Three essays on economic history and experimental economics

by

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Abstract

In the first chapter, Erik Kimbrough and I design an experiment to explore the relationship between subjects' dispositions to individualism/collectivism and their willingness to engage in trade under enforcement institutions of varying strength. Overall, we find a positive effect of strong institutions on trade, but once we control for individualism/collectivism, institutions have no significant effect, and we observe that individualists engage in trade more often than collectivists. This suggests that cultural dispositions may even outweigh institutions in the promotion of trade.

The choice of enforcement mechanism in conducting long-distance trade has long been associated with cultural dispositions to individualism and collectivism. In the second chapter, I designed a laboratory experiment in which the options for both a safe local trade and a risky yet more profitable long-distance trade are available. Long-distance trade is governed by either a formal or an informal enforcement mechanism. I examined the choice of informal versus formal enforcement mechanism while controlling for the cultural disposition of subjects. I found that individuals with a collectivist cultural orientation used informal enforcement when effective formal enforcement is available significantly more frequently than those with an individualist orientation. Those with individualistic cultural orientation substituted formal enforcement for informal enforcement when the former created a reliable contract.

In the third chapter, I compare the impact of Islamic inheritance law and that of primogeniture on the welfare of economic agents. In the model, I define three types of agents: the sovereign, nobles and peasants. The nobles, unlike the peasants, own land. Furthermore, nobles also own firms/estates that produce food. To protect their produce, nobles engaged in a conflict with an extractive sovereign to determine the tax rate. The findings demonstrated that primogeniture led to a lower tax rate and higher welfare level for both nobles and the sovereign. Peasants, however, due to lower wages, suffered under primogeniture.

Keywords: Collectivism; individualism; inheritance law; long-distance trade; enforcement mechanisms; primogeniture; experiment

Dedication

To my dear wife and best friend *Shilan*.

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Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

The question of why Western Europe prospered while the Middle East stagnated, has long intrigued many scholars. To answer this question many researchers focused on Western Europe [63] or solely sought the roots of this divergence in the late Middle Ages [1]. There have been some comparative studies of the institutional differences between the two regions in the early Middle ages. For example, [28] investigates how Mediterranean merchants of Islamic versus Christian regions conduct long-distance trade. Combining laboratory experiments and economic history, my research is a two-pronged attack on understanding this puzzle.

With this question in mind, I have focused my attention on the role of culture in historical patterns of economic development. The most significant cultural difference between eastern and western societies is their individualistic versus collectivistic orientation [74]. In the first chapter of my thesis, coauthored with Erik Kimbrough, we study the effect of cultural dispositions to individualism and collectivism on the willingness to seek trade opportunities using an experimental paradigm. We follow the lead provided by [30, 29, 28] that historical long-distance trade is influenced by the cultural dispositions to individualism and collectivism. In the design of this experiment, we employ a "narrativized" modified trust game in which subjects assumed roles of "farmer", "local merchant", and "traveling merchant". Farmers had the option between the safe local trade and risky[1] yet more profitable long-distance trade. We examined the trade behavior of individualistic and collectivistic subjects who are faced with this choice under different institutional arrangements. That is, how subject's trade behavior correlates with having a range of non-credible to credible third party enforcement mechanism that exogenously govern long-distance trade.

We find that regardless of the credibility of third party enforcement, individualist farmers tended to engage in long-distance trade significantly more often than their collectivist counterparts did, and that this was driven in part by different reactions to being cheated. However, introducing a formal enforcement mechanism in the form of a court system mit-

[1] In this context, the sole source of risk is the possibility of cheating by traveling merchants.

igated the effect of cultural disposition. We, also, established that this effect disappears when, by eliminating the role of the local merchant, the option of personal trade between farmers and local merchants is removed. That is, engaging in long-distance trade is only less prevalent in people with collectivist leanings, when trading with an actual human local merchant exists as an alternative.

These results piqued my interest in better understanding the relationship between culture and enforcement mechanisms, which I sought to clarify in the second chapter of my thesis. Specifically, I was interested in better understanding the relationship between cultural disposition, trade relationships, and the choice of formal vs. informal institutions for governing these trades. From a historical point of view, cultural orientations played a crucial role in the selection of enforcement mechanisms in long-distance trade. Mediterranean trade in the early Middle Ages is a prime example of the effect of individualistic versus collectivistic cultures on the choice of enforcement mechanism. Genoese traders who come from a more individualistic culture, employed a formal patron system that later evolved into an extensive judicial system that emphasized individual traders' reputation in order to mitigate the problem of being cheated in long-distance trade [29]. In contrast, *Maghribi* traders whose cultural orientation was more collectivistic, devised an informal coalition network to collectively punish a cheating merchant and credibly enforce long-distance trade. It is important to note that the choice of informal enforcement mechanism by the *Maghribis* was not necessarily due to the lack of formal enforcement mechanism as "the Jews in the Muslim world had a well-developed legal system... and its decisions were enforced... hence, it is misleading to consider the *Maghribis'* coalition as reflecting a lack of legal options." [29, p. 275]. This choice stems from their underlying cultural history; therefore, [29] suggests that the formation of *Maghribis'* coalition was likely a by-product of their immigration to North Africa and their cultural attributes.

In this chapter, similar to the previous chapter, I use a laboratory experiment to explore the choice of enforcement mechanisms by individuals who engage in long-distance trade. I design a repeated modified trust game, simulating historical long-distance trade. To mimic the context of the aforementioned historical episode, I embedded a narration into to a trust game [64] in which the "farmer" has the option of engaging in trade either in a "local market " or with a "traveling merchant". In this setup, the local market is portrayed as the safer option where the farmer trades with known community members. In contrast, engaging in long distance trade with the traveling merchant represents a more impersonal and high-risk option, given that the possibility of higher gains and being cheated are both greater in this scenario. Contrary to the first chapter, farmers are offered an endogenous choice between informal and formal enforcement mechanisms to conduct long-distance trade. This allows us to observe the development path of enforcement mechanisms along distinctive cultural orientations. The primary question is, in the presence of institutional

alternatives, how does one's choice of enforcement mechanism to conduct long-distance trade depend on cultural background?

The formal enforcement mechanism is operationalized in the narration via a court system. Farmers could ex-ante register their transaction with traveling merchant in the court for a fee. The court probabilistically catches a cheating traveling merchant ex-post. Importantly, I probe into how the efficiency of a court system relates to the selection of the enforcement mechanism across the cultural spectrum. Hence, I define two treatment conditions, varying the probability of catching of cheating traveling merchant. In the inefficient formal enforcement treatment, the probability of being caught by the court is low whereas in the efficient formal enforcement treatment, this probability is high. Given the low probability of getting caught in the inefficient formal enforcement treatment, it would be predicted that, in the unique subgame perfect Nash equilibrium with money-maximizing agents, risk-neutral traveling merchants would cheat and that farmers would avoid long-distance trade. In contrast, given the high probability of getting caught in the efficient formal enforcement treatment, it would be predicted that risk-neutral farmers would engage in long-distance trade though traveling merchants would still cheat. The informal enforcement mechanism is operationalized as a knowledgeable elder who has information about the past dealings of traveling merