is reflected in the extent to which they established agency relations and by traders' statements. For example, one trader wrote to his business associate who served as his overseas agent that "all profit occurring to me comes from your pocket," while another mentioned that in trade "people cannot operate without people."<sup>30</sup>

## **5.2 The Commitment Problem and Reputation Based Community Enforcement Mechanism**

Agency relations among the Maghribis were characterized by a commitment problem. Efficiency was enhanced by letting an overseas agent transact business with capital he did not own. When the capital was in his possession, however, he could embezzle it. Without a supporting institution, merchants anticipating opportunistic behavior would not operate through

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<sup>29</sup>De Roover 1965: 43, 45 ff., 70 ff.; Postan 1973: 66 ff.; Lopez and Raymond 1955: 174.

<sup>30</sup> DK 22, b, l.18, Gil 1983a: 97-106; TS 13 J 25, f. 18, Goitein 1967a: 164. For extent of agency relations through business associations, see Stillman 1970, Michael 1965.

agents, thus mutually beneficial exchanges would not be carried out. To gain from cooperation there was a need for an institution capable of surmounting this commitment problem, an institution through which an agent could commit himself *ex ante*, before receiving the merchant's capital, to be honest *ex post*.<sup>31</sup>

The historical records implicitly indicate the existence of such an institution among the Maghribis, as agency relations were the rule rather than the exception. Further, agency relations as reflected in the *geniza* were characterized by the prevalence of trust. Despite the many opportunities for agents to cheat, only a handful of documents contain allegations of misconduct.<sup>32</sup> How was the merchant-agent commitment problem resolved?

There are situations in which a legal system surmounts a commitment problem. The historical evidence, however, suggests that this was not the case among the Maghribi traders. Many, if not most, of the agency relations reflected in the *geniza* were not based on legal contracts. Only a few documents indicate that commercial disputes between merchants and agents were brought before the court, and the operation of the court in these cases seems to be expensive and time consuming.<sup>33</sup> For example, sometime around the turn of the eleventh century Hillel ben Isaac served as an agent for Nahum AlHazan. About half a century later, in 1065, Nahum's two grandsons applied to the court, suing Hillel for what they claimed he still owed their late grandfather. In their letter they mentioned that they had "nominated Rabbi Maṣṣliah some time ago" to represent them in court – a nomination that probably took place sometime

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<sup>31</sup> Were a merchant to sell the benefits from a particular trade venture, or the "business" as a whole to an overseas agent, he would have to become the agent. Selling it to a local agent meant losing the advantages of an overseas agency.

<sup>32</sup> See Shelomo Dov Goitein 1973: 7. In less than 5% of the approximately 250 documents examined for this study, mis-conduct is mentioned. This was not the case in Italy, where allegations of mis-conduct are well reflected the historical records. E.g., de Roover 1965: 88-9.

<sup>33</sup> On the cost of litigation, see Bodl. MS Heb., a3 f.26, Goitein 1973: 97.

before 1038.<sup>34</sup> Furthermore, the court also faced difficulties in tracking down agents who emigrated.<sup>35</sup>

Most likely the legal system was not used to mitigate the merchant-agent commitment problem, mainly due to the asymmetric information that characterized agency relations. Because of the complexity and uncertainty of long-distance commerce, the outcome of a commercial transaction depended on many realizations that could not be directly observed either by the merchant or by the legal system (Greif 1989). Further, since the timing of ships' departures depended on weather conditions, a report concerning the results of commercial transaction sent by an agent reached the merchant a few months after the transaction had taken place. Hence, a merchant who believed that he had been cheated could only sue the agent several months after the transaction had been completed. How could the court, several months later, verify the condition of the goods upon their arrival, the price received for the goods, the amount of the bribe given in the port, the cost of delivery, whether the goods were stolen from the agent's warehouse, and so forth?<sup>36</sup> Furthermore, the Jewish law restricts the ability to sue agents. For example, an agent entrusted to buy certain items cannot be sued for "bringing [to the merchant] an item worth 1 [dinar] for [which he charges the merchant] 100 [dinars]."<sup>37</sup> Indeed, in 1095 an agent who received 70 dinars reported that he had lost all but 20 dinars. The furious merchant,

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<sup>34</sup> TS 10 J 4, f. 4, Greif 1985, appendix: 5-7. For other examples, see Bodl. Ms. Heb. f. 42, S. Poznanski 1904: 171-72; TS 20.152 and Bodl. MS Heb. a3 f.9, Gil 1983b, vol. 2: 724-32; Bodl. MS Heb., a3 f.26, Goitein 1973: 97. On Rabbi Maşliah and the timing of his nomination, see Greif 1985. For a similar situation in fifteenth century Italy, see De Roover 1965: 88.

<sup>35</sup> Goitein 1967a: 439, n. 39; Maimonides 1951: 210.

<sup>36</sup> For the dependency of trade venture's outcome on these factors see, for example, TS 20.122, b. l. 10. Dropsie 389, a, ll. 21-23, Gil 1983a: 113-25; TS 10 J 10, f. 30, ll. 11-12, Gil 1983b, vol. 3: 193; Bodl. MS Heb. a3, f. 26, Goitein 1973: 98, sect. B; Greif 1985: 96, n. 62.

<sup>37</sup>Maimonides, 1951, p. 208. See additional discussion in Greif 1989.



although certain that he had been cheated, was unable to sue the agent since his claim did not have any legal base.<sup>38</sup>

The conviction of the furious merchant that the agent had cheated him was, most likely, based on information which enabled him to imperfectly monitor the agent. A Maghribi merchant was associated with many Maghribi traders residing in different trade centers, and it was customary to reciprocate in the supply of trade-related information that was so crucial to business success. Reciprocity, most likely, prevented "free riding" on these information flows.<sup>39</sup> These information flows within the Maghribis traders group, as well as a merchant's experience, circumvented to some extent the asymmetric information between merchants and agents and enabled the former to monitor the latter.<sup>40</sup> The ability to monitor, however, was most likely imperfect in the sense that a merchant could also be mistaken in concluding that his agent was dishonest. For example, around the middle of the century Maymun ben Khalpha of Palermo sent a letter to Naharay ben Nissim of Fustat. Discussing a conflict that Naharay had with one of his agents, Maymun makes clear that in contrast to Naharay he contends that the agent was honest and should not be accused of cheating.<sup>41</sup>

The theory of repeated games with imperfect monitoring illuminates how a commitment problem can be surmounted in the absence of an effective legal system. According to the theory of repeated games, the commitment problem can be mitigated by endogenously motivating an agent to be honest out of desire to retain his position as an agent. To make this position attractive, the merchant must create a gap between the expected lifetime utility of an agent

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<sup>38</sup> TS 13 J 2, f. 5, Goitein 1967a: 176.

<sup>39</sup> E.g., TS 20.76; TS 13 J 15, f. 9, Goitein 1973: 113-19, 320-22; TS 10 J 11, f. 22, a, 11. 11-12, Goitein 1967a: 195, 201 ff.; Greif 1985: 133, 95, n. 60. For the importance of information flow for commercial success see, for example, Dropsie 389, a, 11. 2-4, Gil 1983a: 113-25; Michael 1965, Gil 1983b, vol. 3: 96 ff..

<sup>40</sup> E.g., DK 22, a, ll. 11, ff., Gil 1983a: 97-106; ULC Or 1080 J 42, Gil 1983b, vol. 3: 300. E.g., TS Box Misc. 28, f. 225, Gil 1983b, vol. 3: 96-101).

<sup>41</sup> DK 22, b, l. 5 ff., Gil 1983a.

employed by him and the agent's best alternative elsewhere. To do so the merchant has to provide the agent a premium; for example, he can pay him a wage premium.<sup>42</sup> Of equal importance is the rule of conduct established between merchant and agent, under which the merchant threatens to fire the agent and never operate through him again if he discovers that the agent has ever cheated.<sup>43</sup> Given a premium and this rule of conduct, a dishonest agent can earn a short-run gain by cheating while an honest agent will earn a long-run gain by being paid a premium. An agent acquires the reputation of an honest agent if it is known that the long-run gain is not less than the short-run gain.<sup>44</sup> The agent can not increase his lifetime utility by cheating. The merchant will offer the agent an optimal premium -- the lowest cost premium for which the long-run gain is not less than the short-run gain.<sup>45</sup> When the actions taken by the agents can be only imperfectly monitored, however, there is a positive probability that an agent, although honest, will be considered a cheater. To sustain cooperation it may be optimal to punish the agent for a specific period of time during which he collaborates in his own punishment.<sup>46</sup>

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<sup>42</sup> That is, above the wage that the agent can get elsewhere.

<sup>43</sup> Note that it is assumed that there is some positive probability that the merchant will be able to detect deviation. See below on the mechanism employed by the Maghribi traders to balance the asymmetric information.

<sup>44</sup> Roughly speaking, a player's reputation is a function from past history to a probability distribution over his strategies. See discussion and applications in Milgrom and Roberts 1982; Shapiro and Stiglitz 1984; Kreps 1990a; Williamson 1985: 121, 138 and Joskow 1984: 14; Nelson 1974; Klein and Leffler 1981; Shapiro 1983; Akerlof and Yellen 1986.

<sup>45</sup> For the theory of collective enforcement, see Kandori 1992; Okuno-Fujiwara and Postlewaite 1990; Bendor and Mookherjee 1990. These theories differ from the one explicitly developed below. See also the general discussion in Klein 1996.

<sup>46</sup> See Green and Porter 1984; Abreu, Pearce, and Stacchetti 1986, 1990; Fudenberg, Levine, and Maskin 1989. For an excellent recent survey, see Pearce 1991.

The above theory points to an arrangement which can improve upon this simple reputation mechanism.<sup>47</sup> Agency relations can be organized within an economic institution that may be referred to as a "coalition." That is a nonanonymous organizational framework through which agency relations are established only among agents and merchants with a specific identity ("coalition members"). Relations among the coalition members are governed by a code of conduct which states that each coalition merchant will employ only member agents and will pay them the optimal premium.<sup>48</sup> Moreover, all coalition merchants agree never to employ an agent who cheated while operating for any coalition member. Furthermore if an agent who was caught cheating operates as a merchant, coalition agents who cheated in their dealing with him will not be considered by other coalition members to have cheated.

This code of conduct improves upon the simple reputation mechanism. It reduces the optimal premium that a merchant has to pay an agent to keep him honest, all other things being equal.<sup>49</sup> In addition, this code of conduct enables merchants to employ agents for assignments which both parties know ahead of time will be of short duration. Since an agent who considers cheating a specific merchant risks his relations with all the coalition members, the agent's lifetime expected utility is rather robust with respect to the length of his associations with a specific merchant. Hence the optimal premium is independent of the ex ante known length of his relations with a specific merchant.

While theoretical considerations can generate many hypotheses, one has to look at the evidence to verify any postulate. The *geniza* contains direct evidence to the operation of the coalition suggests that a reputation mechanism governed agency relations and, in particular, that merchants conditioned future employment on past conduct, practiced community punishment,

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<sup>47</sup> An improvement means a reduction in the optimal premium -- a reduction that has efficiency, in addition to distributional, implications.

<sup>48</sup> The coalition, however, is not a monopsony in the usual sense of the term since, as described below, a Maghribi trader usually operated as a merchant and an agent at the same time.

<sup>49</sup> Since it reduces the probability that a cheater will be able to receive the premium somewhere else.

ostracized agents who were considered cheaters until they compensated the injured, and that agents were ready to forgive current gain to sustain their good standing in the merchants' group.

Evidence of collective punishment within the coalition is found in two letters dated 1055. According to the letters, an agent who lived in Jerusalem, Abun ben Zedaka, was accused (although not charged in court) of embezzling the money of a Maghribi trader. When word of this accusation reached other Maghribi traders, merchants as far away as Sicily canceled their agency relations with him.<sup>50</sup> In the first decade of the eleventh century Samhun ben Da'ud, a prominent trader from Tunisia, sent a long letter to his business associate, Joseph ben 'Awkal of Fustat. The letter reflects the traders' awareness of the importance of the implicit contract in governing their relations. Joseph made this point clear when he made his future dealings with Samhun conditional upon his record: "If your handling of my business is correct, then I shall send you goods."<sup>51</sup> Conditioning future relations upon past conduct--the essence the reputation mechanism--is well reflected here.

The use of economic, rather than social, sanctions and the expectations for collective punishment among the coalition members are also revealed in this letter. Joseph believed that Samhun had not remitted his revenues on time and imposed economic sanctions against him by not providing him with agent's services. He ignored Samhun's request to pay two of Samhun's creditors in Fustat and failed even to inform them of Samhun's request. By the time Samhun found out about it, "... their letters filled with condemnation had reached everyone." The content of these letter caused Samhun to complain that "my reputation [or honor] is being ruined."<sup>52</sup>

The letter also reveals why agency relations were established, and sheds light on their nature. Economic interdependence, not internalized norms regarding mutual help or altruism, motivated the parties. Samhun's words suggests that agents received a "premium" through a "wage premium" and a "capital premium." He cited two reasons for acting as Joseph's agent. The

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<sup>50</sup> TS 13 J 25, f. 12; TS 12.279; see also TS 8 J 19, f. 23; all published by Gil, 1983b, vol. 3, pp. 218-33.

<sup>51</sup> DK 13, a, l. 41; Stillman 1970, no. 16.

<sup>52</sup> Ibid, a, ll. 26 ff.

first was his desire to receive the agent's share in the profits. He complained that he had been inadequately remunerated: "... you did not think that I should have a profit through you of even 10 dinars. Although you have made through me ten times as much." Elsewhere he mentions that he sold Joseph's pearls for 100 percent profit, and adds, "Should I not have taken one quarter of the profit?"<sup>53</sup>

Samhun also sought to maintain mutual relations with Joseph in order to increase the expected value of his capital. "What I do need is the benefit of your high position and for you to take care on my behalf..." he writes, "... it is my desire to avail myself of your high standing for those things which I send to you...."<sup>54</sup> Note that the ability of the merchant to create a gap between the future utility stream of an honest agent and that of a cheater is achieved here through the merchants' ability to control the expected income stream from the agent's capital.

The businesslike nature of the relations between Joseph and Samhun and the imposition of economic sanctions against Samhun and Abun ben Zedaka suggest that loss of reputation led to a reduction in a cheater's lifetime expected income. Further evidence is found in a document dated 1041/42 in which a trader from Fustat accused his Tunisian agent of having failed to remit the revenues from a certain sale. As a result of the accusation, so the agent complained, "the people became agitated and hostile to [me] and whoever owed [me money] conspired to keep it from [me]."<sup>55</sup> This incident suggests the economic nature of the punishment imposed upon a cheater by the members of the coalition and reveals why coalition members participated in punishing a deviator. Since traders usually acted as both merchants and agents, they maintained "open accounts" with other traders, that is, accounts that were cleared only periodically. When an agent was rumored to be in trouble, traders feared that he would not be able to pay his debts. Thus, as a preventive measure, they ceased sending him goods and held on to the money they owed him.

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<sup>53</sup> DK 13, b, ll. 12-13, 20-21, Stillman, 1970, pp. 267 ff., and Goitein, 1973, pp. 26 ff..

<sup>54</sup> Ibid, a, l. 32 and a, l. 43.

<sup>55</sup> Bodl. MS Heb a 2 f. 17, Sect. D, Goitein, 1973, p. 104.

The deterrent effect of the implicit contract within the coalition is clear from an incident described in a letter sent from Mazara (Sicily) in 1059. The writer had sold flax illegally (before the ships had arrived and the trading season officially opened) in Sfax (Tunisia), receiving an average price of 13 dinars a load. By the time the ships arrived, the price had dropped to 8 dinars a load and the buyers refused to pay the agreed price. Eventually the buyers paid, solely out of fear of losing their reputations. As the seller wrote, "we were lucky...if not the honor...we wouldn't have received a thing...."<sup>56</sup>

A letter sent around 1050 from Maymun ben Khalpha of Palermo (Sicily) to Naharay ben Nissim of Fustat also suggests that relations between a particular agent and merchant were of concern to other coalition members. Discussing a conflict that Naharay had with one of his agents in Palermo, Maymun writes, "You know that he is our [the Maghribi traders'(?)] representative [so the conflict] bothers us all."<sup>57</sup> Another letter, sent around 1060, confirms the functioning of a deterrent effect induced by the relations between the traders. In this letter an agent justifies his actions, which caused some loss to the merchant, on the ground that he did not want people to say that he did things that contradicted the merchant's instructions.<sup>58</sup>

The linkage between past relations with one merchant and future relations with another is also suggested by a letter sent in the middle of the eleventh century from Palermo (Sicily) to Yeshu`a ben Isma`il in Alexandria. The writer, a respectable merchant, was disappointed with his partner's performance: "Had I listened to what people say, I never would have entered into a partnership with you ...."<sup>59</sup>

The same letter contains additional evidence on the importance of reputation within the coalition. The merchant describes how he handled the sale of two loads of pepper--one for himself and the other belonging to his partner. The pepper price was very low: "... I held it [the

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<sup>56</sup> Dropsie 389, b, ll. 22 ff., Gil, 1983a, pp. 113-25. See also Bodl. MS Heb a3, f. 26 and ULC Or 1080 J 42, Goitein, 1973, pp. 97, 92-95.

<sup>57</sup> DK 22, b, l. 5 ff., Gil, 1983a, pp. 97-106.

<sup>58</sup> Bodl. MS Heb. d 66, f. 60, a, margin, ll. 7-9, Gil, 1983b, vol. 3, p. 216.

<sup>59</sup> Bodl MS Heb a3 f. 13, Goitein, 1973, p. 123.

pepper] until the time when the sailing of the ships approached in the hope it would rise. However, the slump got worse. Then I was afraid that suspicion might arise against me and I sold your pepper to Spanish merchants for 133 [quarter-dinars].... It was the night before the sailing of the ships . . . pepper had become much in demand ... [since] boats [with buyers] arrived.... Thus, it [the pepper] was sold for 140-142 [quarter-dinars]. I took collateral for the sale of my pepper at 140-142. But brother, I would not like to take the profit for myself. Therefore, I transferred the entire sale to our partnership...."<sup>60</sup> The merchant decided to share the profits to maintain his reputation, which is all the more interesting because the merchant did not intend to do business with his partner in the future: "... settle my account with yourself and give the balance to my brother-in-law," he wrote, "for you are a very busy man...." Thus the merchant acted honorably solely to maintain his reputation with the other coalition members.

Finally, the *geniza* indicates that if an agent who had been accused of cheating were to receive agency services from other Maghribi traders, they could cheat him free from community retaliation. The words of a Tunisian merchant who was accused in 1041-1042 of cheating exemplify this. That merchant complains that when it became known that he had cheated, "people became agitated and hostile to [me] and whoever owed [me money] conspired to keep it from [me]."<sup>61</sup>

Agency relations among the Maghribi traders were characterized by a commitment problem in the presence of asymmetric information regarding agents' conduct. The evidence suggests that information flows among the Maghribis mitigated information asymmetry and enabled merchants to imperfectly monitor their agents. The theory of repeated games with imperfect monitoring indicates that cooperation in agency relations could have been sustained by conditioning future patterns of cooperation on the history of the relations. Indeed, the historical records indicate to the operation of informal community enforcement mechanism which was based on this principle.

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<sup>60</sup> Ibid.

<sup>61</sup> Bodl. MS Heb a 2 f. 17, Sect. D, Goitein 1973: 104. See also Greif 1989.

Yet, many questions should be addressed: Why was the community punishment self-enforcing? Why was a boycott effective? Why was it not undermined by agents' ability to seek employment by non-Maghribis? Why was the merchants' commitment to future employment of honest agents credible despite the (potential) temptation to hire non-Maghribi agents? What was the mechanism that coordinates punishment? After all, for a collective punishment to be effective, there must be a consensus about which actions constitute "cheating." In short, what was the exact nature of the institution that governed agency relations? The formal model presented in the next section provides the foundation for addressing this issue by enable us to exactly identify the cultural beliefs that prevailed among the Maghribis by exposing why the associated behavior was an equilibrium and what incentives it implied.

### **5.3 Model: The Agent Commitment Problem and Multilateral Punishment Strategy**

Constructing a model aimed at facilitating the examination of the actual functioning of a contract enforcement institution in a specific historical episode presents a methodological problem. Should the assumptions concerning the basics of the model be restricted only to those reflected in the historical records? Or is any assumption about the model which does not conflict with the evidence legitimate? The approach taken in this chapter is that the model should be based, to the extent possible on assumptions justifiable by the historical evidence, and the model with the least additional assumptions that can account for the phenomena under consideration should be used.

Thus, the model presented below does not impose the assumption which generates what is arguably the most intuitive explanation for collective punishment. That is, that merchants perceived an agent who cheated to be a of a "bad type" who will keep on cheating in the future if hired. (Sections 4.5, 10.2.) There is nothing in the evidence that directly justifies such an assumption or indirectly justifies it by indicating that an agent who had proven himself honest in the past was considered to be more likely to be honest in the future. On the contrary, there is evidence suggesting that merchants were likely to participate in collective punishment even when they believed that the agent was honest. In Maymun's letter mentioned above, Maymun makes clear that he believes that Naharay's agent was honest and "should not be accused [of cheating] ...." Yet, Maymun feared that if the agent would be openly accused it would affect his



relations with the agent, presumably since Maymun would have to participate in a collective punishment. "You know that he is our [the Maghribi traders'] representative [so the conflict] bothers us all."<sup>62</sup>

Further, a model based on agents' types seems unable to provide a satisfactory explanation for some historical phenomena. For example, as discussed below the Maghribis did not hold agency relations with Jewish Italian merchants although, ignoring agency cost, these were perceived by the Maghribis to be very profitable. A model based on agents' types can account for this behavior, but this requires either imposing strategies contingent on social affiliations or that members of one group could not verify whether a specific member of the other group ever cheated (that is, that a non-Maghribi could not "free ride" on the information generated among the Maghribis by observing actions). Neither possibility is appealing. There is no reason to believe that these Jews "discriminated" each other and whether a specific individual was serving as an agent could easily be verified since merchants could examine a ship's cargo, its ownership and destination (see Goitein 1967a: 336-7).

Whatever was the importance of asymmetric information regarding agents' types in accounting for the collective punishment practiced by the Maghribis, an efficiency wage, complete information model of the agent's commitment problem indicates to another mechanism which can support collective punishment and account for other historical phenomenon.<sup>63</sup> In this model, the collective punishment is feasible due to the availability of information, and self-enforcing due to an inter-link between expectations with respect to future hiring and the stream

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<sup>62</sup> DK 22, b, l. 5 ff., Gil 1983a: 97-106. Similar considerations led to the rejection of a model in which costly participation in collective punishment is supported since non-participation provokes retaliation. E.g., Pearce 1991; Kandori 1992.

<sup>63</sup> For efficiency wage models, see, for example, Shapiro and Stiglitz 1984; Akerlof and Yellen 1986.

of rent required to keep an agent honest. To simplify the presentation of the insights generated by this model, it abstracts away from imperfect monitoring.<sup>64</sup>

Consider a perfect and complete information economy in which there are  $M$  merchants and  $A$  agents, each of which live an infinite number of periods. Further, assume that  $M < A$ , and that agents have a time discount factor  $\delta$ . In each period, a merchant can hire an agent from the pool of unemployed agents, and each agent can be hired by only one merchant. A merchant who does not hire an agent receives a payoff of  $\kappa > 0$ . A merchant who hires an agent offers him a wage  $W$ . An employed agent can decide whether to be honest or to cheat. If he is honest, the merchant's payoff is  $\gamma - W$ , and the agent's payoff is  $W$ . (Hence, the gross gain from cooperation is  $\gamma$ .) If the agent cheats, however, his payoff is  $\alpha$  and the merchant's payoff is 0. After the allocation of the payoffs, the merchant can decide whether to terminate his relations with that agent or not. There is also the possibility that the merchant is forced to terminate the relation due to some exogenous reason, an event that can occur each period with probability  $\tau$ . An agent who is unemployed during some period receives the reservation utility,  $\bar{w} \geq 0$ . It is assumed that  $\gamma > \kappa + \bar{w}$ , (cooperation is efficient);  $\gamma > \alpha > \bar{w}$ , (cheating entails a loss, and an agent prefers cheating over receiving his reservation utility); and  $\kappa > \gamma - \alpha$ , (a merchant prefers operating by himself if the agent is to cheat him or to receive a wage  $\alpha$ ).

While the above formulation captures the essence of the agent's commitment problem, some elaboration on its details is in order. A merchant could initiate agency relations and since an employed agent held the merchant's capital, he was assured of receiving his wage. The need to shift commercial operations over places and goods, and the high uncertainty of commerce and life during the eleventh century curtailed a merchant's ability to commit himself to future wages

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<sup>64</sup> To capture also the asymmetry and imperfectness of information, as well as commercial uncertainty, the model presented below can be extended as follows: The revenue is observed only by the agent and is a random variable  $x$  with domain  $[a,b]$ . The agent reports a revenue realization  $y \in [a,b]$ . A wage is a contract which is a function of the agent's report,  $w:[a,b] \rightarrow [a,b]$ ,  $w(y) \leq y \forall y$ . The merchant observes the actual realization in probability  $f(y,x)$  where  $1 > f(\cdot) > 0$ ,  $\forall y \neq x$ , (information asymmetry), and  $f(\cdot) > 0$ , when  $x = y$  (imperfect monitoring).

or employment. Hence, the model assumes a stationary wage scheme (which was indeed practiced among the Maghribis) and a limited ability to commit to future employment. Like any other economic agents, the Maghribi traders did not enjoy an infinite lifespan. The results obtained from this infinite horizon model, however, are equivalent to those obtained from a finite horizon model with a constant probability of termination. Furthermore, among the Maghribi traders, relatives were considered morally responsible for each other's business dealings while traders' sons followed their fathers' occupation and were their old age "insurance policies".<sup>65</sup> Hence, the value of one's reputation did not diminish with old age. Intergenerational transfers insured a horizon long enough to support the operation of a reputation mechanism.

Consider a *Multilateral Punishment Strategy* combination (MPS) according to which a merchant offers an agent a wage  $W^*$ , rehires the same agent if he was honest (unless forced separation had occurred), fires the agent if he cheated, never hires an agent who has ever cheated any merchant, and (randomly) chooses an agent from among the unemployed agents who never cheated if forced separation had occurred. An agent's strategy calls for being honest if paid  $W^*$  and for cheating if paid less than  $W^*$ . Is MPS a sub-game perfect equilibrium (SGPE)? Will a merchant retaliate against an agent who did not cheat him?

To address these questions the wage,  $W^*$ , that will be offered by the merchants should be determined. For this aim, denote by  $h_h$  the probability that an unemployed honest agent, that is, an agent who was honest when last employed, will be rehired, and by  $h_c$  the probability that an unemployed cheater, that is, an agent who cheated when last employed, will be rehired. Proposition 1 presents the relations between the lowest wage for which an agent's best response is to be honest and the above parameters.<sup>66</sup>

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<sup>65</sup> See Goitein 1973: 60. Shelomo Dov Goitein 1978: 33 ff. noted that "both the government and public opinion were prone to hold a father, or brother, or even more distant relative responsible for a man's commitments, although strict law, both Islamic and Judaic, did not recognize such a claim."

<sup>66</sup> This specification enables the examination of the optimal wage under both MPS and BPS discussed below.

*Proposition 1.* Assume that  $\delta \in (0, 1)$ ,  $h_c < 1$ , and  $h_c \leq h_h$ . The **optimal wage**, the lowest wage for which it is an agent's best response to play honest, is  $W^* = w(\delta, h_h, h_c, \tau, \bar{w}, \alpha) > \bar{w}$ , and  $w$  is monotonically decreasing in  $\delta$  and  $h_h$ , and monotonically increasing in  $h_c$ ,  $\tau$ ,  $\bar{w}$ , and  $\alpha$ .<sup>67</sup>

*Proof.* To show that an agent cannot gain from playing cheat one period if offered  $W^*$ , denote by  $V_h$  the present value of lifetime expected utility of an employed agent who, whenever hired, plays honest. Denote by  $V_h^u$  the present value of the lifetime expected utility of an unemployed honest agent. Denote by  $V_c^u$  the lifetime expected utility of an unemployed cheater (who will be playing honest in the future if hired). These life-time expected utilities are:

$$V_h = W^* + \delta(1 - \tau)V_h + \tau V_h^u, \quad V_i^u = \delta h_i V_h + \delta(1 - h_i)(\bar{w} + V_i^u) \quad i = h, c.$$

Cheating once yields  $\alpha + V_c^u$  and hence an agent will not cheat if  $V_h \geq \alpha + V_c^u$ . Substituting and rearranging yields that an agent's best response is playing honest iff  $W \geq (T - \delta\tau H_h)[\alpha/(1 - \delta H_c) + \delta\bar{w}(P_c/(1 - \delta H_c) - \tau P_h)] = W^*$ , where  $T = 1 - \delta(1 - \tau)$ ;  $H_i = h_i/(1 - \delta(1 - h_i))$ ,  $i = h, c$ ;  $P_i = (1 - h_i)/(1 - \delta(1 - h_i))$ ,  $i = h, c$ . The properties of  $w$  can be derived directly from this expression. ■

Under MPS an agent is motivated to be honest by the carrot of a premium over his reservation utility and the stick of firing. If the induced difference between the present value of the lifetime expected utility of an unemployed and employed agent is higher than the one period gain from cheating, the best response of an agent is to be honest. Hence, the optimal wage decreases as an honest agent is more likely to receive future wage premiums (higher  $h_h$ ), can gain less by cheating (lower  $\alpha$ ), is more likely to remain employed if he was honest (lower  $\tau$ ); has worse opportunities elsewhere (lower  $\bar{w}$ ), and has a smaller chance of being hired if he is a cheater (lower  $h_c$ ). Further, the optimal wage decreases as an agent values future income more (higher  $\delta$ ), since rewarding for honesty and punishing for cheating is done in the future.

For the MPS to constitute a symmetric SGPE, each merchant should find it optimal to hire agents. On the equilibrium path this condition amounts to a wage low "enough," that is,  $W^* = w(\delta, h_c, h_h) \leq \gamma - \kappa$ , where  $h_c = 0$ , and  $h_h = \tau M/(A - (1 - \tau)M)$ . Assume that this condition holds. Will a merchant find it optimal to retaliate against an agent who did not cheat him? When switching agents does not impose any cost – as was assumed here – merchants may as

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<sup>67</sup> More exactly, this monotonicity is weak at some neighborhoods of the extreme values of the parameters.

well punish a cheater and hence the MPS is a SGPE. Having the credibility of multilateral punishment rests on a knife edge result, however, is unsatisfactory. Clearly, Maymun be Khalpha considered that punishing the Sicilian agent was costly. Therefore, a more relevant question is whether the multilateral punishment strategy motivates a merchant to **strictly** prefer hiring an honest agent rather than a cheater.

As proposition 2 demonstrates formally, a merchant strictly prefers to hire an honest agent under the MPS, merely since a cheater is not expected to be hired by other merchants. An honest agent is expected to be hired in the future, but an agent who has ever cheated is not. Since the optimal wage decreases in the probability of future hiring, a cheater's optimal wage is higher than an honest agent's wage and hence each merchant strictly prefers to hire an honest agent. It is the uncoordinated response of all the merchants and the interrelations between their expected future behavior and an agent's optimal wage as perceived by an individual merchant that insures solidarity of incentives. The possibility of forced separation links the optimal wage that a specific merchant has to pay his agent and the agent's expected future relations with other merchants, and it is this link that increases the optimal cheater's wage above an honest agent's wage, since punishments are independent from the agent's past conduct while rewards are not. Hence, merchants follow the multilateral punishment **despite** the fact that the agent's strategy does not call for cheating any merchant who violated the collective punishment, and **despite** the fact that cheating in the past does not indicate that the agent is a "lemon." Hence, it is reasonable that Maymun was concerned about Naharay's interpretation of his agent's actions because open accusation would have initiated an uncoordinated response that would have affected Maymun's business with that agent.

*Proposition 2.* Assume that  $\delta \in (0, 1)$  and  $h_c < 1$ . Under MPS a merchant **strictly** prefers to hire an honest agent.

*Proof.* Under MPS the probability that an agent who has ever cheated would be rehired if he cheated or was honest this period and became unemployed is  $h_c^c = h_c^h = 0$ . The same probabilities for an agent who has never cheated before are  $h_c^h = 0$ , and  $h_h^h = \tau M / (A - (1 - \tau)M) > 0$  respectively. The optimal wage for a cheater is  $W_c^* = w(., h_h^c = 0, h_c^c = 0)$ , and the optimal

wage for a honest agent is  $W_h^* = w(\cdot, h_h^c > 0, h_c^c = 0)$ . Hence, since  $h_c \leq h_h$  for cheaters and honest agents, proposition 1 implies that  $W_c^* > W_h^*$ .<sup>68</sup> ■

#### 5.4 The Maghribi Traders Coalition – Theory and Indirect Evidence

The historical anecdotes presented above indicate that collective punishment of a specific nature facilitated by a network of information-transmission was practiced among the Maghribis. Theory indicates the importance of expectations concerning future hiring in making the collective punishment credible. Hence, history and theory lend support the main hypothesis of this chapter, namely, that agency relations among the Maghribis were organized with a **coalition**, which is defined as a network of traders whose member merchants are known to each other (directly or indirectly through mutual acquaintances), are expected to hire only member agents, and the cultural beliefs associated with these agency relations are those captured by the MPS. Furthermore, these cultural beliefs includes the expectations that if an agent who was caught cheating operates as a merchant, coalition agents who cheat him are not subject to collective retaliation. (That is, they are not considered by other members to have cheated.) Finally, internal informal information-transmission mechanism enables monitoring agents and makes cheating known.

While the reference to and the quotations from Maghribi traders' letters presented earlier directly supports the above hypothesis by indicating that the Maghribis practiced MPS, that an agent who cheated a cheater was not subject to MPS, and that the Maghribis shared the appropriate information-transmission mechanism. Yet, can the hypothesis be further substantiated? Can a coherent explanation of historical observations be advanced based on the assumption that a coalition governed agency relations? Can predictions based on this assumption be generated and confirmed by the historical records?

Indeed, the historical records are rich in facts that should be explained. The Maghribis were the descendants of merchants who lived in the `Abbasid Caliphate centered in Baghdad

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<sup>68</sup> For this proof it is sufficient that players can recognize cheaters and honest agents. On the role of "social labels" in random matching games see Kandori 1992; Okuno-Fujiwara and Postlewaite 1990.

until the first half of the tenth century, when they emigrated for political reasons mainly to Tunisia. This area prospered at the time, under the control of the Fatimid caliphate. As time passed, the Maghribi traders extended their trade from Spain to Constantinople. While the agency relations required for this expansion could have been established with non-Maghribi traders (Jewish or Muslim), evidence of such relations is rare. Instead, members of the Maghribi traders' group emigrated abroad and during the eleventh century one finds Maghribi traders who emigrated from Tunisia to other trade centers in the Muslim world such as Spain, Sicily, Egypt, and Palestine. Members of these colonies kept agency relations for generations with the descendants of other Maghribi traders.<sup>69</sup>

Since the Maghribis adopted the customs and language of the Muslim world, emigration outside the Muslim sphere of influence was culturally and materially difficult. Indeed, the Maghribis did not emigrate to the emerging trade centers of Italy despite the Maghribis' perception that trade with the Christian world was most profitable.<sup>70</sup> This perception is reflected, for example, in the words of a merchant from Palermo, Sicily, who complained around 1035 that even the Rums (that is, in this case, Christians from the Latin world) were not ready to buy the inferior black ginger!<sup>71</sup> Despite the perceived profitability of this trade, Maghribi traders did not establish agency relations with the Italian Jewish traders who were active during this period. The communities within which the Maghribi traders operated held communal ties with the Italian Jewish communities and there were no political restrictions that could have hindered cooperation between the Maghribis and the Italian Jews. Yet, the documents never reflect agency relations between the Maghribis and Jewish traders from the Christian world.

In the trade centers to which the Maghribi traders emigrated, a well established Jewish community already existed, and the Maghribi traders integrated into the existing communal structure. Yet, they preserved their separate social identity as long as they were active in long-

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<sup>69</sup> Goitein 1967a: 156-59, 186-92; Gil 1983b, vol. 1: 200 ff.; and Greif 1985: 124-27.

<sup>70</sup> E.g., TS 8 Ja I, f. 5, Goitein 1973: 44-45. See also Goitein 1973: 44, 211; Greif 1989.

<sup>71</sup> Dropsie 389, b, ll. 6 ff., Goitein 1973: 45; see also Bodl. MS Heb. c 28, f. 11, ll. 171-13.

distance trade. Their separate social identity is reflected in the documents in which they are referred to as "our people, the Maghribis the travellers (traders)."<sup>72</sup> The Maghribis operated in the Mediterranean during the eleventh century until the Italian naval and military supremacy drove the traders out from the Muslim world. Then they turned to the Indian Ocean trade until toward the end of the twelfth century when they were forced by the Muslim rulers of Egypt to withdraw.<sup>73</sup> At that point they integrated within the Jewish communities and vanished from the stage of history.

The above historical observations raise intriguing questions. Why were seemingly profitable agency relations with non-Maghribis not established? How can the governance of agency relations by a coalition and the possibility of establishing an agency with non-members be reconciled? After all, this possibility seems to undermine the foundations of the coalition. It undermines the member merchants commitment to hire honest member agents in the future and it undermines the effectiveness of the collective punishment since agents can potentially enter agency relations with non-member merchants. Why then was the coalition sustainable? To support the hypothesis that a coalition governed agency relations these issues should be explained based on or reconciled with the assumption that agency relations were governed by a coalition. Furthermore, can theoretical insights relate the Maghribis' immigration to Tunisia and the emergence of the coalition, as well as accounting for the fact that the Maghribis retained their social identity only as long as they were active in long-distance trade?

To address these questions there is a need to examine the relations between coalition and efficiency. A coalition enhances efficiency relative to a situation in which agency relations are governed by the *bilateral punishment strategy* (BPS) usually considered in the efficiency wage

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<sup>72</sup> Gil 1971: 12-15, 1983b, vol. 1: 215, 223; Goitein 1967a: 30-34, 148-9, 157; Greif 1985: 153, n. 32; and see, for example, DK 13, section G, F, Goitein 1973: 32; TS Box Misc. 25, f. 106, a, l. 9, Gil 1983b, vol. 2: 734; TS 13 J 26, f. 24, b, ll. 3-5 and TS Box Misc 25, f. 106, l. 9, Gil 1983b, vol. 2: 601, 734.

<sup>73</sup> For their trade in the Indian ocean, see Goitein's India Book, (forthcoming); Walter J. Fischel 1958; Shelomo Dov Goitein 1957.



literature. This strategy is identical to the MPS except that merchants do not condition their hiring on past conduct (either because they do not have information regarding past actions, or they do not expect others to make hiring conditional on that information, or they do not observe the wage paid to the agent and believe that cheating reflects under-payment). Under BPS merchants would not hire agents in situations in which, under MPS, they would hire agents. Consider, for example, the case in which each merchant can commit himself to hire an agent for only one period ( $\tau = 1$ ). Under BPS it implies that for any finite wage, agents will cheat. Hence agents are never hired. Under MPS, however, an agent takes into account the implications of cheating a particular merchant on his future employment with other merchants. Hence, the optimal wage will be finite and may be low enough to support cooperation. Proposition 3 indicates that in general, MPS supports cooperation when BPS fails due to the limited ability of each merchant to commit himself to rehire an honest agent by decreasing the probability that a cheater will be rehired,  $h_c$

*Proposition 3.* For ease of presentation, suppose that the agents' time discount factor approaches one ( $\delta \rightarrow 1$ ). Define  $a$  to be the ratio of agents to merchants, that is,  $a = A/M$ . Recall that  $\bar{w} < \alpha$  and  $a > 1$ . Given  $a$ , cooperation is feasible for all  $\tau \in [0, 1]$ , iff  $\gamma - \kappa \geq (a - 1)\bar{w} + \alpha + \epsilon$ ,  $\forall \epsilon > 0$  under BPS, but iff  $\gamma - \kappa \geq a\bar{w} + \epsilon$ ,  $\forall \epsilon > 0$  under MPS. Given  $\tau$ , cooperation is feasible for all  $a \geq 1$ , iff  $(\gamma - \kappa) \geq \alpha + \epsilon$ ,  $\forall \epsilon > 0$  under BPS, but iff  $(\gamma - \kappa) \geq \bar{w} + \epsilon$ ,  $\forall \epsilon > 0$  under MPS.

*Proof.* Taking the limits of  $W^*$  as  $\delta$  goes to 1 using the fact that  $h_c = h_h = \tau M / (A - (1 - \tau)M)$  under BPS, and that  $h_c = 0$ , and  $h_h = \tau M / (A - (1 - \tau)M)$  under MPS. Finally, use the relations between  $W^*$  and the appropriate parameters as specified in proposition 1 to take the appropriate limits. ■

MPS enhances efficiency since it enables cooperation when each merchant's ability to commit to future hire is rather limited. Furthermore, as long as the ability of a merchant to commit to future hire is less than perfect coalition decreases the optimal wage,  $W^*$ , relative to the situation in which BPS governs agency relations. This reduction reflects a decrease in the probability that a cheater will be hired,  $h_c$ , and an increase in the probability that an honest agent will be hired ( $h_h$ ) which is due to the restriction of agency relations to a specific sub-set of the agents' group. This wage reduction further enhances efficiency by making agency relations

profitable in situations in which the total gain from cooperation is relatively low ( $\gamma$  is small). While in such cases cooperation is efficient, it will be initiated only if it is profitable to a merchant, that is, only if  $W^* \leq \gamma - \kappa$ . Since the optimal wage under MPS is lower than under BPS, more cooperation will be initiated. The wage reduction and the enhanced efficiency imply that organizing agency relations in a coalition increases member merchants' profits and may, at the same time, increase the life time expected utility of a coalition member honest agent relative to that of an honest agent under BPS.

Efficiency gains generated by a coalition encourage its emergence while the coalition rewards member merchants and agents in a manner which encourages agency relations among coalition members. Hence, by affecting efficiency and profitability the sustainability of a coalition can be assured – member merchants are motivated to establish agency relations with member agents while the latter are better off being employed by member merchants.

Additional factors also contribute to the sustainability of a coalition. Expectations with respect to future hiring, the nature of the networks for information transmission, and strategic considerations discourage members from initiating agency relations with non-members and discourage non-members from initiating agency relations with members. To illustrate the impact of these factors, consider an economy in which two identical coalitions emerged. By definition, coalition members are not expected to establish inter-coalition agency relations. Will these expectations be self-enforcing? A merchant will initiate inter-coalition agency relations only if it is expected that the other coalition's merchants will use MPS against a member agent who cheated a non-member merchant. Otherwise, the merchant strictly prefers to establish intra-coalition agency relations since the optimal wage in inter-coalition agency relations is  $w(\cdot, h_c = h_h > 0)$ , which is, by proposition 1, strictly higher than the optimal wage in intra-coalition agency relations,  $w(\cdot, h_c = 0, h_h > 0)$ . For this wage differential to exist, it is sufficient that the merchant is uncertain whether MPS will be applied in inter-coalition relations.<sup>74</sup>

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<sup>74</sup> Formally: denote the coalitions by  $K$  and  $J$ , and denote by  $M_s$  and  $A_s$  a merchant and an agent from coalition  $s$  respectively,  $s \in \{K, J\}$ . Denote by  $\mu$  the expected probability that the merchants from coalition  $t$  will consider an  $A_t$  last employed by  $M_s$  as a cheater if he cheated  $M_s$ . All other things being equal, for any  $\mu \in [0, 1)$ , no individual merchant finds it optimal to

A merchant is likely to be uncertain whether MPS will be applied in inter-coalition relations due to information barriers between coalitions and strategic considerations. Within a coalition, each trader is known to others and this enables informal information flows which the agent does not control to facilitate monitoring and inform traders about cheating. In inter-coalition agency relations, however, this mechanism does not function. Furthermore, coalition members are strategically motivated to ignore an outsider's accusations concerning the conduct of a coalition member agent. If the coalition members simply "take the word" of an outsider, an agent is vulnerable to blackmail by nonmembers, which reduces his lifetime expected utility as an honest agent. This reduction comes at the expense of member merchants, since it increases the optimal wage. Hence, coalition members find it optimal to ignore an outsider's accusations. In contract, insider's accusations are not likely to be ignored since they could have been assessed more accurately and since, when accusing an agent, an insider merchant puts his own reputation on the line. "Had I listened to what people say," wrote Khalluf ben Musa to his partner in response to the accusation that he had retained revenues received for the partner's goods, "I never would have entered into a partnership with you."<sup>75</sup>

As MPS does apply in inter-coalition relations, the wage required to keep an agent honest in inter-coalition agency relations is higher than the intra-coalition wage. Hence, merchants are discouraged from establishing inter-coalition agency relations and the expectations that inter-coalition agency relations will not be initiated are self-enforcing. Note that this result holds even in situations in which these inter-coalition relations are more efficient. More precisely, inter-

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establish inter-coalition agency relations.

Proof. For any  $\mu$ , the probability that  $A_t$  who cheated  $M_s$  will be rehired is  $h_{cs,t}(\mu) = \mu h_{ct,t} + (1 - \mu)h_{ht,t} > 0$ . The probability that  $A_s$  who cheated  $M_s$  will be rehired is 0. By proposition 1, this implies that the honesty inducing wage is higher in inter-groups' agency relations than in intra-groups' agency relations. ■

<sup>75</sup> Bodl MS Heb. a 3, f. 13. Section B. Goitein 1973: 121. See also DK 13, Section G; ULC Or 1080 J 48; Bodl. MS Heb. a2 f.17, Goitein 1973: 32, 92-93, 103. Goitein 1967a: 168, 196; Greif 1985: 143.

coalition agency relations will not be established if the increase in the gains from cooperation does not compensate a merchant for the wage increase. Note that this result does not hold under BPS. When agency relations across two identical traders' group in which BPS prevails become possible, efficient inter-group agency relations will be initiated.

Expectations with respect to future hiring, the nature of the networks for information transmission, and strategic considerations are the factors that ensure the sustainability of a coalition. These factors encourage member merchants to hire only member agents and discourage member merchants from hiring non-member agents. Thus, these factors enable member merchants to commit to hire only member agents even if efficient agency relations can be established with non-members. At the same time, these factors makes the collective punishment effective since it discourage non-member merchants from hiring member agents, thus enabling member agents to commit themselves not to enter agency relations outside the coalition. By discouraging inter-coalition agency relations, these factors make the expectations on which the coalition rests self-enforcing. Hence, once a coalition is formed through some historical process, agency relations will be established only among the traders with respect to whom expectations were initially crystallized.

These theoretical observations suggest that the informal social networks for information transmission, which became available to the Maghribis in the process of their immigration to Tunisia, enabled them to support agency relations based on MPS. Further, this immigration process determined the social identity of the individuals with respect to whom expectations of collective punishment and future hiring were established. Once these expectations were crystallized – once the Maghribi traders' coalition was formed – only descendants of Maghribis were perceived by others as members, and hence only they could become members. Further, the factors which encouraged intra-coalition agency relations and discouraged agency relations with non-members made membership a valuable asset. Hence the descendants of a Maghribi trader followed the trade of their fathers and continued to be active in long-distance commerce as members of the Maghribi traders' coalition.

As the Maghribis expanded the geographical scope of their trade, the profitability of intra-coalition agency relations was high enough to encourage emigration and the establishment of colonies in other trade centers. Since Maghribi merchants were motivated to employ other

coalition members, they were able to commit themselves to future employment of Maghribi agents. This assured the emigrants that they would be compensated for the cost of emigration. Emigration to Italy, however, was more difficult culturally and hence forgone. Non-member Italian Jews were not employed as agents, despite the common religion and the potential gains from trade with Italy, since the additional gains from establishing agency relations outside the coalition did not compensate for the relatively high agency cost.

The Maghribi traders' social structure was an organizations that provided them with the initial information-transmission mechanism required for the emergence of an economic institution – the Maghribi traders' coalition. At the same time, this economic institution for the governing of agency relations provided the interactions required to sustain the social structure while the Maghribis' social identity provided the means to coordinate expectations required for the functioning of the coalition. When the Maghribis ceased to operate in long-distance trade and their coalition ceased to function, the motivation for social interactions diminished, their social structure lost its vitality and the Maghribi traders assimilated into the existing Jewish communities.

As long as the Maghribi group survived, it retained social characteristics and trade practices which differed substantially from those of the Italian traders and can be consistently explained as reflecting the governance of agency relations by a coalition. The social structure of the Maghribi traders' group was "horizontal," as traders functioned as agents and merchants at the same time. Each trader served as an agent for several merchants while receiving agency services from them or other traders (e.g., Stillman 1970; Greif 1994). In contrast, among the Italian traders of the late Medieval period, merchants and agents constituted two distinct sub-groups. Agency relations were organized "vertically," as wealthy merchants who did not function as agents employed ambitious young traveling agents who did not function as merchants.<sup>76</sup> For example, in the cartulary of John the Scribe, which reflects the Genoese trade of the mid-twelfth century, 180 merchants are mentioned, twelve of whom invested 40.4 percent of the total Genoese investment in trade. About 300 agents are known, but only 36 individuals functioned as both agents and merchants. Eugene H. Byrne (1916) concluded that "as a rule "

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<sup>76</sup> De Roover 1965: 51 ff.; Lopez and Raymond 1955: 174, 185-86; Lane 1944: 178 ff..

the Genoese agents during the late twelfth century were "not men of great wealth or of high position in Genoa." (p. 159).<sup>77</sup>

The differences between the Maghribis and the Genoese were not confined to their social structure. These two groups also differed in the choice of forms of business association through which agency relations were established. The common denominator of the forms of business association employed by the Maghribis was that they required both parties, the merchant and the agent, to invest capital in the commercial venture. In sharp contrast, the Genoese traders established agency relations mainly through *commenda* contracts which required only the merchant to invest.<sup>78</sup>

The Maghribi and the Genoese traders operated mainly in the western basin of the Mediterranean and their merchandise consisted largely of textiles and luxury goods. Further, the two groups were familiar with similar forms of business association and employed, roughly speaking, the same technology.<sup>79</sup> Yet, despite these similarities the two groups differed in their social structures and choice of forms of business associations.<sup>80</sup> How does the choice of forms of business association and the social characters of a traders' group relate to the cultural beliefs associated with agency relations? Are the forms of business association and the social character of the Maghribi traders consistent with the claim that agency relations were governed by a coalition?

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<sup>77</sup> Krueger 1957, 1962; Byrne 1920: 210-1, 1928: 160-1. These scholars based their analysis on records from Genoa. Venice seems to have been different. See de Lara 2002.

<sup>78</sup> For an elaboration on these forms of business associations and the differences between the Jewish and the Genoese, see Goitein 1967a, 1973: 11 ff.; Greif 1989, 1990; Gil 1983b, vol. 1: 216 ff.; de Roover 1965; Lopez and Raymond 1955; Krueger 1962.

<sup>79</sup> "Familiar" means that either they actually used these forms or they were authorized as legal. See Greif 1989.

<sup>80</sup> For recent analyses of contract selections among medieval traders, see De Lara 2002 and D. Williamson 2002

To address these questions, assume that a merchant can hire either an agent (who does not invest in trade) or another merchant (who is able to invest in trade) to provide him with agency services. Recall that within a coalition a capital premium is generated. That is, the returns on the capital of a coalition member merchant is higher than that available to him outside the coalition or if he had cheated another coalition merchant while serving as an agent to him. If a merchant has to establish agency relations outside the coalition (or in the coalition after he had cheated) he has to rely on BPS which implies a lower profit for the reasons discussed above. Receiving this capital premium within a coalition is conditional on past conduct, and hence it provides a coalition member merchant with a commitment device not available to an agent. The value of the future capital premium constitutes a "bond" that insures honesty. Hence, *ceteris paribus*, it is profitable for each merchant to employ a merchant as his agent.

To demonstrate how the capital premium provides a bond within a coalition, consider the honesty condition for a merchant. This honesty condition should take into account the fact that after he had cheated while employed as an agent, a merchant's relations with his member agents would be governed by BPS. A merchant will be honest if the present value of his lifetime utility obtained from being honest,  $V_h^a$ , is not smaller than the gains from one period of cheating,  $\alpha$ , plus the present value of his lifetime expected utility as an unemployed cheater agent,  $V_c^{u,a}$ , minus the reduction in the present value of his lifetime expected utility as a merchant that results from cheating,  $V_h^m - (R_c + \delta V_c^m)$ . ( $R_c$  is the merchant's net profit from employing an agent in the period in which he cheats.) Hence, the honesty condition is  $V_h^a \geq \alpha + V_c^{u,a} - [V_h^m - (R_c + \delta V_c^m)]$ . Recall from the proof to proposition 1 that the honesty condition for an agent (who does not invest in trade) is  $V_h^a \geq \alpha + V_c^{u,a}$ . Since BPS governs the relations between a merchant who had cheated and his agents,  $V_h^m > (R_c + \delta V_c^m)$ . Hence, *ceteris paribus*, a merchant strictly prefers to hire a merchant over hiring an agent. When the *ceteris paribus* assumption is relaxed, the analysis implies that hiring only or mostly merchants is an equilibrium within a coalition for a larger set of parameters than under BPS.

On the other hand, it should be noted that according to proposition 1 under MPS and BPS the higher the reservation utility, the higher the wage required to insure honesty. Hence, *ceteris paribus*, a merchant would prefer to hire an agent rather than another merchant if the reservation utility of the latter is higher. Furthermore, in reality it may be the case that a merchant's

reservation utility is higher than that of an agent since a wealthy merchant is likely to allot some of his capital in non-trade related investment. Hence, within a coalition the capital a merchant invests in trade enhances his ability to commit while the capital he invests elsewhere hinders his ability to commit. While agency relations are governed by BPS, however, capital invested in trade does not enhance the ability to commit while capital invested elsewhere hinders the ability to commit.<sup>81</sup>

These theoretical considerations offer a coherent explanation on the differences between the Maghribis and the Genoese which is consistent with the hypothesis that agency relations among the Maghribis were governed by a coalition. Among the Maghribis agency relations were governed by a coalition and merchants stood to lose their capital premium if they ever cheated. At the same time, the Maghribis were professional traders who, as far as can be judged by their letters, invested most, if not all, their working capital in trade. Hence, their capital did not hinder their ability to commit. The resulting incentives shaped the nature of the Maghribi traders' social structure and choice over forms of business associations. By and large, each of them was a well to do merchant with the capital required to enhance his ability to commit.<sup>82</sup> Each Maghribi trader provided agency services to some Maghribis and received agency services from others. Establishing agency relations among merchants enabled the Maghribis to utilize forms of business associations in which both parties invested in trade and which, presumably, enabled them to benefit from diversification while retaining economies of scale and scope.

In Italy, one may conjecture, agency relations were governed by BPS and thus the capital a merchant invested in trade did not enhance his ability to commit. Furthermore, the Genoese cartularies indicate that Genoese merchants, by and large, invested a significant portion of their capital in non-trade related ventures. For example, they bought real estates, farmed taxes, and were active in agriculture. These investments, according to the theory, hindered their ability to

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<sup>81</sup>The above discussion ignores the possibility that a cheater invests the capital he embezzled in trade. Introducing this possibility only strengthens the results.

<sup>82</sup> Although some of Maghribis were net givers of wage premium and some were net receivers of capital premium.



commit. Hence, merchants were motivated to recruit agents with low reservation utilities. Vertical social structure and *commenda* relations were the result.

Theoretical considerations also illuminate the rationale behind patterns of employment of agents and bookkeeping among the Maghribi traders. Among the Maghribi traders, agency relations resembled the relations between a modern firm and its workers, in that typically no explicit legal commitment governed the length of the relationship. Where a commitment was made, it was for a short period of time. The duration of agency relations ex post varied from a single season to several generations with sons replacing their fathers.<sup>83</sup> Further, the Maghribi traders used a per trade venture rather than multiventure accounting system, in which the income and expenses associated with each trade venture were detailed. (Goitein 1967a: 178, 204 ff.).

These trade practices are consistent with the operation of a reputation mechanism within a coalition. Intuitively, whenever a reputation mechanism is employed, a merchant may prefer short-term contracts since the shorter the contract, the sooner the merchant can discover deviation, and thus the less he will have to pay to keep the agent honest.<sup>84</sup> In other words, a sequence of short-term contracts was more efficient than a single long-term contract. Further, a per venture accounting system is more efficient than a multiventure accounting system whenever a reputation mechanism is employed, since it facilitates comparing agents' reports with any relevant information.

## 5.5 Endogenous Information Structure

The discussion so far had assumed that the Maghribis had the information required for the operation of the coalition. How was such information generated? Coalition members enjoyed internal information flows that facilitated the reputation mechanism. These information flows provided the information required to uncover cheating, and contributed to the "capital

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<sup>83</sup> Goitein 1967a: 169-70, 178; and Greif 1985: 133. In the Italian trade cities, *commenda* relations were also of short duration, e.g., Lopez 1952: 323.

<sup>84</sup> See Abreu, Milgrom, and Pearce 1990 for differences on this point between perfect monitoring and imperfect monitoring models.

premium" available to honest coalition members. Information was crucial to business decision-making, however coalition members blocked a cheater's access to the coalition's internal information flows.

For diversification each coalition member associated with many coalition members residing in different trade centers.<sup>85</sup> One of the coalition member's duties was to supply his business associates with trade-related information.<sup>86</sup> This information enabled the traders to respond appropriately to price signals. The importance of information is indicated in many letters in which the writer requests information or mentions that he is expecting to receive additional information before making a business decision.<sup>87</sup>

Such information allowed a merchant to uncover cheating. Traders who operated abroad often knew what trade circumstances an agent faced or had access to information that might indicate what these circumstances were. They passed this information on to the merchant, thus helping him evaluate his agent's conduct.<sup>88</sup>

Within the Maghribi coalition, information regarding the circumstances that an agent faced was essentially free, since it was obtained as a by-product of the commercial activity and passed on along with other commercial correspondence. The fact that this information was

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<sup>85</sup> For example, a Sicilian merchant, Jacob ben Isma`il, had at least five business associates who lived in three different trade centers. See Greif, 1855, p. 133. An important sedentary merchant like Naharay ben Nissim of Fustat had business relations with dozens of coalition members from Spain to Syria. See Naharay archive published in Michael, "Naharay ben Nissim," and letters to him published in Gil, 1983b, vol. 3, pp. 96 ff.

<sup>86</sup> Trade-related information, including prices, ship arrivals and departures, the general economical and political situation, and so forth, appears in many geniza documents. See, for example, TS 20.76; TS 13 J 15, f. 9, Goitein, 1973, pp. 113-19, 320-22; TS 10 J 11, f. 22, a, ll. 11-12. Cf. Goitein, 1967a, pp. 195, 201 ff. and additional reference in Greif, 1985, p. 95, n. 60.

<sup>87</sup> See, for example, Dropsie 389, a, ll. 2-4, Gil, 1983a, pp. 113-25.

<sup>88</sup> See, for example, DK 22, a, ll. 11, ff., Gil, 1983a, pp. 97-106, and ULC Or 1080 J 42, Gil, 1983b, vol. 3, p. 300.

essentially free is important, since it made credible the merchant's claim that he would monitor his agents. Without such monitoring, of course, the reputation mechanism could not have functioned.<sup>89</sup> The information transmission *per se* did not solve the contractual problem associated with agency relations, however, since evidence provided by business associates was not always acceptable in court and the cost of applying to the court was very high.

Information flows within the coalition also enabled agents to signal that they were honest. Just as modern firms hire auditors to establish the legitimacy of their financial statements, eleventh-century Maghribi agents generally conducted important business in the presence of other coalition members, including in their reports the names of those witnesses whom the merchant knew, thus enabling him to verify the agent's report.<sup>90</sup>

## **5.6 The Merchants' Law: Rules, Coordination, and Comprehensive Contracts**

The operation of a coalition is based on uncoordinated responses of merchants located at different trade centers. Hence, for the threat of collective punishment to be credible, "cheating" must be defined in a manner that ensures collective response. If some merchants consider specific actions to constitute "cheating" while others hold a different opinion, the effectiveness of the collective threat is undermined.<sup>91</sup> The required coordination can be achieved by

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<sup>89</sup> According to the theory advanced here, an agents will never cheat. Thus, if monitoring agents is costly, the merchant's claim that he will monitor is not credible. Knowing that the merchants will not monitor, agents will cheat. Anticipating this, a merchant will not employ agents to begin with.

<sup>90</sup> For a discussion of auditing, see Jensen and Meckling 1976. For historical survey of auditing practices, see Watts and Zimmermann 1983. For the use of witnesses, see, for example, DK 13, Section G; ULC Or 1080 J 48; Bodl. MS Heb. a2 f.17, all published in Goitein 1973: 32, 92-93, 103. See also the discussion in Goitein, 1967a: 168, 196 and Greif 1985: 143. It should also be noted that eyewitnesses, in certain circumstances, are also required by the Jewish law. See Maimonides 1951: 214.

<sup>91</sup> For relevant theory, see Banks and Calvert 1989.

specifying an agent's obligations in an explicit contract – ideally a comprehensive contract. Given the eleventh-century communication technology and the uncertainty and complexity of trade, detailed contracts entailed high negotiation cost. If a merchant and an agent had to agree upon a contract before any goods could be shipped to an agent, the negotiation costs would have made trade through agents impractical.<sup>92</sup>

Indeed, the *geniza* reflects the extensive use of incomplete contracts, usually in the form of letters with instructions that involve no negotiation. "Do whatever your propitious judgment suggests to you," wrote Musa ben Ya`qub from Tyre, Lebanon, to his partner in Fustat sometime in the second half of the eleventh century.<sup>93</sup> Merchants often authorized their agents to do whatever they deemed best if none of the pre-specified contingencies occurred. Incomplete contracts, however, undermine the operation of a coalition, since which actions should be considered cheating are not defined. Furthermore, when incomplete contracts are used, an agent can act strategically to reach circumstances in which he benefits from the incompleteness of the contract.<sup>94</sup>

Theoretically, hierarchy – authority relations – may be used as a substitute for an ex ante comprehensive contract by assigning the merchant with the right to all (ex post) decisions (Williamson 1985). Similarly, culture may substitute for comprehensive contracts by specifying ex ante systematic rules of behavior.<sup>95</sup> These cultural rules indicate what members of the organization should do after an unforeseen state of nature occurs. Hierarchy and culture, however, differ substantially. While culture requires ex ante learning of the rules but no ex post

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<sup>92</sup> The inappropriateness of comprehensive contracts in long-distance medieval trade is reflected in the difference between the Maliki and the Hanafi schools of law in Islam. See Udovitch 1970: 208-09. For theoretical considerations of the inability to specify comprehensive contracts, see Hart 1988; Grossman and Hart 1986; Williamson 1985.

<sup>93</sup> ULC Or. 1080 J 42, Goitein 1973: 94. For a similar situation in Europe, see Gras 1939: 80.

<sup>94</sup> To some degree, such situation is reflected in Dropsie 389, Gil 1983a

<sup>95</sup> See discussion in Camerer and Vespallaninen 1987; Landa 1988. Cf. Kreps 1990b.

communication, hierarchy does not require ex ante learning but requires ex post information-transmission between the parties.

Given the communication and transportation technology of the eleventh century, it is not surprising that hierarchy was not used among the Maghribi traders.<sup>96</sup> Instead, they employed a set of cultural rules of behavior – a Merchants' Law – that specified how an agent should act to be considered honest in circumstances not mentioned in the merchant's instructions. The Merchants' Law was shared by all the Maghribi traders and served as a default contract between agents and merchants. When it became known that an agent failed to follow the Merchants' Law, he was considered a cheater.

The importance of the Merchants' Law in determining the expectations about and attitude toward an agent's behavior is reflected, for example, in the letter, mentioned above, which was sent by Maymun ben Khalpha to Naharay ben Nissim. In discussing the conflict between Naharay and his agent, Maymun justified the agent's actions by arguing that he "did something which is imposed by the trade and the communication [system; what you asked him to do] contradicts the merchants' law" (or "the way of the trade"). In another letter, a "very angry" merchant accused his business associate of taking "actions [that] are not those of a merchant."<sup>97</sup>

Unfortunately, not much is known about the content of the Merchant's Law, and the most convincing evidence for its existence and the process of its formation is found outside the *geniza*. In the middle of the twelfth century, Maimonides, a major Jewish spiritual leader who lived in Fustat, wrote in his legal code, "...if [an agent] enters a partnership with another without specifying any terms, he should not deviate from the custom current in the land in regard to the

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<sup>96</sup> See DK 22, A, ll. 9 -11, Gil 1983a: 97-106, as an example of letters that explicitly indicate that it was impractical for an agent to await new instruction when an unspecified contingency occurred.

<sup>97</sup> DK 22, b, l. 5 ff., Gil 1983a: 97-106. TS 12.434 1.7, Goitein 1967a: 202, n. 50. See also Goitein 1967a: 171.

merchandise they deal with."<sup>98</sup> Similarly, the early medieval Islamic legal literature contains numerous instances in which systematic legal reasoning is suspended because of the "custom of the merchants." (Udovitch 1970: 13, 250-59). Unfortunately, neither the legal literature nor the *geniza* reflects exactly how the Merchants' Law was formulated and changed.<sup>99</sup>

Within the Maghribi traders' coalition, Merchants' Law promoted efficiency by providing a coordination device necessary for the functioning of the coalition, economizing on negotiating cost, and enabling flexibility in establishing agency relations. The Merchants' Law also imposed, however, a rigidity on the system, as its process of adjustment was, most likely, impeded by agents' concerns regarding what others would be thinking about their actions rather than what the outcome of their actions would be. This is reflected in the words of Joseph ben Yeshua, who wrote to a merchant that without written instructions he could not do as he was instructed since he did not wish that "people will ... say that I did something that I was not ordered."<sup>100</sup>

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<sup>98</sup> Maimonides 1951: 223. Note that this may indicate that the Merchants' Law was not specific to the Maghribi traders coalition but was shared by a larger group. In the *geniza* see DK 13, b. ll. 7 ff., Stillman 1970: 272; Dropsie 389, b, ll. 22 -23, Gil 1983a: 113-25; TS 20.26, section I, Goitein 1973: 117.

<sup>99</sup>See, however, DK 22, a, margin right, Gil 1983a: 97-106; Goitein 1973: 111-12; and Greif 1985: 136.

<sup>100</sup> Bodl, MS Heb. d 66, f. 60, a. margin ll. 7-9. Gil 1983b, vol. 3: 216.

## 5.7 Conclusion

A specific economic institution – the coalition – governed agency relations among the Maghribi traders. The coalition enabled merchants to “trust” their agents. Among the Maghribis, trust was a social phenomena as members of the coalition, even if not link by personal relationships could rely on each other’s honest behavior. The Maghribi traders group and the behavioral rules that defined relevant state of the world (the Merchants’ Law) and coordinated on particular code of conduct constituted the organization and rules that enabled and coordinated upon particular cultural beliefs, those associated with the MPS. Because these cultural beliefs were self-enforcing, following the behavior associated with them optimal for each trader. This behavior, in turn, regenerated the Maghribi traders coalition, the associated social group, its rules, cultural beliefs, and the information required for its operation. Each of these institutional elements was exogenous to each Maghribi traders but they were endogenous to the group as a whole.

The nature of the coalition - a specific type of business network - and its importance are evident from direct quotations of Maghribi traders and the impact of the coalition on their behavior, social structure, and business practices. The evidence suggests that the coalition was mitigated problems of contract enforceability and coordination that arose in complex trade characterized by asymmetric information, slow communication technology, inability to specify comprehensive contracts, and limited legal contract enforceability.

Within the coalition, information flows balanced the asymmetric information, enabled monitoring, and coordinated responses. The multilateral punishment, the value of the information flows for commercial success, and the importance of the Merchants' Law as a substitute for comprehensive contracts generated wage and capital premiums. Receiving these premiums was conditional on past conduct, while intergenerational transfers insured a horizon long enough to support the operation of a reputation mechanism. Since the premiums' present value was larger than what an agent could gain by cheating, agents could credibly commit themselves to be honest. While the Merchants' Law provided a unified interpretation of actions and thus coordinated responses, the operation of the coalition was based on information flows within a well defined group of traders and expectations concerning future hiring and collective punishment. The credibility of the collective punishment was based on the links generated by

the MPS between the optimal wage and expectations concerning future hiring by member merchants. Finally, expectations with respect to future hiring, the nature of the networks for information transmission, and strategic considerations ensure the sustainability of the coalition.

Although I examine the emergence of the coalition in part VI, I will note here that its emergence and size reflect an institutional path-dependent process. It reflects the relationships between an historical process initiated by political events, the resulting social entity, and the positive reinforcement between economic and social institutions. In particular, networks for information-transmission within a social structure of an immigrants' group determined the coalition's initial size. In the coalition that emerged based on that initial social structure, the original social identity served as a signal that coordinated actions and expectations. The economic institution that governed agency relations, by promoting agency relations and information transmission among a specific group of individuals, preserved the initial social structure, which in turn determined the boundaries of the economic institution.

By reducing agency costs and other transaction costs, the coalition promoted efficiency among its members.<sup>101</sup> It provided the foundations for the operation of market in agents' services. It enabled operating through agents, even when the cost of establishing agency relations between a specific merchant and an agent in isolation was prohibitively high. In addition, the Merchants' Law economized on negotiation cost, governed the transmission of information and the provision of services, and substituted comprehensive contracts in the relations between a specific agent and merchant.

On the other hand, the coalition seems not to have been an optimal institution. The same factors which ensure its sustainability prevent the coalition from expanding in response to welfare enhancing opportunities.<sup>102</sup> The Merchants' Law potentially introduced another distortion as its adaptation, most likely, was conducted in a manner that did not ensure optimal

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<sup>101</sup> Although in general such network can also imply inefficiency the magnitude of which depend on how the contractual problem that the network mitigate would be resolved in its absence.

<sup>102</sup> For relevant theoretical analyses, see, for example, Kali (1999); Dasgupta (2000).



changes. Further, within a coalition agents are more concerned about the interpretations of their actions by other members than about the outcomes of their actions. Hence, their actions, while aiming at maximizing their expected utility, do not necessarily maximize total profit. An introduction of some form of leadership might have mitigated these distortions, perhaps at the cost of introducing others.

Further, following Coase it is customary in historical and theoretical research to distinguish between the operation of market and non-market institutions. The Maghribi traders' coalition was a non-market institution which provided the foundation for market in agency relationships and which thereby influenced the integration of inter-regional markets. Hence, the study of this coalition indicates the importance of a non-market institution in providing the institutional framework required for the operation of the market. The nature of non-market institutions impacts the cost, if not the feasibility, of trade and thereby effects the process of market integration. As market integration is commonly believed to be a key to economic growth, institutional analysis of non-market institutions, their relationships to social and business networks, and their relations to market integration is likely to advance our understanding about processes of economic growth. I will return to this issue in the conclusion.

## **&Chapter 6 Organizations, Beliefs, and the State: the Merchant Guild<sup>103</sup>**

One of the central questions about the institutional foundations of markets concerns the power of the state. The simplest economic view of the state as an institution that enforces contracts and property rights and provides public goods poses a dilemma: A state with sufficient coercive power to do these things also has the power to withhold protection or confiscate private wealth, undermining the foundations of the market economy. In the particular case of medieval cities, these threats were sometimes realized, discouraging trade by foreign merchants to the mutual disadvantage of the ruler and the merchants. The thesis presented here is that merchant guilds emerged with the encouragement of the rulers of trading centers to be a countervailing power, enhancing the ruler's ability to commit, and laying an important institutional foundation for the growing trade of that period.

The study of the Maghribi merchants examines an institution used to overcome contractual problems among individual merchants active in long-distance trade. Individual merchants, however, were not the only important parties during the late medieval period; the rulers of the trading centers where the merchants met and brought their goods were an important independent force. Trading centers needed to be organized in ways that secured the person and property of the visiting merchants.

Before a trading center became established, its ruler might be inclined to pledge that alien traders would be secure and that their rights would be respected. Once trade was established, however, the medieval ruler faced the temptation to renege on that pledge, failing to provide the promised protection or abusing the merchants' property rights by using his coercive power. In the age prior to the emergence of the nation state, alien merchants could expect little military or political aid from their countrymen. Without something tangible to secure the ruler's pledge, alien merchants were not likely to frequent that trading center – an outcome that could be costly for both the ruler and the merchants.

That rulers recognized the importance of this problem is well reflected in the words of the English king, Edward the First, who noticed in 1283 that because alien merchants' property

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<sup>103</sup> This chapter builds on Greif, Milgrom, and Weingast 1994.

rights were not properly protected, “many merchants are put off from coming to this land with their merchandise to the detriment of merchants and of the whole kingdom.”<sup>104</sup>

Based on the theory of repeated games, one might conjecture that since trade relationships between a specific merchant and ruler consist of a potentially long sequence of trading visits, the rulers' commitment problem could be overcome by either a *bilateral reputation mechanism* in which a merchant whose rights were abused ceased trading, or a *multilateral reputation mechanism* in which the cheated merchant and his close associates ceased trading. (Chapter 4.) Yet, the historical records indicate that by and large, the ruler-merchant relations were governed by neither bilateral nor informal multilateral arrangements. On the contrary, the records reflect the importance of formal organizations. Specifically, administrative bodies rooted outside the territory of the ruler which held certain regulatory powers over their member merchants in their own territory and which supervised the operation of these merchants in foreign lands. What roles could these organizations theoretically play in overcoming the ruler's commitment problem? What roles did they play in fact?

To investigate these questions, historical records are utilized to develop a series of game theoretic models corresponding to different institutional arrangements. This analysis exemplifies the role of organizations in changing the set of cultural beliefs that can prevail in a particular interaction and how game theory fosters the analysis of this role.

In this particular study, the theoretical analyses indicate that although some trade is possible even without supporting organizations, sustaining the efficient level of trade is more demanding. Without administrative bodies capable of coordinating and sometimes compelling merchants' responses to a ruler's transgressions, trade could not expand to its efficient level. The set of cultural beliefs that can prevail as an equilibrium outcome does not include those that are required to sustain the efficient level of trade.

The corresponding historical analysis then suggests that during the late Medieval commercial revolution, a specific institution – the *merchant guild* – developed the necessary

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<sup>104</sup> English Historical Documents, Vol. 3, p. 420. The recognition that unprotected alien merchants would not come to England is also expressed in the Carta Mercatoria of 1303. See English Historical Documents, Vol. III, p. 515.

attributes to enforce agreements with rulers, thus overcoming the commitment problem and enabling trade expansion. Merchant guilds exhibited a range of administrative forms from subdivision of a city administration to an inter-city organization. Yet, these forms all shared the common function of ensuring the coordination and internal enforcement required to surmount the commitment problem by permitting effective collective action among the merchants. This, in turn, changed the rules of the game relevant in the interaction among each individual merchant and the rule. The relevant rules of the game were such that cultural beliefs supporting trade at the efficient level of trade were now possible.

The discussion emphasizes two points at the outset. First, the argument concerns merchant guilds and not craft guilds.<sup>105</sup> Second, merchant guilds are defined according to their function rather than their “official,” late Medieval name. Hence, as discussed below, the theory applies to a wider range of medieval merchant organizations than those labeled as merchant guilds.

The evaluation of merchant guilds as supporting efficient trade is complementary to the view more common among economic historians that merchant guilds emerged to reduce negotiation costs, to administer trade and taxation, to extract privileges from foreign cities, and to shift rent in their own city.<sup>106</sup> While the existence of merchant guilds could affect the distribution of rents besides enhancing the security of agreements, the unadorned theory of merchant guilds as cartels presents a puzzle: If the purpose of the guilds was to create monopoly power for the merchants and to increase their bargaining power with the rulers, why did *powerful* rulers during the late Medieval period cooperate with alien merchants to establish guilds in the

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<sup>105</sup> Economists have long associated the latter with the monopolization of a given craft within a specific town. For a recent economic analysis of craft guilds, see Hickson and Thompson 1991. See also, Gufstafsson 1987.

<sup>106</sup> See, for example, Thrupp 1963; Gross 1890; North and Thomas 1973.

first place? What offsetting advantages did the rulers enjoy? The puzzle is resolved if the gild's power enabled trade to expand to the benefit of the merchants and rulers alike.<sup>107</sup>

While this analysis emphasizes the function of the merchant gild in facilitating trade between political units during the late Medieval period, it also sheds light on the changing nature of guilds over time and the complex nature of guilds at any point in time. Although certain features of the merchant gild enabled it to advance trade during the late Medieval period, these same features were, in some cases, utilized during the pre-modern period to restrict trade. Furthermore, even during the late Medieval period some merchant guilds had quasi-monopoly rights in their own territories. These rights were part of the relations between rulers and local merchants. Since the analysis concentrates on the relations between ruler and *alien* merchants, such rights are not considered here. It is interesting to note, however, that the theory suggests that a merchant gild's monopoly rights in its home locality may have been instrumental in advancing trade between different localities. This type of monopoly rights generated a stream of rent that depended on the support of other members and so served as a bond, allowing members to commit themselves to collective action in response to a ruler's transgressions.<sup>108</sup>

The chapter proceeds as follows. Section 6.1 reports the relevant history. It describes the serious problems trading centers and merchants faced in providing security for merchants and their goods, demonstrates that the gild structure had the features required to resolve the problem, and recounts milestones in the evolution of the gild among German traders and the related expansion of trade. Section 6.2 formalizes the analysis. Its game-theoretic model allows us to explore the incentives of traders and cities and explain why a gild organization could sometimes

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<sup>107</sup> De Roover 1965: 111 asserts that the gild's role “was, of course, to provide collective protection in foreign lands, to secure trade privileges, if possible, and to watch over the strict observance of those already in effect.” While his intuition carried him a long way, it did not explain how the guilds could provide protection and assure observance of rights by local rulers in foreign lands where the ruler had a preponderance of military force.

<sup>108</sup> This is not to argue, however, that this function was necessarily the main reason for these local monopoly rights.

successfully support an efficient level of trading activity when a simple reputation mechanism could not. Section 6.3 concludes by considering the subsequent history – the transformation and decline of the merchant guild associated with the rise of the state and suggests other applications of the theoretical framework.

## **6.1 The Commitment Problem and the Role of Merchant Guilds**

### **6.1.1 Institutions and Commitment**

Long-distance trade in late medieval Europe was based upon the exchange of goods brought from different parts of the world to central cities or fairs located in geographically or politically favorable places. Yet the presence of gains from trade and locations suitable to conduct exchange does not imply that exchange could occur without an institutional environment in which the merchants and their property were secure. The concern that rulers felt to provide security, reflected in the words of the Edward I quoted above, should be understood against the background of events like the following one that occurred in Boston, England in, or shortly before, 1241. A Flemish merchant accused an English trader of not repaying a commercial loan. This resulted in an uproar on all sides and the English merchants assembled to attack the Flemings, who retired to their lodging in the churchyard, ... The English threw down the pailings, broke the doors and windows and dragged out Peter Balg [the lender] and five others, whom they foully beat and wounded and then set in the stocks. All the other Flemings they beat, ill-treated and robbed, and pierced their cloths with swords and knives. ... Their silver cups were carried off as they sat at table, their purses cut and the money in them stolen, [and] their chests broken open and money and goods, to an unknown extent, taken away.<sup>109</sup>

Such disorders were not peculiar to England but mark the history of long-distance medieval trade. For example, the commercial relations between Byzantine and the Italian city states were often hindered by insecurity during the twelfth century. The Genoese quarter in Constantinople was attacked by the Pisans in 1162. At least one merchant was killed, while the other Genoese merchants had to escape to their ship leaving all their valuables behind them. In

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<sup>109</sup> Curia Regis, 121, m.6, published by Salzamn 1928.

1171 the Venetians attacked and destroyed the same Genoese quarter. About 10 years later a mob destroyed all the Italian quarters in Constantinople during the “Latin massacre” of 1182.<sup>110</sup>

In light of the theory of repeated games, one might conjecture that a ruler's commitment problem could be solved by a *bilateral reputation mechanism* in which individual merchants whose person and property were not protected by a local ruler would refuse to return with their goods in the future. The ruler, while perhaps reaping short run gains from ignoring a merchant's rights, stood to lose the future stream of rents from the cheated merchant's trade.<sup>111</sup> As section 6.2 demonstrates formally, this intuition is misleading. At the level of trade that maximizes the total net value of trade – that is, at the *efficient volume of trade* – a bilateral reputation mechanism cannot resolve the commitment problem. In the formal model, the reason is that, at the efficient volume of trade, the value of the stream of future rents collected by the ruler from an individual marginal merchant is almost zero, and therefore smaller than the value of the goods that can be seized or the cost of the services that can be withheld. The same conclusion would hold even at lesser volumes of trade if the frequency of visits by an individual trader were low. As long as ruler-merchant relations are governed only by a bilateral reputation mechanism, the theory holds that trading volume cannot expand to its efficient level.

The preceding discussion, as well as the formal model below, allow only one kind of sanction for cheated merchants: the withdrawal of trade. Military action might seem another important alternative. In the late medieval period, however, defensive technology was superior to

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<sup>110</sup> Day 1988. For additional examples, see also Kedar 1976: 26 ff.; Lane 1973: 34; De Roover 1963: 61.

<sup>111</sup> Clearly, there was a limit to the security a ruler could provide the merchants. Accordingly, the instances in which rights were abused in major cities or trade centers presented above relates to cases in which the relevant ruler had relatively high level of ability to secure rights.

offensive, and the costs and risks of offensive military action at distant ports limit its credibility as a sanction for trade violations.<sup>112</sup>

A possible means to increase the punishment is a multilateral response by all the merchants to transgressions against any subgroup of merchants. Indeed, the history of the relations between trade centers and alien merchants presents several examples of multilateral retaliations against rulers who had reneged on their contractual obligations. For example, circa 1050 the Muslim ruler of Sicily imposed a ten-percent tariff (instead of the five-percent tariff specified in the Islamic law) on goods imported to Sicily by Jewish traders. The traders responded by imposing an embargo and sending their goods to the rival trade center, Tunisia. The embargo was effective, and after a year the Sicilian ruler relented and removed the tariff.<sup>113</sup>

The above examples suggest that a *multilateral reputation mechanism* might be able to surmount the commitment problem without the aid of any formal organization. In each case, merchants imposed a collective punishment on the city that included participation by merchants who had not been directly injured. Several of the cited offenses were offenses *against an entire group of merchants*. In medieval trade, however, a city could also discriminate among merchants, abusing or not protecting them selectively. For example, a city could confiscate the belongings of some traders or withhold legal protection from them without directly harming other alien merchants. Indeed, the Sicilian rulers increased the tariff only to Jewish traders; and during two attacks on the Genoese quarter in Constantinople, other Italian merchants were not harmed. This suggests two interconnected reasons why, without a supporting organization, a multilateral reputation mechanism may be insufficient to surmount the commitment problem at

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<sup>112</sup> Parker 1990): comments that “After the proliferation of stone-built castles in western Europe, which began in the eleventh century.... [I]n the military balance between defence and offense, the former had clearly become predominant.” This situation changed only during the so called “Military Revolution” of the 15th century.

<sup>113</sup> David Kaufmann Collection, Hungarian Academy of Science, Budapest, document # 22, a, ll. 29 - 31, b, ll. 3 - 5, Gil 1983: 97-106; Taylor-Schechter collection, University Library, Cambridge, England, document 10 J 12, f. 26, a, ll. 18-20, Michael 1965, vol. II: 85.



the efficient level of trade. The first involves contract ambiguities and asymmetric information, while the second reflects the distinct incentives among different traders generated by a multilateral response.

Long-distance pre-modern trade took place in a highly complex and uncertain environment. Unanticipated events and multiple interpretations of existing agreements were always possible under these circumstances, implying that the definition of a “contract violation” was often ambiguous. Information asymmetry, slow communication, and different interpretations of facts among merchants imply that without an organization that coordinates responses, it was not likely that all the merchants would respond to the abuse of any group of merchants. As demonstrated formally in section 6.2, if the fraction of merchants who detect and react to an abuse against any group of merchants is only proportionate to the number abused, then a multilateral reputation mechanism is ineffective at the efficient volume of trade. It is ineffective for the same reason that bilateral reputation mechanism is ineffective: a threat by a group of marginal traders to withdraw their trade is barely significant once trade has expanded to its efficient level.

To permit an efficient expansion of trade in the medieval environment, there was a need for an organization that would supplement the operation of a multilateral reputation mechanism by *coordinating* the responses of a large fraction of the merchants. Only when a coordinating organization exists can the multilateral reputation mechanism potentially overcome the commitment problem. In the formal model, when a coordinating organization exists there is a Markov perfect equilibrium at which traders come to the city (at the efficient level of trade) as long as a boycott has never been announced, but none of them come to trade if a boycott has been announced. The ruler respects merchants' rights as long as a boycott has never been announced, but abuses their rights otherwise. Thus, when a coordinating institution exists, trade may plausibly expand to its efficient level.

Although the behavior described forms a perfect equilibrium, the theory in this form remains unconvincing. According to the equilibrium strategies, when a coordinating institution organizes an embargo, merchants are deterred from disregarding it because they expect the ruler to abuse violators' trading rights. But are these expectations reasonable? Why would a city not *encourage* embargo-breakers rather than punish them? As verified in section 6.2, this

encouragement is potentially credible. During an effective embargo, the volume of trade shrinks and the value of the marginal trader increases; it is then possible for bilateral reputation mechanisms to become effective. That is, there may exist mutually profitable terms between the city and the traders that the city will credibly respect. This possibility limits the potential severity of an embargo and, correspondingly, potentially hinders the ability of any coordinating organization to support efficient trade. To support the efficient level of trade, a multilateral reputation mechanism may need to be supplemented by an organization with the ability both to *coordinate* embargo decisions and to *enforce* them by applying sanctions on its own members.

### **6.1.2 Evidence of the Role of Formal Organizations**

The discussion has so far focused on two issues: a demonstration that guaranteeing the security of alien merchants and their goods was problematic in medieval Europe and that both historical evidence and theoretical reasoning suggest that a simple reputation mechanism could not completely resolve the problem. This subsection identifies more direct evidence that merchants and rulers recognized the need to provide believable assurances of security for traders and their goods, that they negotiated trading arrangements that often included a role for formal organizations, that these organizations served an important coordination and enforcement role, and that trade expanded in cities that negotiated these agreements. Notice that this pattern of facts is inconsistent with at least the simplest cartel theories of guilds, which predict that guilds would form only after trade relations were already established and would limit entry and price competition, leading to *smaller* quantities being traded.

That Medieval rulers and merchants recognized the need to secure alien merchants' property rights before trade expansion could occur is born out repeatedly in the historical record. Christians traders, for example, did not dare to trade in the Muslim world unless they received appropriate securities. Similarly, throughout Europe itself, merchants did not trade in locations in which they did not have security agreements. The Italians began travelling to other European cities and to the Champagne fairs and the Germans began travelling to Flanders, England and the Slavic east only after negotiating appropriate safety agreements.<sup>114</sup>

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<sup>114</sup> E.g., De Roover 1965; De Roover 1948: 13; Dollinger 1970.

Safety agreements allowing the merchants some measure of internal organization appear crucial to trade expansion. The Genoese trade with North Africa provides an instructive illustration. Prior to 1160, the Genoese trade with North Africa never exceeded 500 lire. In 1161, the Genoese legate, Otobonus d'Albericis, and the local ruler of North Africa, Abd alMumin, signed a fifteen year agreement securing the property rights of the Genoese. Genoese trade more than doubled to 1057 lire and remained at this higher level in later years. Moreover, the agreement focused on security issues. Though it specified a two percent reduction in the ten percent custom, it was hardly concerned with the distribution of gains from trade. Given that the expected gains from goods that reached North Africa was, on average, more than twenty-six percent during this period, it is highly unlikely that the custom reduction accounts for the expansion of trade that followed.<sup>115</sup>

Merchants from other trading cities has similar experiences. For example, the Catalan merchants' trade expanded “within only a few months” after they received, in 1286, privileges and the right to have a consul in Sicily. (Abulafia 1985: 226-27.) The trade of the German merchants in Bruges expanded after they received privileges and the right to have a *Kontor* (establishment or office). (Dollinger 1970: 41.) The Italian trade with Flanders flourished only after they were allowed to establish local organizations, called *nations*. (De Roover 1948: 13.)

There also exists indirect evidence that the parties recognized the importance of an *institutionalized commitment* to security, rather than mere promises. Muslim rulers provided European traders with *aman* – a religious obligation to secure the merchants' rights. Some cities in England went so far as to elect an alien merchant as mayor. Yet, it seems that a specific institution – the *merchant gild* – was the most common successful institution. The core of a merchant gild was an administrative body that supervised the overseas operation of merchant residents of a specific territorial area and held certain regulatory powers within that territorial area. In England, for example, the merchants of a town were granted the right to establish a society of merchants that retained specific commercial privileges in the internal and external trade of the town and usually had representation in the trade centers where its members traded. On the European continent, many towns were controlled by the mercantile elite who organized a

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<sup>115</sup> Krueger 1933: 379-80. Krueger 1932: 81-2.

merchant guild to advance their interests. In some Italian and German towns the merchant guilds were virtually identical with the town's government itself while in some Italian cities the merchants' operations were supervised by the city.<sup>116</sup>

Guilds provided merchants with the leadership and the information transmission mechanisms required for coordinated action. It was the guild that decided when to impose a trade embargo and when to cancel it.<sup>117</sup> The trade center usually provided the guild with the right to obtain information about disputes between its members and that center's authorities or between its members and other traders. The guild's regulations facilitated the collection and transmission of information among its members.<sup>118</sup>

Though the term “merchant guild” was not used in Italy, the Italian cities served the same functions on behalf of their resident merchants. The city's role in coordinating embargo decisions is well reflected in the relationships between Genoa and Tabriz, a vital city on the trade route to the Persian gulf and the Far East. In 1340 Tabriz's ruler confiscated the goods of many Genoese traders. Genoa responded by declaring a *devetum* (a commercial embargo) against Tabriz. In 1344, however, Tabriz's ruler sent ambassadors to Genoa promising an indemnity for everything which had been taken from the Genoese and favorable treatment in the future. As a consequence, the *devetum* was removed and the Genoese traders flocked to Iran. However, the ruler of Tabriz did not keep his promise to protect their rights and the Genoese traders were robbed and many of them were killed. The material damage reached two hundred thousand lire, an immense sum.

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<sup>116</sup>Gross 1890; Rorig 1967; Rashdall 1936: 150-153; For a general discussion of the concept of corporation in Medieval English law, see Pollock and Maitland 1968, vol. I: 486 ff.

<sup>117</sup> An exception is the case of the Maghribi traders. That case, however, seems to reflect the situation in the Muslim world rather than in Europe. See Greif 1992c.

<sup>118</sup>Gild members were required to travel together, to live and store their goods throughout their stay in quarters that belonged to the guild, to examine the quality of each other's goods, and to witness each other's sales. See, for example, Moore 1985: 63 ff. As de Roover 1948: 20 noted, the “main purpose of the consular organization [of the Italians in Bruges] was .. to facilitate the exchange of information...”

When the ruler later invited the Venetians and Genoese to trade, he “could not give them the guarantees they required, ... [hence] the Italian merchants, eager as they were to recover their prosperous trade in Persia and to reopen the routs to India and China, felt it was unsafe to trust a mere promise.” (Lopez 1943: 181-4.) As discussed below, however, it was the Genoese traders as a whole who could not trust a “mere promise”; an individual Genoese trader might still be able to trust the ruler of Tabriz while the *devetum* was in force.

An incident that occurred during the Genoese embargo of Tabriz confirms the historical importance of enforcement within the merchant group and that merchant guilds assumed this enforcement role. In 1343, during the *devetum* against Tabriz, a Genoese merchant named Tommaso Gentile was on his way from Hormuz to China. Somewhere in the Pamir plateau he became sick and had to entrust his goods with his companions and head back to Genoa the shortest way. That way, however, passed through Tabriz. When knowledge concerning his journey through Tabriz reached Genoa, Tommaso's father had to justify this transgression with the “Eight Wisemen of Navigation and the Major [black] Sea,” that is, the superior colonial board of Genoa. These officers accepted the thesis of an act of God, and acquitted Tommaso from every penalty, in as much as he had gone through Tabriz without merchandise. (Lopez 1943: 181-3.)

The merchant guild's strategy of conditioning future trade on adequate past protection, the use of ostracism to achieve security (rather than privileges or low prices), and the relationship between acquiring information, coordination, and the ability to boycott, are reflected again in the agreement made in 1261 between the Flemish merchants from Ghent, Ypres, Douai, Cambrai, and Dixmude who purchased English wool. “For the good of the trade,” they decided that if it should happen that any cleric or any other merchant anywhere in England who deals with sales of wool deals falsely with any merchant in this alliance ..., by giving false weight or false dressing of the wool or a false product, ... and if they do not wish to make amends, we have decided that no present or future member of this alliance will be so bold as to trade with them.” To make this threat of boycott functional, they “decided that there will be in each of these cities one man to view and judge the grievances, and to persuade the wrongdoers to make amends.” (Moore 1985: 301.)

The credibility and force of a coordinating organization's threat to embargo depended crucially on the ruler's ability to undermine an embargo by offering special terms to embargo violators. In theory, the marginal gains from additional trade rise during an embargo. Both this fact and the fact that guilds needed to take special measures to prevent shipments to the embargoed city are confirmed by the historical evidence. For example, in 1284, a German trading ship was attacked and pillaged by the Norwegians. The German towns responded by imposing an embargo on Norway. The export of grain, flour, vegetables and beer was prohibited. According to the chronicler Detmar, "there broke out a famine so great that (the Norwegians) were forced to make atonement." The temptation for an individual merchant to smuggle food to Norway in this situation is clear. To sustain the embargo, the German towns had to post ships in the Danish Straits.<sup>119</sup> The fact that the success of a trade embargo depended crucially on obtaining the support of virtually all of the merchants involved was also clear to the cities on which embargo was inflicted. When, in 1358, the German towns imposed an embargo on Bruges, the city attempted to defeat the embargo by offering merchants from Cologne extensive trade privileges. (Dollinger 1970: 65-6.)

Placing ships in a strait and imposing fines are specific ways to overcome the distinct incentives problem. The evidence, however, suggests that the credibility of the threat to carry out an embargo was, in many cases, sustained by a different means. Credibility was established by endowing guilds with the ability to impose commercial sanctions upon their member merchants. In England and other regions in Europe a local guild usually had exclusive trade privileges in its own town, typically including monopoly rights over retail trade within the town, exclusive exemption from tolls, and so forth, as well as the right to exclude, under certain circumstances, members from the guild.<sup>120</sup> These guilds therefore were able to provide their members with

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<sup>119</sup> Dollinger 1970: 49. See also his description of the embargo on Novgorod (p. 48). Anyone who broke the embargo was to suffer the death penalty and the confiscation of his goods.

<sup>120</sup> Gross 1890: 19-20, 38 ff. 65.; de Roover 1948: 18-9. Exclusive commercial rights for the guild should not be confused with monopoly rights. Entry into the guild was permitted during

streams of rents in their home towns. Receiving these rents, however, could have been made conditional on following the recommendations, rules, and directives of the gild. Hence these rents could serve to tie a member to the Gild by making change of residence costly and to ensure solidarity among the Gild's members.<sup>121</sup>

The Flemish regulations of 1240 illustrate the role of the stream of rents in providing the appropriate incentives: A merchant who ignored the ban imposed by the gild on another town was expelled, losing his rent stream.

If any man of Ypres or Daouai shall go against those decisions [made by the gild] ... for the common good, regarding fines or anything else, that man shall be excluded from selling, lodging, eating, or depositing his wool or cloth in ships with the rest of the merchants ... And if anyone violates this ostracism, he shall be fined 5s... (Moore 1985: 298.)

### 6.1.3 Evolution of Gild Organizations

Perhaps the best example of the gild's contribution to fostering the growth of trade is the evolution and operation of the institution that governed the relations between the German merchants, their towns, and the foreign towns with which they traded. To achieve the coordination and enforcement that was required for the reputation mechanism to operate effectively, a means was needed to influence the behavior of merchants from **different** towns.

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the period under consideration. The German Kontore were established by the merchants who actually traveled abroad to trade. In England, for example, even individuals who did not live in a specific town could join its merchant gild and each member had to pay entry fee. See, for example, Dollinger 1970 or Gross 1890. Note that by creating barriers and consequent rents, such a system also motivates each merchant to adhere to the gild rules, including honoring gild-sponsored embargoes. As shown below, this in turn permits a higher volumes of trade than would be possible without the entry restrictions.

<sup>121</sup>This is not to claim that this was the chief role of these rents. The analysis examines the role of the merchant gild in the expansion of trade between political units and not within political units.

This fact led to the rise of an interesting form of gild – the German Hansa.<sup>122</sup> Several extensive studies have mined the abundant historical records of the Hansa and enable us to examine its evolution in light of the theoretical analysis.

The analysis of the evolution of the gild in Northern Europe emphasizes episodes in which conflict occurred and trade was affected. In purely theoretical terms, conflict can be explained as an equilibrium phenomenon when information about the behavior of the parties is imperfect,<sup>123</sup> as it surely was in this period. The episodes presented here, moreover, are ones in which conflict was followed by institutional change, and it seems implausible to model these as equilibrium outcomes. Instead, the episodes themselves as can be considered as disequilibrium outcomes and the resulting changes as adaptations to changing circumstances or as improvements based on accumulated experience.

Specifically, the focus here is on the development of the German *Hansa*. For historical reasons, membership in the basic organizational unit that coordinated the activities of German merchants abroad – the *Kontor* – was not conditional upon residency in one particular town. Any German merchant who arrived in a non-German city could join the local *Kontor*. A *Kontor* had the same function as the gild in coordinating the responses of the German merchants in disputes with the town; however, it lacked the ability to punish merchants in the towns where they resided, weakening its ability to enforce sanctions against its members. If this theory is correct, the difference between the German *Kontore* and other guilds should have made the *Kontore* less effective and should have led to changes in or the dissolution of that form of merchant organization. The history of the contractual relations among the city of Bruges, the

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<sup>122</sup> Clearly, this is not to claim that the efficiency attributes of the Hansa presented discussed below were sufficient for its emergence. For a general discussion of the relationships between social and political institutions, gains from trade, and the emergence of institutions that facilitate trade, see Greif 1992a, 1992b and parts V and VI below.

<sup>123</sup> For the imperfect monitoring approach, see the pioneering work by Green and Porter 1984. For refinements of this approach, see Abreu, Pearce, and Stacchetti 1986 and Abreu, Milgrom, and Pearce 1991.



local *Kontor*, and the German towns provides a clear illustration of the evolution of merchant organization.

In 1252, a *Kontor* of German merchants obtained extensive trading privileges from Bruges, and a permanent settlement followed. (Weiner 1932: 218.) The *Kontor* was led by six aldermen elected by the German merchants present in the town. Two of the aldermen were from Rhenish towns, two from Westphalian-Wendish towns, and two from Prussian-Baltic towns, reflecting the range of origins of the participating German merchants.<sup>124</sup> The trading privileges given to the alien merchants in Bruges were continually abused, and eventually riots broke out, endangering both people and property. The situation is described in a document dated 1280 reporting that “it is unfortunately only too well known that merchants travelling in Flanders have been the objects of all kinds of maltreatment in the town of Bruges and have not been able to protect themselves from this.”<sup>125</sup> Along with most of the other alien traders who operated in Bruges, the German merchants retaliated in 1280 by transferring their trade to Aardenburg. After two years of negotiation, a new agreement was reached and the *Kontor* returned to Bruges.

Seemingly successful, the embargo failed to guarantee the property rights of the German merchants, as Bruges simply ignored its agreement with them. (Dollinger 1970: 48-51.) It should be noted, however, that Bruges did respect the rights of other alien merchants who frequented the city. This present analysis points to the reason for that discrimination. The embargo was not imposed by the German merchants alone but by all alien merchants in Bruges, including the important and well organized Italian and Spanish *nations*. While the lesson for Bruges from that episode was to respect the rights of those well organized groups, it became clear to the city that the German merchant organizations were different. The *Kontor* proved incapable of enforcing its decisions upon its members. Because the *Kontor* encompassed only the German merchants actually present in Bruges – rather than all the potential German traders who might want to trade during a boycott – its threat of sanctions was not credible. For a time, German merchants had to accept inferior treatment.

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<sup>124</sup> De Roover 1965: 114; Dollinger 1970: 86.

<sup>125</sup> Urkundenbuch der Stadt Lubeck, I, no. 156, p. 371, translated by Dollinger 1970: 383.

Another embargo, from 1307 to 1309, was thus required to force Bruges to respect its contractual agreements with the Germans, and in this embargo, only they participated. What had changed between 1280 and 1307 was the ability of the German traders from different towns to coordinate their responses and enforce their embargo. A milestone occurred in 1284 when the Wendish German towns imposed an embargo on Norway. Merchants from the city of Bremen refused to cooperate in the embargo, and the other German towns excluded Bremen's merchants from all German *Kontore*. The German towns had achieved the coordination needed to expel one of their members. The importance of the achievement is indicated by the fact that the act of expelling a city came to be referred by a special word, *Verhansung*.<sup>126</sup>

After 1307, the ability of the German merchants to commit themselves to coordinate their actions and to enforce their decisions on individual merchants and towns was rather advanced, thus guaranteeing Bruges's adherence to its contractual obligations. Bruges respected the charters agreed upon in 1307 and 1309, and consequently Flanders' trade flourished and expanded for the next 50 years. (Dollinger 1970: 51.) As the theoretical analysis indicates, once the ability of the German *Kontor* to coordinate and enforce their decisions upon their members was well developed, the contract enforcement problem could be resolved and trade expanded.

It was not until the middle of the century, when the cost of providing security around Bruges rose drastically, that a new level of cooperation among the German towns was required to force Bruges to provide the security required to support efficient trade. The Hansa relations with Bruges deteriorated around 1350, mainly because Bruges was not ready to compensate the Germans for their damages in Flanders from the war between England and France. The Hansa responded by strengthening its internal organization. In 1356 the German Hansa held its first *Diet*. It was decided that the *Kontor* of Bruges should be operated according to the decisions of the *Diet*. Apparently recognizing the need for coordination among towns, the *Kontor* accepted this decision. The prominent historian of the Hansa, Dollinger, has emphasized the importance of this change. "In law, and not only in fact, the towns, acting through the general diet were establishing their authority over their merchants in foreign ports." (Dollinger 1970: 63.)

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<sup>126</sup> Dollinger 1970: 49; Weiner 1932: 219.

A Hanseatic embargo of Bruges followed in 1358. It was announced that any disobedience, whether by a town or an individual, was to be punished by perpetual exclusion from the Hansa. Bruges attempted to defeat the embargo by offering trade privileges to individual cities, including both non-Hanseatic ones like Kampen and a Hanseatic one, Cologne. The theory suggests that by offering these privileges it hoped to undermine the effectiveness of the new leadership. While the non-Hanseatic cities accepted Bruges's terms, Cologne refused to cooperate. The embargo proved a success and, in 1360, Bruges came to terms with the Hansa. This time, reflecting the parties more complete understanding of the range of circumstances in which the city would have to provide services, the privileges were written, “in much detail as to prevent any one-sided interpretations.”<sup>127</sup>

The institution of the German Hansa was now crystallized. It was a nexus of contracts that links various interactions among merchants, their towns, and foreign cities that advanced exchange. The Hansa's leadership served to coordinate and enforce cooperation between German merchants and towns – a cooperation that served the interests of all sides. The trade of Northern Europe prospered for generations under the supremacy of the Hansa. Although the trade embargo of 1360 was not the last, later trade disputes seemed to center around distributive issues such as the provision of trade privileges. Commitment for security was no longer an issue.

It is illuminating to contrast the development of the Hansa among German towns with the rather different organization among the Italian merchants. The solid internal political and commercial organization of the Italian cities and their prominence in trade enabled them to overcome the coordination and internal enforcement problems. Collective action among the merchants from Italian cities was ensured. And, because none of the cities were “marginal players” in the ports where they traded, coordination among the cities was unnecessary.<sup>128</sup> In

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<sup>127</sup> Dollinger 1970: 66. For further details of this embargo, see Dollinger 1970: 63-66 and Weiner 1932: 220.

<sup>128</sup> For the relative size of Italian and German cities, see Bairoch, et. al. 1988. Some inter-city cooperation was also practiced among the Italian where smaller cities “affiliated” themselves with larger ones. See the discussion below.

contrast, the German *Kontor* was a local organization in a trading center which lacked the ability to enforce its decisions upon its members who came from various German towns. As noted, the German towns were small and, before the establishment of the Hansa, most were relatively insignificant in large trading centers like Bruges.

The historical analysis presented in this section supports the hypothesis that the Medieval merchant guild was an institution that overcame the ruler's commitment problem and facilitated trade expansion. Although the merchant guilds exhibited a range of administrative forms – from sub-division of a city administration (such as that of the Italian city-states) to the inter-city organization (of the Hansa) – their functions were the same – to ensure the coordination and internal enforcement required to surmount the commitment problem by permitting effective collective action. The actions taken by rulers and traders, their strategies as reflected in their regulations, and the expansion of trade that followed the establishment of guilds all confirm the importance of this role of the guild organization.

## 6.2 The Formal Model

The theoretical modeling is kept intentionally simple and directed to analyzing the potential of various plausible mechanisms for overcoming the ruler's commitment problem. Each of the mechanisms examined here might feasibly permit commitment by the ruler at some levels of trade; the focus is on the growing need for more sophisticated mechanisms as the level of trade rises and approaches the efficient level.

We model the basic environment in which trade took place as having two kinds of players: a city and individual merchants. The merchants, identical and large in number, are identified with the points on the interval  $[0, \bar{x}]$ . The city – a potential trading center – has the following trading technology: If the number of traders passing through the city in a single period is  $x$ , the gross value of trade in that period is  $f(x)$ . In addition, suppose that there is a cost of  $c > 0$  per unit of value traded incurred by the city for the services it provides and a cost  $\kappa > 0$  per unit of value incurred by each trader, so that the net value of trade is  $f(x)(1 - c - \kappa)$ . Assume that trade is profitable, that is,  $c + \kappa < 1$ . Also assume that  $f$  is non-negative and differentiable, that  $f(0) = 0$ , and that  $f$  achieves a maximum at some unique value  $x^* > 0$ , which is referred to as the

*efficient volume of trade.* In this model, the city funds its services and earns additional revenues by charging a toll or tax of  $\tau \geq c$  per unit of value passing through its ports, so that its total tax revenues are  $\tau f(x)$ . If it provides the services contracted for, then its net revenue for the period is  $f(x)(\tau - c)$ . If the city breaches its contract by failing to provide services to a fraction  $\epsilon$  of the traders, it saves costs of  $\epsilon c f(x)$ , so its payoff for the trading period is  $f(x)(\tau - c(1 - \epsilon))$ .<sup>129</sup> Traders who are not cheated each earn profits, net of costs, tolls and taxes, of  $(1 - \tau - \kappa)f(x)/x$ . Traders who are cheated pay taxes and incur costs  $\kappa$  but receive no revenues; they each earn  $-(\tau + \kappa)f(x)/x$ .

All of this is repeated period after period, and the players' payoffs from the whole repeated game are the discounted sum of the periodic payoffs using discount factor  $\delta$ . Thus, the city's payoff when the trading volume is  $x_t$  in period  $t$  is given by:

$$\sum_{t=0}^{\infty} \delta^t f(x_t) (\tau - c(1 - \epsilon_t)) \quad (1)$$

and the payoffs of the individual traders are determined similarly as the discounted sum of their periodic payoffs.

The specification of the model captures the idea that merchants are substitutes as far as the ruler is concerned and each of them is relatively “small.” The historical observation that rulers could discriminate between traders is captured through the specification of the ruler's strategy. Abstracting away from the issue of competition among alternative trade centers seems appropriate since an essence of medieval trade was that it was based on exchange of goods brought by traders from several regions to a specific trading place. Thus, by and large, the threat of a group of traders from a specific region to permanently switch to an alternative potential trade center, without the cooperation of traders from other regions, was not credible.

The historical records also indicate, as discussed above, that merchants were most likely to trade abroad when they perceived their rights to be secure. The specification of the merchants' payoffs is based on this observation. The specification of the ruler's payoff reflects the fact that a ruler could gain from abusing rights or from allowing his subjects to do so. While the model equates the gains from abusing rights as the protection costs saved, one can alternatively think of

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<sup>129</sup> Note that this formulation captures the gains to the ruler from either abusing rights directly or from neglecting to provide merchants with costly protection.

gains from abuse as reflecting gain from ruler's confiscation of merchants' goods. The ruler's and the merchants' payoffs are specified to allow a conceptual and analytical distinction between issues of distribution and efficiency. This treats the tax rate as given and hence abstracts away from examining the process through which the gains from trade are allocated. Any losses to the merchants above the agreed upon rate of taxation, however, is defined to be an abuse.

Analytically, this specification implies that any first-best is characterized by the level of trade  $x^*$  in every period and no cheating by the city. Different first-best utility allocations are achieved by setting different tax rates  $\tau$ . Technically, this conclusion reflects the assumption that some value is being lost when the ruler fails to provide protection, which reflects events such as those that took place in Boston, as described earlier: Failure to provide protection led to a destruction of goods and loss of value. Whatever the merchants were willing to pay the ruler, namely all issues of transfer, are modeled here as part of the tax.

### **Game 1: Informationally Isolated Traders – Bilateral Reputation Mechanism**

Our first model represents the situation of traders who travel alone or in small groups with no social or economic organization, so that they remain unaware of how the city has treated other merchants. Although this model is surely too extreme to be fully descriptive, it highlights the difficulties faced by individual traders negotiating with the city on their own.

In this game, a trader must decide whether to bring his goods to the city in each period, knowing only the history of his own decisions and his own past treatment by the city. A strategy for the trader is a sequence of functions mapping the trader's personal history into decisions about whether to offer his goods for trade in that period. Similarly, the city must decide who to cheat under various conditions. A strategy for the city is a sequence of functions identifying a (measurable) subset of the current traders for the city to cheat as a function of who shows up to trade currently and the full past history of the game.

Readers familiar with either the economics of reputations or the theory of repeated games will recognize that the repetition of the interactions between the city and the individual traders creates the possibility for reputations to be created that enforce good behavior by the city. The idea is that a trader who is once cheated might refuse to return to the city in future periods, leading to a loss of profits for the city. The effectiveness of this threat depends both on the

frequency of trade and the periodic value of the individual merchant's trade to the city. If the frequency of trade is sufficiently high and the volume sufficiently low, so that the value of the repeat business of any individual trader to the city is high, the simple reputation mechanism can be effective for providing incentives to the city to protect individual rights. In the analysis, however, when the volume of trade rises to the efficient level, the value of repeat business falls to zero, so the usual conclusions of the Folk Theorem of repeated games do not apply.

*Proposition 1.* No Nash equilibrium of Game 1 can support honest trade ( $\epsilon_t \equiv 0$ ) at the efficient level ( $x_t \equiv x^*$ ), regardless of the levels of  $c$ ,  $\tau$ ,  $\kappa$ , or  $\delta$ .

*Proof.* Suppose there were such an equilibrium and consider the payoff to the city if it deviates from the equilibrium strategy and cheats a fraction  $\epsilon$  of the first period traders. In the initial period, its payoff is  $f(x^*)(\tau - c(1 - \epsilon))$ . In subsequent periods, the informational assumptions of the model imply that the play of at most  $\epsilon$  traders is affected. Consequently, at least  $1 - \epsilon$  traders come to the city in each future period, and the city's payoff from treating them honestly is, in present value terms, at least  $\gamma(\tau - c)f(x(1 - \epsilon))$  where, for convenience, define  $\gamma = \delta/(1 - \delta)$ . So, the city's total payoff from cheating a fraction  $\epsilon$  of the traders in the first period and adhering to the purported equilibrium thereafter is at least:

$$f(x)(\tau - c(1 - \epsilon)) + \gamma(\tau - c)f(x(1 - \epsilon)), \quad (2)$$

and this expression coincides exactly with the actual payoff when  $\epsilon = 0$ , that is, when the city adheres to the purported equilibrium. The derivative of expression (2) with respect to  $\epsilon$  at  $\epsilon = 0$  and  $x = x^*$  is:

$$cf(x^*) - \gamma(\tau - c)x^*f'(x^*) = cf(x^*) > 0, \quad (3)$$

because  $f'(x^*) = 0$ . This establishes that the city has a profitable deviation, that is, the specified behavior is not consistent with Nash equilibrium.  $\square$

No mechanism based only on sanctions by those who are cheated can support honest trading at the efficient level,  $x^*$ , because, when trading is conducted at that level, the marginal trader has zero net value to the city. By cheating a few marginal traders, the city loses nothing in

terms of future profits, but saves a positive expense in the present period. To support the efficient level of trading, some kind of collective action among merchants is needed.<sup>130</sup>

The proposition is stated in terms of Nash equilibrium because it is a negative result and it should be emphasized that, even with the most inclusive of noncooperative equilibrium concepts, there is no way to support the efficient volume of trade. For positive results, stronger, more convincing equilibrium concepts is used.

### **Game 2: Informational Isolated Small Groups of Traders – An Uncoordinated Multilateral Reputation Mechanism**

While information in medieval times was slow to diffuse by modern standards, it was nevertheless available. In particular, if a specific merchant was ever abused, even in the absence of any organization for information diffusion, some of his peers were likely to learn it. For example, the traders cheated in Bruges might become known to some others from the same home town or to their traveling companions. Can this process of limited, uncoordinated information diffusion enable the ruler to commit himself at the efficient level of trade?

To examine this issue, suppose that an incident in which the city cheats a group of traders always becomes known to a larger group of traders. Formally, whenever a set  $T$  of traders is cheated, there is a set of traders  $\hat{T} \supset T$ , each of whom learns of the event. Assume that there is some constant  $K$  ( $1 \leq K < \infty$ ) such that if the number of traders cheated is  $\mu(T)$ , then the number who learn about the event,  $\mu(\hat{T})$ , is no more than  $K\mu(T)$ : If few traders are cheated, then proportionately few discover that the event has occurred. In Game 2, traders make their decisions to bring goods based on the what they know of their own past behavior and the city's, including

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<sup>130</sup> This result is not an artifact of the specification of costs. For example, if the costs born by the city include some fixed costs per trader (possibly in addition to the proportional costs), the city would have an even stronger incentive to reduce the number of traders, because it bears only a fraction  $\tau$  of the resulting loss of value but saves all of the service costs. Making costs proportional to value minimizes the distortion in the city's incentives, but still leaves it tempted to seek short-term gains by cutting services at the expense of individual traders when only the bilateral reputation mechanism is at work.



whatever they may know about how the city has cheated others. Potentially, an incident of cheating may then lead to a withdrawal of trade by a group that is many times larger than the group that was cheated. Even if this potentiality could be realized, however, it would not be sufficient to support an efficient volume of trade.

*Proposition 2.* No Nash equilibrium of Game 2 can support honest trade ( $\epsilon_t \equiv 0$ ) at the efficient level ( $x_t \equiv x^*$ ), regardless of the levels of  $c$ ,  $\tau$ ,  $\kappa$ , or  $\delta$ .

The proof is essentially the same as for the first proposition, except that the bound on the number who decline to trade in the future is multiplied by  $K$ . In particular, (3) is replaced by  $cf(x^*) - \gamma K(\tau - c)x^*f'(x^*) = cf(x^*) > 0$ .

Violations against a few merchants that are noticed by proportionately few cannot be deterred by a threat of retaliation by just those with first-hand knowledge.

The real situation faced by the traders is considerably more complicated than is modeled in Games 1 and 2. One important missing element concerns informal and word-of-mouth communication. Although this allows that some traders were informed when the city cheated another trader, it is also assumed that traders know nothing about who else is currently trading. This assumption was a device to rule out endogenous communication among the traders in the game, by which one trader may infer that another was cheated because someone did not show up to trade. In theory, this kind of communication can be significant. (Kandori 1992.) No doubt, both word-of-mouth and some inferences of this kind could take place, but builds in the formal model to disallow them on the assumption that they were of minor importance for enforcing contract compliance. To the extent that informal communications and indirect inferences could provide effective information, the need for organized communication and coordination is reduced.

### **Game 3: Gild with Coordinating Ability**

We have now seen that it is impossible for the city and the traders to sustain an efficient level of trade based only on sanctions applied by small groups. Given the historical evidence of the existence of organizations that governed the relationships between the traders and the city, it is natural to examine whether these could contribute to trade expansion.

There is a serious issue of how the guild ought to be modeled. A crucial characteristic that separates formal institutions like guilds from informal codes of behavior is the creation of specialized roles such as those of the guild's aldermen. Determining how the guild selects its aldermen, what private interests those merchants may have, and how the guild manages the principal-agent problem of controlling the aldermen is a serious and complex issue that merits close analysis. Nonetheless, including such a model here would only obscure the main point of this paper. So, these issues are set aside for future research and model the guild here as a mere automaton. By assigning different information and behavioral rules to the guild, it is possible to evaluate its contribution to trade expansion.

This subsection examines the role of the guild as an *organization* for communication and coordination. In the formal model, if the city cheats a set of traders,  $T$ , then the guild is assumed to discover the event and announce a boycott with probability  $\alpha(T) \geq \mu(T)$ . This specification entails that the more merchants were abused, the more likely is the guild to conclude that some abuse has occurred. On the other hand, it does not imply that the guild has information superior to that available to the merchants under the uncoordinated reputation mechanism examined in game 2.

In this game, the guild makes boycott announcements mechanically and without any means of enforcement. Traders learn the guild's announcement in each period, but they are not forced to heed it. It simply becomes part of the information that is available to them and to the city. Otherwise, the game is the same as Game 1. Despite the guild's lack of enforcement ability, the mere change in information alters the set of equilibria.

*Proposition 3.* Suppose that  $\tau + \kappa \leq 1$  and

$$c \leq \gamma(\tau - c). \quad (4)$$

Then, the following strategies form a Markov perfect equilibrium of Game 3:<sup>131</sup> The city does not cheat unless a boycott is announced by the guild leader; after a boycott is announced, it cheats any trader who offers to trade. Traders offer to trade in a given period if and only if no boycott has been announced.

The formal proof is by direct verification. The condition (4) is just the condition that what the city stands to gain by cheating a trader, which is proportional to  $cf(x^*)$ , be less than the average future profits from each trader, which is  $\gamma(\tau - c)f(x^*)$ . With group enforcement, it is *average* trading profits rather than marginal profits that determine the city's incentives. It is that fact that accounts for the continued effectiveness of group sanctions even at the efficient level of trade.

As remarked earlier, the equilibrium strategies contain a counterintuitive element: that the city cheats any trader who offers to trade during a boycott. It is the traders' unanimous expectations that the city will behave that way which causes them all to honor the boycott. But why should the city not welcome traders during the boycott, rather than cheating them? In a Markov perfect equilibrium, the city can be expected to cheat embargo-breaking traders only if it is actually in the city's interest to do so once the embargo has been announced. Given the specified strategies, if  $y$  traders violate the boycott and offer their goods, the city expects a payoff of  $(\tau - c)f(y)$  in the current period, and zero in future periods, if it acts honestly. If it cheats, it expects  $\tau f(y)$  in the current period and zero in the future, so cheating is, indeed, optimal.

Although the strategies described in Proposition 3 do constitute an equilibrium, the expectations and behavior that they entail seem implausible. The equilibrium requires, for

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<sup>131</sup> This is a Nash equilibrium of the game with the properties that (1) the player's strategies at any date depend only on whether a boycott has been announced and (2) each player's strategy at each date maximizes his payoff from that date onward, given the equilibrium strategies of the other players.

example, that no matter how desperate the city may be for renewed trade relationships once a boycott has been announced, the city must nevertheless cheat anyone who ventures to trade with it. In addition, the traders must expect that behavior. By the equilibrium logic, the city does this because it expects the boycott to take full hold in the next round anyway, so it anticipates that any cooperation it may offer would be fruitless.

This equilibrium behavior does not match the historical facts very well, and it is of doubtful import even as theory, because it supposes that the city and potential embargo breakers play the equilibrium with the lowest possible value for themselves. Similar criticisms have been leveled at the equilibria of other repeated game models, notably by Farrell and Maskin 1989, Bernheim and Ray 1989, Pearce 1987, and Abreu and Pearce 1991. None of the alternative solution concepts that these authors suggest apply directly to the present model, but all suggest that it is more reasonable to suppose that some cooperation may be achieved between traders and the city even after a boycott is announced. As an example, consider the possibility that mutually profitable *bilateral* agreements between the city and individual traders may be reached even during a boycott. It will be apparent from the logic of the arguments that any other kind of cooperation would lead to qualitatively similar conclusions.

Let us therefore suppose that if some traders agree to trade with the city despite the embargo, they cannot rely on the threat of a group boycott to enforce their own claims against the city. What, then, can enforce honest behavior by the city during the boycott? It can be achieved, for example, by the threat by a cheated trader to withdraw his own future trade. Proposition 1 established that the efficient level of trade  $x^*$  could not be supported by such an equilibrium, but it leaves open the possibility that some inefficiently low level of trade can be supported. It is thus natural to ask: What is the highest level of exchange,  $x'$ , that can be supported in this way?

*Proposition 4.* Assume that  $f$  is concave. Consider the strategies in which the city cooperates in each period with just those traders that it has never before cheated and each trader offers to trade in each period if and only if he has not been cheated before. These strategies constitute a subgame perfect equilibrium of Game 1 when the volume of traders is  $x$  and the taxes are  $\tau$  if and only if for all  $y \leq x$

$$0 \geq cf(y) - \gamma(\tau - c)yf'(y). \quad (6)$$

A sufficient condition is that (i)  $0 \geq cf(x) - \gamma(\tau - c)xf'(x)$  and (ii) the elasticity  $e(x) = d \ln f(x) / d \ln(x)$  be a decreasing function of  $x$ .

*Proof.* It is obvious that the traders' strategies are best replies from any point in the history of the game to the strategy of the city, so there is only a need to consider the optimality of the city's strategy.

Beginning with  $x$  current traders, consider the subgame achieved after  $x - y$  traders depart, when there are  $y \leq x$  traders remaining. By cheating a fraction  $\epsilon$  of the  $y$  current traders, the city's payoff will be  $g(\epsilon; y) = (\tau - (1 - \epsilon)c)f(y) + \gamma f(y(1 - \epsilon))(\tau - c)$ . A necessary condition for the optimality of  $\epsilon = 0$  is  $\partial g(\epsilon; y) / \partial \epsilon \leq 0$  at  $\epsilon = 0$ . An easy calculation verifies that this is just the same as condition (6), so the latter condition is necessary for all  $y$ .

By the optimality principle of dynamic programming, it is sufficient to show that there is no subgame in which the city would do strictly better by setting  $\epsilon > 0$  in the initial period and then adhering to its equilibrium strategy thereafter, given the strategies of the others. If  $f$  is concave, then for all  $y$ ,  $g(\epsilon; y)$  is concave in  $\epsilon$ , so a sufficient condition is that for all  $y$ ,  $\partial g(\epsilon; y) / \partial \epsilon \leq 0$  at  $\epsilon = 0$ , which is again equivalent to (6), proving sufficiency.

The elasticity can be rewritten as  $e(x) = xf'(x)/f(x)$ . The condition (6) is that  $e(y) \geq c/[\gamma(\tau - c)]$  for all  $y \leq x$ , which follows from  $e(x) \geq c/[\gamma(\tau - c)]$  and the hypothesis that  $e(\cdot)$  is decreasing.  $\square$

Let  $x'$  be the largest solution of (6). The equilibrium described by Proposition 4 suggests an interesting interpretation of the levels of trade  $x'$  observed during boycotts and explains why some merchants continued to trade but others did not. According to the theory, additional traders, beyond the number  $x'$ , would be cheated by the city and would be unable to exact retribution for their losses. Alternatively, if one thinks of the level of trade  $x < x^*$  during the

boycott as being determined by factors outside the model (such as existing alliances or other interests), then condition (6) implies that the minimum tax rate necessary to deter cheating is less the lower  $x$  is. This confirms the intuition that an embargo breaker may be able to negotiate an unusually attractive deal, both because the value of trade per trader ( $f(x)/x$ ) is higher when  $x$  is small and because the minimum tax rate  $\tau$  necessary to prevent cheating is lower for small  $x$ .

Proposition 4 implies that in the absence of a strong gild – one that can enforce the boycott on its members – the gild cannot credibly threaten to reduce the city's income to less than  $f(x')$ . This threat may or may not be sufficient to support honest trade, depending on the parameters  $\gamma$ ,  $\tau$ , and  $c$ . That is, a boycott with leaks may or may not be enough to deter the city from violating its agreement. If this kind of boycott is not enough, then there may be mutual gains to be had by strengthening the gild and enabling it to make a more powerful threat. In particular, a gild with ability to enforce its boycott decision on all the merchants may be able to assure trade expansion.

The force of any potential boycott depends not only on  $f(x')$  and  $f(x^*)$  but also on the net rate of profit  $\tau - c$  earned by the city. Incentives for honest behavior by the city are stronger when the taxes and tolls are high, because the city then has more to lose from a boycott. A strong gild can make it feasible to offer lower taxes and tolls while still promoting honest behavior by the city which, in a richer model, could lead to additional advantages in terms of increased value of trade.

#### **Game 4: The Gild with Coordination and Enforcement Abilities**

The final variant is a game in which the gild has the ability to enforce compliance from the individual traders. No formal analysis of this case is presented here because it is obvious that the only role of enforcement by the gild against member merchants in the formal model is to prevent trade during boycotts. Accordingly, the results are the same as in proposition 3, but now the traders participate in the boycott because they are required to do so, rather than because they expect participation to serve their individual interests.

### **6.3 Discussion**

All models in economics are stylized to highlight particular points and the models presented here are no exception. The game models treat all merchants as small and perfect substitutes for one another; they abstract from the costs of running a guild and the problems of enforcing good behavior on the part of guild leaders; they omit the issues of competition among different trading centers and do not delve into how organized merchants actually enforce sanctions against their own members. Although the models' narrow focus highlights the need for cohesiveness among merchants and gives what is arguably a convincing account of many details of the historical record, the omitted features are also important for understanding the history of merchant guilds. Merchant guilds were primarily an urban rather than rural phenomenon. That may be accounted for by the costs of organizing merchants over large geographic areas. Guild membership also extended gradually. In Germany, large cities took the lead in forming inter-city guilds. This pattern, too, seems to reflect the costs and other barriers to forming large organizations, and the potential for success for small guilds is surely an important part of the dynamics of guild development.

Although the models treat merchants as homogeneous in their commercial affairs with the city, their geographic diversity was the very basis for the trade. There were exports of timber and Sengalese gold from North Africa, silk, spices, drugs, flax and wine from the Middle East and Byzantine, luxury furs, cheese, butter, fish, and iron from Scandinavia and Russia, grains from Germany, wine from France and Spain, textiles from Flanders, wool, copper, dried fish and goat- and sheepskins from England, and so on.

When groups of merchants are close substitutes for one another, competition among them can undermine the joint action needed to enforce rights obtained from rulers of trading centers. The pattern of guild membership along product lines that the theory implies are nearly identical to the patterns implied by a theory of the merchant guild as an instrument of monopoly, so it is important to emphasize how the other predictions of the theories differ.

Our theory predicts that rulers will *encourage* the establishment of merchant guilds with specific rights and an effective organization. Such encouragement would not be expected if the sole purpose of guilds was to shift some of the fixed gains from trade from rulers to merchants unless the encouragement itself reflect the merchants' ability to coerce the rulers to shift rent in merchants' favour. The evidence reveals that, even when merchants could not coerce rulers by

the threat of embargo and even when the privileges provided to the merchants did not entail any shift in the rent, rulers did grant merchants various rights,<sup>132</sup> including the rights to organize, to hold courts and assemblies, to elect their own consuls, and to participate on juries when merchants were being tried. The analysis predicts that establishment of these guild rights would lead to trade *expansion*, but a cartel theory of guilds would suggest that guilds would form to reduce trade in goods in order to drive up relative prices. The evidence cited earlier supports the conclusion that, at least during the Late Medieval period, guilds led to trade expansion. While it is likely that the merchant guilds sought to advance the merchants' interests in many ways, including by negotiating for rights to control prices, these rent-seeking activities cannot account for the patterns identified here.

Of special interest for the point made here is the richness and complexity of the guild system. The guild functioned as a nexus of contracts, weaving separate agreements with the individual merchants and the cities where its members traded into a system whose parts were mutually supporting. Exclusive (but not necessarily monopolistic!) trading arrangements with the city allowed the guild to organize merchants, and other rights helped it to keep informed about disputes and to help the city enforce good behavior by merchants. The guild's contracts with the merchants were fundamental to allow it to enforce its agreements with the city and with other merchants, including those from towns that tried to smuggle goods past its embargoes. The Hansa, effectively involving inter-city contracts, further strengthened the merchants' hands in enforcement.

As centuries passed and trade gave impetus to political integration, larger political units emerged, taking upon themselves the functions that the merchant guild previously had performed. The political, commercial, and military relations among rulers enabled each to commit to the safety of the alien merchants frequenting his realm. Illustrative are such acts as those of the English kings, who made agreements and enforced embargoes to provide the English Merchants of the Staple and the Merchant Adventurers with security in their dealings with the Hanseatic

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<sup>132</sup> In addition to the evidence mentioned above, see Carus-Wilson 1967: xviii and EHD, III: 515-6. The role of the guild in securing rights rather than in achieving privileges in Bruges is suggested by the city policy to provide all nations with the same rights. See de Roover 1948: 15.



league. As the state system evolved, the need for the merchant guilds to secure merchants' rights declined.<sup>133</sup>

Merchant guilds, however, did not necessarily disappear and some guilds became fiscal instruments that hindered trade expansion in the emerging states. Other guilds consolidated their political power and, after securing their members' rights, turned to limit the rights of their competitors. For example, the German Hansa of the late Medieval period was a new political entity aimed at preserving the property rights of German merchants. Although its establishment enabled Northern European trade to flourish, once organized, the Hansa's concern was not efficiency but profitability. In its constant efforts to preserve trade rights and supremacy, the Hansa crushed the advance of other traders' groups without consideration of their comparative efficiencies. Thus, a merchant guild that had facilitated trade in the late Medieval period was transformed into a monopolistic organization that hindered trade expansion during the pre-modern period.<sup>134</sup>

Up to this point, the discussion have focused exclusively on the role of the merchant guild in a particular time and place, but arguably the principles that applied then help to explain the emergence of other organizations in other places and times. The analysis explains why a powerful party might find it advantageous to help weaker powers organize themselves into entities that can exert countervailing power, in order to allow itself to commit to certain mutually beneficial arrangements. For example, prior to the Revolution, the French kings developed an elaborate system to help secure their borrowing and thereby enhance their ability to borrow.<sup>135</sup> The ingredients of this system – using the officer corps both to aggregate loans and to help borrowers coordinate and relying on the Parlements to authorize the legality of royal edicts –

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<sup>133</sup> For the relations between the Hansa and England during this later period, see Colvin 1971; Postan 1973.

<sup>134</sup> See above regarding the Hansa embargoes during the late 14th century. Regarding the English traders, see Lloyd 1991; Dollinger 1970. For a general discussion, see Greif 1992b.

<sup>135</sup>For details, see Bien 1989, Hoffman 1989, and Root 1989. See also Weingast ??? for an analysis of the Bank of England from the perspective developed above.

suggests an attempt by the kings to create organizations capable of collective action to enforce the king's fiscal promises.

## **&Chapter 7 Institutions as Complementary Cultural Beliefs, Rules, and Organizations**

Chapter 4 elaborated on a basic game theoretic contribution to institutional analysis: it provides an analytical framework to study cultural beliefs and their inter-relationships with behavior. The previous two chapters illustrated how this analytical framework facilitates a positive, empirically oriented institutional analyses. These analyses demonstrate some general, well known, insights regarding the roles and nature of rules and organizations as institutional elements and how game theory facilitates their presentation and analysis. Furthermore, these chapters highlighted how game theory facilitates studying rules, organizations, and beliefs as a system of complementary institutional elements. In particular, game theory enables us to study how rules and organizations coordinate and enable particular behavioral cultural beliefs that generate a regularity of behavior.

This chapter contains a general discussion of these issues. Specifically, section 7.1 presents the contribution of the game theoretic framework to our understanding of the nature, role, and analysis of rules as institutional elements. Game theory highlights the complexity of decision making: one's best response critically depends on one's cognitive understanding the situation, beliefs regarding what others know about it, what they would do in various circumstances, and what these circumstances are. (Chapter 4.) One can devote cognitive and other resources to obtain such cognitive understanding and beliefs but institutions economize on the need to do so. Specifically, socially transmitted rules are mechanisms that enable individuals to gain a cognitive understanding of the situation, create common knowledge, and coordinate their actions. Rules coordinate actions by assisting individuals in placing probability estimate over others' actions in the various circumstances these rules define. Rules thus constitute an important institutional element that coordinate behavior and release cognitive ability to the pursuit of tasks other than considering behavior in the situation under consideration. The section elaborates on these roles of socially transmitted rules and the contribution of game to their analysis.

Section 7.2 highlights the contribution of game theory to the study of organizations. The institutions-as-rules approach, for example, conceptualizes organizations as collective bodies which participate in the political processes through which rules are determined. The game theoretic analysis highlights a complementary role of organizations. Organizations are among

the factors that determine the set of feasible cultural beliefs in the interaction under consideration. They are exogenous to each of the interacting individuals and alter the relevant rules of the game from the perspective of each of them. Such organizations can originate in the state as is the case with, for example, the police and courts; they can reflect private initiative as is the case with, for example, the credit card company or credit rating organization ; they can also reflect the aggregate implications of behavior by sufficiency many of the interacting individuals as is the case with, for example, business associations or networks. Furthermore, organizations can reflect inter-relationships among all of these such as arbitration courts operated by business associations but whose verdicts are legally binding.

Organizations, however, are socially created. Accordingly section 7.2 highlights the endogenous nature of organizations themselves and how game theory facilitates their analysis as reflecting cultural beliefs and rules. While these beliefs and rules are conceptually the same as those governing the original interaction under consideration, they are distinct in relating to other interactions. Merchant guilds, for example, alter the rules of the game relevant to each interaction between a ruler and a merchant. Thus, they change the set of self-enforcing beliefs that could have prevailed in these interactions. The guilds themselves, and their ability to coordinate and enforce actions among the merchants however, reflect interactions among merchants and among them and the authorities in their towns. Part IV presents the important implications of this observation for institutional dynamics.

Section 7.3 concludes by elaborating on the game theoretic contribution to the study of the complementary relationships among beliefs, rules, and organizations. Rules and organizations enable, coordinate, and propagate particular beliefs. The behavior induced by this beliefs, in turn, validate the relevance of these rules, organizations, and beliefs. Game theoretic equilibrium analysis facilitates the study of such institutions as such complementary system of institutional element. We can study how the behavior of the interacting individuals generate a structure composed of complementary institutional elements - rules, organizations, and behavior cultural beliefs - which each individual takes as exogenous in choosing behavior. At the same time, this structure is endogenous to the interacting individuals. It motivates each of them to follow the behavior that created this structure to begin with. Game theory enables to study how

individuals' behavior generate the structure exogenous to each of them and how this structure, in turn, provides each with the incentives required to maintain it.

Game theory thus facilitates the study of institutions as a system of complementary institutional elements by exposing their inter-relationships, distinct roles, and the incentive they provide to each of the interacting individuals to take the actions required for they continue influence. It enables, in principle, to study institutions as a self-contained system of complementary institutional elements. This does not imply, however, that in practice we can study a particular institution without taking some man-made, non-technological factor as exogenous to the analysis. (Chapters 11 and 12.) Furthermore, the above discussion abstracts away from such institutional elements as norms which the next part discusses.

## **7.1 Rules, Coordination, and Common Knowledge**

Game theory highlights that in many strategic situations and in recurring situations in particular, multiple, self-enforcing behavior is possible. (Chapters 4 and 11.) In the merchant-agent game used to analyze the Maghribi traders' coalition, for example, the strategy calling for merchants not to hire agents and agents to cheat if hired, is an equilibrium. Similarly, in the merchant-ruler game used to study the merchant guild, the strategy calling for merchants not to travel to trade and for a ruler to abuse the right of any merchant who did travel is also an equilibrium.

How do individuals behave in such situations in which multiple behavior, if expected, is self-enforcing? Evolutionary and learning game theoretic models examine this issue under the assumption that each individual responds to past outcomes. Individuals do not coordinate their actions or build on their common, social heritage to anticipate the actions of others. (Section 4.7.) But there is also a line of research emphasizing the importance of such social heritage in influencing behavior in strategic situations.

Schelling (1960) was the first to elaborate on the importance of social factors which are not captured in the formal presentation of the game in facilitating equilibrium selection. His analysis concentrated, in particular, on non-recurrent situations. Where would you go to meet someone in New York? Which strategy will you play in the following game:

	Player 2 actions		
Player		Green	Red
1	Green	1, 1	0, 0
Actions	Red	0, 0	1, 1

Schelling emphasized that in such situations individuals use “focal points” to guide their behavior. A focal point is a feature of the game which is “salient” to the interacting individuals and which, by attracting attention, influence equilibrium selection. Each of the interacting individual notes this salient feature and assume that the other will note it as well. His argument implies, for example, that the equilibrium Green, Green is likely to be played in the above game.

This important insight, however, is regarding “non-institutionalized” situations: non-recurrent situations in which individuals have to make decision without the ability to coordinate their decisions and draw on their mutual or others’ experience.<sup>136</sup> In recurrent interactions, however, socially created and transmitted rules coordinate behavior among individuals. Rules, in game theoretic jargon, specify a strategy for one to follow in recurrent situations and as such they are institutionalized means to coordinate behavior. More specifically, rules are means to assist individuals to form beliefs - to place a probability estimate - about what others would do and would expect them to do.

Socially transmitted rules that coordinate behavior in that manner express themselves in such diverse forms as laws, regulations, customs, taboos, conventions, and constitutions. The rule-of-the-road helps us to form expectations regarding how other drivers will behave in various circumstances while laws and regulations do the same with respect to the court. Conventions

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<sup>136</sup> There is an important line of research using evolutionary and learning game theory to explore how experimentation and learning by individuals can lead to the emergence of rules of behavior. See part V.

similarly coordinate behavior: a “convention is one of two or more rules of behavior, any one of which, once established, would be self-enforcing” (Sugden 1989: 91).<sup>137</sup>

Rules articulating strategies that individuals were supposed to follow are well reflected in the institutional analysis presented in the previous chapters. Among the Maghribi traders these rules specified the multilateral punishment strategy. Among the German merchants, the rules of the Hanseatic League specified the behavior expected of merchants, rulers, and the guild in various circumstances that the rule defined.

Similarly, socially transmitted rules also create common knowledge of a situation among interacting individuals. The theoretical importance of such knowledge has already been discussed in section 4.7 and the above analyses assumed the traders, agents, and rulers shared a knowledge regarding the structure of the interaction. But the actions, preferences, and outside options of a Maghribi agents directly observable. Similarly, the action set of a particular medieval ruler and his preference were not necessarily observable to a merchant contemplating traveling to his domain. Among these traders, however, socially transmitted rules, reflecting knowledge that had been accumulated among them over time, propagated and distributed this knowledge among them.

In the particular case of the medieval traders whose institutions were examined above, the importance of social rules in creating a common understanding of the situation is reflected in rules that attributed meaning to various actions. The game theoretic model of the Maghribi traders coalition assumed that an agent could have taken an action which was commonly known as “cheating.” But how the common knowledge regarding what act constitute cheating was created? The analysis exposed the importance of making the meaning of various actions common knowledge: the credibility of the threat in collective punishment depended on it. (Section 5.6.) Overseas agents were motivated to be honest despite their ability to embezzle the goods of far-away merchants by the belief that cheating any merchant would imply a collective punishment by all the merchants. For such beliefs to be credible, however, “which actions constitute ‘cheating’ must be defined in a manner that ensures collective response. If some merchants

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<sup>137</sup> See also Schotter 1981: 52 regarding learning and norms and see Lewis 1969; Sugden 1986; Young 1993, 1996, 1998 regarding conventions.

consider specific actions to constitute ‘cheating’ while others hold a different opinion, the effectiveness of the collective threat is undermined” (Greif 1993: 542). What lent credibility to the threat of collective punishment was a merchants’ law, a “set of cultural rules of behavior ... that specified how an [individual] should act to be considered honest in [various] circumstances” (p. 543). Socially transmitted rules that manifested themselves as a customary merchants’ law created the common knowledge required to support a particular strategy.

The importance of socially transmitted rules attributing meaning to various circumstance in creating the common knowledge required for particular outcomes to prevail was also reflected in the study of the Hanseatic league. As we have seen, the embargo of 1360 has ushered a long period in which no conflict occurred between Bruges and the Hansa. This has been the case due to two factors (section 6.3.1). First, the increased ability of the Hansa to coordinate embargoes and to enforce them. Second, the merchants’ privileges were written, “in much detail as to prevent any one-sided interpretations” (Dollinger 1970: 66). Hence, it became clearer what behavior constitute cheating.

In situations in which it is the expected reactions of the many that influence one’s decision how to act, it is imperative that these many have the same understanding of the circumstances under which they have to act in various ways and this is known to all. Indeed, rules specifying expected responses and the meanings of various circumstances (whether a “transgression” had occurred or not) prevail in many situations in which the threat of collective responses is to influence actions. Social pacts, constitutions, and traditions are among the manifestation of rules that, by creating common knowledge, lends credibility to such threats.<sup>138</sup>

The general importance of socially transmitted rules in attributing meaning to circumstances and creating common knowledge of situation is suggested by the social nature of the process through which members of a society are informed about such rules. In an intriguing

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<sup>138</sup> In political science this role of rules had been examined in the context of examining the role of constitutions and other rules in limiting property rights abuse by rules. See, for example, Hardin 1989; Prezworski 1991; Weingast 1995, 1997; Gibbons and Rutten 1996. But similar role is played by rules in many other situations such as relationships within a family, sports, and the work place.



study, Chwe (2001) has noted that common to great variety of rituals, ceremonies, and processes of collective decision making is that they are designed to ensure that the information they convey are common knowledge. It is not a coincidence that the ancient councils among Native American and the US congress have a similar physical arrangement. Their circular shape comes to ensure that everyone knows that everyone knows what had been agreed upon. What is the social rule that one is supposed to follow.

Game theory facilitates studying the role of such socially transmitted rules in various ways. First, because rules specifying expected behavior correspond to strategies, game theory provides a precise way to present rules in a given environment. Furthermore, it makes explicit the need, and provides the language for specifying behavior on and off the path of play in all the possible circumstances that the strategy itself implies. Second, game theory restricts the set of admissible rules regarding behavior that can actually influence behavior to those associated with self-enforcing behavior.

Third, the game theoretic analysis facilitates examining the social and individual incentives leading to the propagation of rules. Society has an incentive to propagate the rules when the structure of the game is such that one who does not know these rules imposes a negative externality on others. This is the case with respect to the rules of the road. When the structure of the situation is such that no such negative externality exists, only private incentives to learn the rules would lead to their propagation. Game theory facilitates studying such propagation by revealing the incentives that individuals have to get exposed, acquire, or teach such rules in a given game. Indeed, the analysis of the Maghribis coalition highlights the importance of knowing the rules for each trader. His commercial success depended on it. Hence, one was motivated to learn these rules while parents were motivated to teach them to their children.

The limits of the discussion for the study of rules should be highlighted as well. Social rules, as is well known and is reflected in the above chapters, can emerge spontaneously or intentionally. In mitigating agency problems among the Maghribis, rules of behavior emerged without intentional design and were propagated over time during the training period of the young Maghribi traders. In mitigating the merchant-ruler commitment problem, these rules were intentionally designed through discussion among rulers and guilds and were propagated through

the official writings and regulations of trade. Game theory highlights that independently of the origin of a rule, it influences behavior only if it influences beliefs about behavior. Which, among the usually many possible rules regarding behavior would thus prevail in a particular situation? Why do some rules influence peoples' beliefs about how other people will act while other rules do not? These issues relate to the origin and dynamics of institutions which are at the center of parts V and VI.

## **7.2 The Organizational Foundations of Institutions**

There are various views of organizations and how they relate to institutions. To understand the new perspective brought about by the game theoretic perspective, a review of the main views is warranted. Often, the terms institutions and organizations are used interchangeably. Institutions are “an established or organized society or corporation; an establishment, especially of a public character, or affecting a community” (Webster's Revised Unabridged Dictionary). Indeed, in political science institutions are often viewed as organizations such as congresses, parliaments, committees, and the police. Institutions are “formal arrangements for aggregating individuals and regulating their behavior through the use of explicit rules and decision processes.” (Levi 1990: 405 and see more general discussion in Rothstein 1996.)

In organizational theory and economics, it is common to distinguish between organizations and institutions.<sup>139</sup> The most important definition of organizations in organizational theory is that they are “collectivities oriented to the pursuit of relatively specific goals and exhibiting highly formalized social structures”(Scott 1998: 26).<sup>140</sup> Similarly, the main

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<sup>139</sup> For general discussion, see Scott and Meyer 1994.

<sup>140</sup> Although this definition dominates Organizational Theory, two additional definitions of organizations are used. A natural system definition: “organizations are collectivities whose participants are pursuing multiple interests, both disparate and common, but recognize the value of perpetuating the organization as an important resource”(Scott 1998: 26). An open system definition: “organizations are systems of interdependent activities linking shifting coalitions of

view in economics of organizations is as “a group of individuals seeking to achieve some common goals, or, in different language, to maximize an objective function” (Arrow 1970: 224). Within an organization there is a “set of operating rules instructing the members of the organizations how to act” and a corresponding set of enforcement rules “to persuade or compel them to act in accordance with the operating rules” (p. 225).

The main lines of analyses regarding the inter-relationships among organizations and institutions in organizational theory and economics complement each other. In organizational theory, institutions are considered as systems of meaning and regulatory processes (enforcement mechanisms) and organizations reflect options and constraints implied by them. In other words, the relationships between institutions and organizations is parametric and top-down as institutions are taken as exogenous to institutional analysis but they dictate possible organizations. “Executives may not be designing their governance structures [organizations] in the light of the particular problems confronted but rather choosing a structure form a menu providing a set of options. Indeed, under many circumstances, participants may not be allowed to select a structure: rather, one is imposed on them” (Scott and Meyer 1994: 74).

The main approach to the study of organizations in economics, Transaction Cost Economics, also considers institutions to be exogenous to organizations but provides a complementary view of their inter-relationships. It postulates that organizations (governance structures) reflect an attempt by economic agents to economize on transaction costs. In particular, organizations are a bottom-up responses to markets imperfections. In the benchmark case explored in neo-classical economics, markets operate without friction. In particular, information is perfect, goods offered by different producers are perfect substitute, and property rights are transferable, well defined and perfectly enforceable without any cost. But in actual markets this is not the case implying transaction costs in exchange. Organizations emerge to economize on transaction costs by moving economic exchange from the market into organizations (Coase 1937; Williamson 1985, 2000.) Firms, for example, emerge to minimize

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participants; the systems are embedded in - dependent on continuing exchange with and constituted by - the environment in which they operate” (p. 28).

on search costs, to overcome commitment problems due to specific investment, to internalize externalities, and to change bargaining power in the presence of asymmetric information.<sup>141</sup>

Common to both approaches is thus the postulate that institutions are parametric to organizations. Organizations are responses to institutions. The institution-as-rule approach (North 1990) also considers organizations as responses to existing institutions but, as common in political science (e.g., Olsen 1982) it recognizes a particular feedback from organizations to institutions.

Economic and political organizations are “interest groups” that labor to maintain or change the politically determined rules that led to their emergence.

This approach accepts that organizations “are groups of individuals bound by some common purpose to achieve objectives” (North 1990: 5). This objective, however, may well be to influence institutions, that is, politically determined rules. The rules allowing producing and selling tobacco provide motivation to establish a tobacco industry lobby. Members of this lobby act in the political arena to promote rules favorable to their industry’s interest. Hence, there is a positive feedbacks from rules to organizations and from organizations to rules. Organizations reflect responses to existing institutions, namely, exogenously enforced rules, and they become players in the political game through which new rules are defined.

Game theory has contributed much to the study of organizations from all the above perspectives. It has been extensively used to study decision making within political organizations and to advance and evaluate theoretical and empirical claims derived from the organizational theory perspective. Using game theory economists began to explore for the first time the black box of firms and to study their internal incentive structure. Game has been extensively used to study organizations from the above transaction costs perspective and the

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<sup>141</sup> More recently, TCE shifted its position closer to that of Organizational Theory. Williamson 2000. Institutions are considered as composed of two layers. The first contains informal institutions such as customs, traditions, norms and religious. The second contains formal rules, namely, laws and regulations defined by the polity. These institutions are taken as exogenous to processes through which new organizations emerge or being established. It is still maintained, however, that organizations do not exert any direct influence on these institutions.

political economy of lobbying.<sup>142</sup> Such analyses have employed the same analytical tools of game theory examined in chapter 4 relying, in particular, on models of asymmetric information.

Equally important, however, game theory highlights and enables to study another conceptualization of organizations and their inter-relationships to institutions. Considering an institution that generate behavior in a particular interaction, an organization can be an integral, yet distinct, element of that institution. In particular, organizations influence the set of possible (behavioral) cultural beliefs that can prevail as a self-enforcing outcome in the interaction under consideration. Using the metaphor of games, “organizations alter the rules of the game by, for example, introducing a new player (the organization itself), by changing the information available to players, or by changing payoffs associated with certain actions” (Greif 1994a: 915-6). Organizations, by altering the rules of the game from the perspective of the individuals involved in the original interaction or the benchmark case under study, change the set of feasible self-enforcing cultural beliefs in it.

This view of organizations and their relationships to institutions is intuitive and goes back at least to Hobbes’ writings. He considered the introduction of a state with the ability to protect property rights and enforce contracts into The Game of Nature. The organization of the state, by making possible the beliefs that one’s property rights will be protected and contracts enforced, fosters tranquility and cooperation.<sup>143</sup> Game theory puts this idea into focus and provides an analytical framework to examine the inter-relationships among organizations and institutions.

Consider the study of the Merchant Guild in chapter 6. To evaluate whether the beliefs that a ruler would respect a merchant’s property rights are self-enforcing at the efficient level of trade, we considered the level of commitment that can be achieved in the presence of various

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<sup>142</sup> See footnote ??? in chapter 1.

<sup>143</sup> For a recent game-theoretic analysis, see Sened (1997, chapter 4). Needless to say, the state can also abuse property rights as has already been discussed in chapter 6. See also the discussion below on the indeterminacy of the impact of organizations which requires studying them in conjointly with studying beliefs.

organizations. Organizations were modeled as changing the rules of the game for the merchants and ruler interacting in the benchmark game between a merchant and a ruler. The analysis began with the benchmark game devoid of any guild. The second game specification incorporated an un-coordinated, informal organization in - a social network - which can communicate that one's property was abused to some sub-set of the merchants. The analysis yielded that in either these games cultural beliefs enabling a ruler to commit to respect merchants' property rights at the efficient level could not prevailed as an equilibrium.

The analysis then proceeded to consider the case in which the rules of the game include an organization with several attributes: the ability to verify an abuse, coordinate merchants' responses to abuses, and ensure traders' compliance with boycott decisions. The analysis revealed that an organization with such attributes is sufficient for the existence of self-enforcing cultural beliefs that support trade at the efficient level. This organization was conceptualized being a part of the rules of the game for each of the ruler and merchants involved in the benchmark interactions.

The analysis of agency relationships among the Maghribi traders was also concerned with the influence of organization on the set of possible beliefs. But the nature of this organization was more subtle than the case of the Merchant Guild. Among the Maghribi traders, the Maghribi traders group had altered the rules of the interaction (among each merchant and agent) by changing the information structure. The group or business network was a mechanism for the transmission of information about agents' past conduct among merchants. The community thus altered the set of self-enforcing beliefs that could have prevailed in the relationships between any particular merchant and agent. The Maghribi trader group enabled beliefs in collective punishment to prevail. Unlike the case of the Merchant Guild this organization did not entail the introduction of a new player. Its analysis required, however, going beyond the examination of the bilateral relationships among each merchant and agent and consider other possible interactions as well.

It is appropriate to consider organizations as altering the rules of the original interaction under consideration or the benchmark game when they are institutional elements. Recall that an institutional element is a man-made, non-technological factor contributing to generating a regularity of behavior by enabling, coordinating, or motivating behavior while being exogenous

to each of the individuals whose behavior it influences. From the point of view of each of those interacting in the original interactions the above organizations were indeed exogenous, part of you one takes as exogenous rules of the game. No single merchant could have established a merchant guild. It was a product of interactions among them, their towns' authorities and the alien rulers. Similarly, although one can try to establish an organization such as the Maghribi traders' network, once it prevailed it constituted part of the rules of the game from the perspective of each of the traders.

Thus, these organizations can be conceptualized as changing the action sets, information, and payoffs in the benchmark game thereby altering - extending or limiting - the set of possible self-enforcing behavioral cultural beliefs in it. This definition of organizations is by their essence rather than by their form. Organizations can take the form of state sponsored or privately organized, intentional or unintentional, and reflect coercive, economic, or social interactions. Their essence, however, is being exogenous to each of the individuals interacting individuals and alter the rules of the game relevant to their interactions. At the same time, that contribute to generating a regularity of behavior among the individuals engaged in the interaction under considerations by altering the rules of the game relevant to each of these individuals. Thus they are distinct from other institutional elements such as behavioral cultural beliefs that influence behavior within the rules of the game. At the same time, they are different from other men-made factors that influence the relevant rules of the game by reflecting the *direct* influence of behavior or expected behavior. Hence, although such factors as wealth distribution, knowledge, and the outcomes of a socialization process reflect human actions and influence the rules of the game, they are not organizations. Such men-made factors do not reflect the direct impact of human actions on the rules of the game relevant to the individuals involved in the interaction under consideration.

Organizations are inhabited by and reflect the direct influence of humans' actions and hence their study closely related to that of social positions. (Sections 3.1, 3.3, 4.6.) The individuals who are the decision makers in an organization have a social position distinct from that of the individuals interacting in the benchmark game. Merchants and agents were the social positions related to the benchmark game of agency relationships while a Maghribi trader is the

social position associated with that of the Maghribi traders' coalition. Rulers and merchants were the social positions in the ruler-merchant benchmark game while the merchant guild added additional social positions. Another way of thinking of organizations is that they involve the introduction of new social positions in the benchmark game.

Hence, a complete understanding of an organization often involves examining the factors motivating the behavior of individuals with these social positions the individuals who are the decision makers in legal systems, arbitration, credit rating companies, business associations, etc. In other words, although organizations alter the game capturing the essence of the original interaction under consideration they can nevertheless be strategic players. In particular, it can be, but does not have to be, a group of individuals pursuing a common goal. Hence, studying the potential and actual influence of organizations is subtle. It requires studying the influence of organizations on beliefs and behavior in the benchmark interaction while examining beliefs and behavior among members of the organization and with respect to it.

A useful feature of game theory is that it provides a unified analytical framework for the study of institutions, organizations, and their inter-relationships. The discussion of how game theory facilitates the study of self-enforcing behavior cultural beliefs applies here as well. A game theoretic analysis can be applied to the benchmark game, to the game with an organization, and, whenever appropriate, to behavior that generate the organization and behavior within the organization itself.

In particular, the analysis has to consider why the organization is motivated to take particular actions rather than alternative ones. If an organization is supposed to punish for cheating, for example, we have to explicitly evaluate how the appropriate motivation is provided. Indeed, this issue was at the core of the analyses of the Maghribis coalition and Merchant Guild. We have seen that in both cases the game theoretic analysis facilitates addressing this question and exposed how the threat of punishment was made credible. (For explicit analyses of organizations as strategic players, see chapter 13 and 16.)

Furthermore, because organizations are players and decision makers, their ability to influence the rules of the benchmark game in a particular manner depends on the organization having a particular information, coordination ability, ability to punish, etc. A comprehensive understanding of an organization should study how such **organizational capacity** is obtained



Namely, how the capacity to take various actions and to acquire the appropriate information is endogenously generated through the interactions among those involved in the benchmark case, the organization, and its members.

Because game theory enables to study motivation within a strategic setting, it enables such analyses. Indeed, it was at the center of the examination of the Maghribi traders coalition. The analysis considered how the coalition acquired its organizational capacity: the incentives of individuals to retain their affiliation with the group, to acquire information, and to transmit it. The study of the Merchant Guild concentrated more on the organizational capacity required for particular behavior to be an equilibrium in the benchmark case rather than on how exactly this capacity was maintained or why exactly the guild was motivated to take the actions it did. In principle, however, the analysis could have been advanced to study these issues. An extensive example of such analyses of organizational capacity are provided in chapter 9.

Although organizations change the set of possible self-enforcing beliefs, they usually do not determine it. No trade and abuse of property rights is still an equilibrium in the ruler-merchant game even in the presence of the merchant guild. The introduction of police force may lead to law abiding behavior or corruption. The above discussion has already touched upon the main factor that contribute to the tendency of organization to change the set of possible self-enforcing behavior in the benchmark game but not to determine it. Organizations and their influence on the rules of the benchmark game are *directly* due to their behavior and expected behavior. Hence, the individuals whose behavior generate the organization are decision makers whose own behavior - and the resulting influence on the rules of the benchmark interactions - depend on factors motivating and enabling them to assume particular behavior. But in repeated interactions, multiplicity of such factors can usually prevail. (Chapters 4 and 11.) Hence, the same organizational forms may be associated with distinct outcome: having a legal system effective in imposing its judgment would not necessarily lead to the rule of law. For this to happen, the appropriate beliefs should influence the behavior of individuals populating this legal system.

In general, it is possible to study the inter-relationships between organizations and institutions sequentially. We first consider a benchmark situation, which captures the essence of

the interactions of interest.<sup>144</sup> In the study of agency relationships, these interactions were those between a merchant and his potential agents (in the absence of the coalition). In the study of alien traders' property right security, these basic interactions were those between a ruler and a merchant (the absence of the merchant guild). For analytical purposes, we present benchmark situations as games while trying to abstract away from any organizational features we want to study as endogenous to the analysis. Clearly, such benchmark games must incorporate many man-made features such as money, language, and knowledge. But the idea is to incorporate in the benchmark game only these socially constructed features that give rise to the interaction of interest in the first place.

We then study the influence of an organization on possible cultural beliefs in the original interaction by altering the rules of the game to capture the existence of the organization on the benchmark game. We then conduct an equilibrium analysis to consider the implications of this alteration on the set of possible self-enforcing beliefs and behavior. The next stage involves studying the internal working of the organization, and finally consider the feedback from the institution on the organization.

In the case of the Maghribi traders we indeed first examined how the availability of information among the traders and their distinct social identity altered the set of possible cultural beliefs among each pair of agent and merchant. Only then the analysis turned to examine why each traders was motivated to provide information and to retain his affiliation with the group. Finally, we noted that the benefits in agency relationships that membership in the Maghribi group entailed motivated members to retain their affiliation with it.

Such sequential analysis is appropriate because organizations, as an institutional element, are exogenous to each of the interacting individuals and reflect interactions other than those examined in the benchmark game. In the case of the Maghribi traders, the benchmark game was regarding bilateral agency relationships while the operation of the Maghribi traders coalition involved examining the exchange of information. In the case of the Merchant Guild, the

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<sup>144</sup> The introduction of an expanded notion of a transaction in part III will enable me to somewhat better present this idea. I do not elaborate on this notion here however, for various considerations.

benchmark game was that among the ruler and a merchant while the study of the guild itself implied examining such diverse interactions as those between the ruler and the guild, the merchants and the guild, and even between different towns.

At the same time, despite their inter-relationships, an organization and the associated institution are distinct entities. They are distinct entities in the sense that each reflect different set of interactions. Technically, this implies that we can often study an organization as an equilibrium in interactions other than those of the benchmark one. In the above examples, this possibility was most transparent in the case of the Merchant Guild. The analysis took as exogenous the coordinating and coercive capacity of the guild and the ruler's ability protect property rights. Clearly, such capacities reflect interactions among various merchants and their town's authorities and between rulers and their subjects. It is in principal possible to study these interactions independently from studying the merchant-ruler interaction. Similarly, the motivation to share information among the Maghribi traders did not depend on the interactions among merchants and agents. It was exactly this feature that enabled them to retain the credible threat of diffusing information despite the absence of cheating on the equilibrium path.

That an organization and an institution are two distinct entities has two important implications. First, we can study organizations using the same analytical framework used to study institutions. We can study the cultural beliefs and rules that generate behavior within such organizations. (See examples in chapter 13.) Second, an organization and its capacity can continue being self-enforcing even if a particular institution of which they were a part is no longer so. The ability of a particular merchant guild to coordinate and punish its members would not have vanished if trade with a particular ruler because no longer self-enforcing. Part V elaborates on the important implications of this on studying institutional dynamics.

Considering the distinction between organizations and institutions highlights an important role that symbols and signs (such as contracts, bills of exchange, marriage ceremony, and handshakes) in the functioning of institutions. Such symbols and signs, are neither institutions nor organizations. They are mechanisms to communicate one's relationships or social position with respect to the relevant organization. A legal loan contract signifies the debtor's social position in the court of law. A handshake among members of business network

such as the Maghribi traders signifies to other members of the network that the two assumed particular obligations toward each other. Marriage ceremony signify to the legal authority and the community one's social position. How one will live up to the rights and obligations associated with this social position, in turn, influence the response to relevant organizations. Symbols are mechanisms indicating, in the context of the inter-relationships among organizations and institutions, a change in one's social position.

In sum: Organizations are means for, and manifestation of the way that the rules of the benchmark game are changed and influence the set of possible beliefs in the original interaction under consideration. From the perspective of each of the individuals involved in the original interactions under consideration organizations are part of the rules of the game because they are not under the direct or exclusive control of each of these individuals. This view is distinct from those surveyed above by considering organizations as both an integral part of institutions as well as potentially strategic players. For example, institutions are taken as parametric for the study of organizations in transaction cost economics while organizations are considered as players in the Northian framework. The game theoretic perspective, however, highlights that organizations, by influencing the set of possible beliefs in the economic situation under consideration are an integral, possibly strategic part of economic institutions.

This perspective thus reveals the common aspect of the study of organizations in economic sociology, economics, and political science. Economic sociology has emphasized the importance of social networks, communities, and groups. In economics and political science concentrated on such organizations as credit bureau, firms, and bodies for collective decision making. From the perspective advanced here, as the analysis of the merchant guild and the Maghribi traders group reveals the commonality in these lines of analysis.

I will return to explore this issue after elaborating on the concept of transactions in part III and will present how this view of the inter-relationships between institutions and organizations facilitated the study of a new class of institutions, reputation based institutions. Part V will also explore the implications of this view for the study of institutional dynamics. Implications of this view for the study of political institutions are presented in later chapters.

### **7.3 Institutions as an Equilibrium: Agency, Structure, and Incentives**

How do institutions constitute the structure leading individuals to take particular actions and how do these actions recreate or regenerate that structure? This question did not take a central stage in institutional analysis in economics but various lines of institutional analysis adopted either an agency or a structural perspective.<sup>145</sup> Lines of research which examine institutions from an agency perspective consider institutions as outcomes emerging through interactions among individuals each of whom pursue his objective. Institutions are, for example, chosen pattern of behavior and contractual and organizational forms. Theory specifying individuals' choices in a given environment is thus central to such analysis and empirical examination has the limited role of providing the details required to make the theory operational.

Transaction Cost Economics, at least as formulated during the 1980s and 1990s, for examples adopted an agency approach. It emphasizes that institutions reflect interactions among economic agents. Each of these agents advance his objective and the transaction cost of exchange by choosing optimal contracts and organizational forms. The role of empirical analysis is to identify the relevant environment and the sources of transaction costs, to substantiate the general validity of the theory, and to facilitate its development by providing empirical feedback.

Other lines of institutional analysis adopted a structural perspective in which the analysis is initiated at the level of the society. It is maintained that institutions are more than the aggregate manifestations of objectives and behavior of a society's members. Institutions constitute a society's cultural and historical heritage which can not be derived from individuals' actions because the whole is bigger than the sum of its components. Institutions have to be studied empirically drawing, in particular, on "thick" or detailed knowledge of the society under consideration. The role of theory in institutional analysis is therefore rather limited and is

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<sup>145</sup> The inter-relationships between agency and structure is implicit in neo-classical economics: individuals act in markets and these actions, in turn, generate the market. A theory of market games which examines how strategic interactions can lead to markets has been advanced. See Osborne and Rubinstein 1990. It demonstrated, however, that markets are not likely to spontaneously emerge.

mainly confine to provide a general guide for the empirical analysis and provide conceptual support to it.

Old Institutionalism is heavily influenced by the structural perspective. It emphasizes, for example, the importance of historically determined beliefs, customs, and norms of behavior. Its methodology therefore stresses the indispensability of detailed knowledge of the context under consideration in identifying relevant institutions and understanding their nature.

A line of research within the NIE attempts to integrate the structural and the agency perspective by considering the inter-relationships among the political and economic spheres. (North 1990; section 2.3.3.) Economic institutions - rules and their exogenous enforcement - provide the structure within which economic agents interact. This structure, in turn, comes mainly from the polity. Political agents strive to advance their economic interest by influencing the political process through which economic institutions, namely rules, are determined.<sup>146</sup> The resulting economic rules, in turn, give rise to those who benefit from them to become involved in the political arena to further their economic objectives. Politically determined rules governing economic interactions are determined by political agents while these rules influence the set of these political agents.

In sociology which the study of the relationships between agency and structure has a long tradition. The three main positions are similar to those adopted in economics. The first, often associated with the considered as the Weberian tradition adopts an agency perspective emphasizing purposive action and methodological individualism. It stresses the importance of the way that individuals create the social world around them.<sup>147</sup> The second position, often associated with Durkheim's work, adopt the structural perspective. It postulates that structures "impose themselves upon" (Durkheim 1950: 2) the interacting individuals and hence can not be

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<sup>146</sup>A similar position has been adopted recently in TCE. See Williamson 2000: 597.

<sup>147</sup> This position is common among sociologist who adopted the paradigms offered by Methodological Individualism, Ethnomethodology, and Phenomenological Sociology. For a wonderful discussion of this perspective, see Berger 1977, chapter 5. See also relevant entries in Abercrombie et. al. 1994.

studied from an agency perspective. This structure constituted of, for example, norms, customs, habits, and beliefs instituted by the collectivity. Sociology, from this perspective, is concerned with social structures that determine the characteristics and actions of individuals whose individualistic characteristics therefore become unimportant.<sup>148</sup>

The third position presents a compromise claiming that either viewing structure as determining individuals' actions or viewing individuals as independently creating their world is partial. Perhaps the best known articulation of such position is that of Berger and Luckmann (1967), who argue that there is a dialectical process in which the meanings given by individuals to their world become institutionlized or turned into social structures. These structures contain the meaning-systems employed by individuals and which limit their actions. "For example, if a man and a woman meet for the first time on a desert Island, they create their relationship and give it meaning. However, their children are born into the society made by their parents; for them it is a given which constrains their actions to actions to a great extent" (Abercrombie et. al. 1994: 10).

Social structures in this framework are the social equivalent of an instinct (Berger 1977: 104). Once established they mold the way that individuals think about what possibilities are open to them. For example, in a society in which monogamous marriage prevails, "the average young man... not only rejects the options of polyandry or polygamy, but, at least for himself, finds them literally unthinkable. He believes that the institutionally predefined course of action is the only one he could possibly take, the only one he is ontologically capable" (ibid: 106). The mechanisms through which socially created institutions regenerate themselves is through their influence on the way that individuals think.

Granovetter (1985) has proposed another approach to the tension between agency and structure. On the one hand, he criticized the structural perspective as postulating that individuals are oversocialized - once the structure is in place, it dictates individuals' actions. On the other hand, he criticized the agency perspective as postulating an "undersocialized" concept of human beings that does not take into account the influence of society upon them. As an alternative he

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<sup>148</sup> Functionalists and Neo-Functionalism associated particularly with the works of Parson and Marxists interested in how social structures influence outcomes often adopt this perspective.

proposed to take social networks as the structure that each individual takes as given and within which individuals pursue their objectives. This position “does not privilege structure over agency, as individuals who find themselves in situations determined by forces beyond their control, and often far beyond their lifespan, may nevertheless turn these situations to their advantage and make deep imprint on future actions and institutions” (Granovetter 2000: 2). Agents operate within but constrained by the social networks within which they happened to find themselves.<sup>149</sup>

More recently, Coleman (1990) presents another sophisticated way to integrate agency and structure to which he refers as micro-macro relationships. He emphasizes, in particular, the importance of understanding how individuals whose objectives may have been shaped by the society take actions which lead to another society, macro level outcomes. In discussing Weber’s thesis that the Protestant ethic led to the rise of capitalism, Coleman (1990: 7-8) emphasizes that evaluating this thesis requires exposing the relationships between the micro and macro level phenomenon. The thesis “begins and ends at macro levels” but evaluating it requires examining how “in between it dips to the level of the individual.” We should study how “1. Protestant religious doctrine generates certain values in its adherents. 2. Individuals with [the above] certain values ... adopt certain kinds of ... economic behavior.” This economic behavior “on the part of the individual help bring about capitalist economic organization in a society.”

Game theory opened a new arena for exploring causal relationships between agency and structure. We have already seen in sections 4.6-7 how game theory facilitates the studying of the regeneration of beliefs: once a particular self-enforcing beliefs established themselves in the sense that they are expected by members of the society and are confirmed by observable outcomes, they induce the behavior that regenerate them. They become steady-state, equilibrium beliefs. The empirical chapters above has demonstrates how game theory can be used, more generally, to explore how institutional elements constitute the environment within which individuals interact, how these institutional elements provide each individual with the incentive to take particular actions, and how these actions, in turn, regenerate the original institutional elements. Game theory enables studying the **causal** relationships between structure and agency: how the structure

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<sup>149</sup> For a wonderful historical application of this approach, see Padgett and Ansell 1993.



- institutional elements - influence individuals' actions and how these actions regenerate this structure, namely, these institutional elements.

To illustrate this point, consider again the study of the Maghribi traders coalition. From an individual's perspective - either a member of the Maghribi traders coalition or an outsider - the coalition was an exogenous structure. Its constituting institutional elements were beyond the control of each of them. Each individual operated in an environment in which various rules were commonly known. Among these rules were those specifying whom to hire as an agent, how to begin and end agency relationships, what action constituted cheating, how to act with respect to an honest agent, how to act in case one is accused of cheating, how to acquire and provide information. Furthermore, each individual took as exogenous the relevant social positions: Maghribi and non-Maghribi traders, merchants, and agents. These social positions and the conditioning of actions on them defined a relevant organization, the Maghribi traders group.

Another institutional element that was part of the structure that each trade faced were the various beliefs held by the other Maghribis. These included beliefs corresponding to the above rules such as the beliefs that Maghribi traders will hire only member agents and will collectively punished any cheater. But the beliefs that the relevant individuals held went beyond those associated with rules of actions. These also included beliefs in the economic benefit of operating through agents and the beliefs that when under the threat of collective punishment, agents, by and large, would find honesty to pay off.

The game theoretic formulation captured some of these institutional elements in the rules of the game. It has been assumed, for example, that the social position "Maghribi trader" was known and that the Maghribis could recognized each other and communicate. It also assumed that agency relationships were profitable and agents could have been induced to be honest when facing with the appropriate incentives. In addition, the rules of the game captured aspects of the situation - institutional and non-institutional ones - that were beyond the control of all the individuals whose behavior was subject to the analysis. The existence of language, money, uncertain markets for goods, and communication technology were explicitly or implicitly integrated into the setting.

The game theoretic analysis enables us to consider how these institutional elements provided the incentives to individuals with various social positions - Maghribis and non-

Maghribi, merchants and agents - to act. The analysis revealed how these institutional elements coordinated, motivated, and enabled each individual, while pursuing his self-interest to behave in a manner that regenerated these institutional elements. The analysis first focused on self-enforcing behavior and behavioral beliefs indicating why, given the behavior and expected behavior of others, individuals with various social positions adopted the behavior expected of them. Understanding how this central feature of the coalition was regenerated by the incentives each individual faced enabled studying how other institutional elements were generated. Furthermore, it enabled us understand why individuals were motivated to acquire the knowledge and information required to for the coalition to function. The Maghribis were motivated to learn who are the other members, retain personal familiarity with each other, invest in the exchange of information, to learn the Merchant Law, and to, more generally, retain their affiliation with the coalition.

In other words, the game theoretic framework advances the study of the inter-relationships between agency and structure by enabling to study institutions through the lens provided by game theoretic equilibrium analysis as **self-enforcing**.<sup>150</sup> Game theory enables examining how regularities of behavior and some of the institutional elements generating them become self-enforcing and confirmed. Each individual, taking the actions and expected actions of others as given, finds it optimal to act in a manner that motivates others to take these actions to begin with. These actions are not confined to behavior specific to the particular situation another consideration - behavior among agent and merchants in the Maghribi traders example. Rather it also includes behavior required to gain the appropriate information and to learn about the rules of the game, who are the players, what to expect of them, and what constitute cheating.

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<sup>150</sup> As has already been emphasized, however, and noted again in chapter 12, any empirical analysis has to take various men-made factors as exogenous. The study of the Merchant Guild has taken many institutional aspects of the situation - such as rulers monopoly over coercive power in their domains and Merchant ' coercive ability outside these domains - as given. In game theoretic analysis such factors are incorporated in the rules of the game making explicit what is the endogenous - self-enforcing - institutional elements under consideration.

Furthermore, game theory advances the study of how such institutions regenerate themselves. It restricts behavioral beliefs to those that are self-enforcing and (weakly) confirmed by the observable implications of everyone's behavior. Furthermore, it facilitates examining the incentives that institutional elements provide to individuals to teach others and to acquire the knowledge and information required to maintain the relevance of various institutional elements.

This chapter considers the general contributions of the game theoretic framework for the study of institutions. It emphasized the important role of socially transmitted rules in enabling coordinated behavior, the role of organizations in constituting the foundations of institutions, and the study of institution as a self-enforcing system of complementing institutional elements which motivate individuals to act in a manner that regenerate these institutional elements.

The above discussion of the game theoretic contribution centered around its ability to open the black box of studying beliefs. Game theory, however, further contributes to institutional analysis by enabling us to also open the black box of social relationships and preference formation. The next part explores these contributions.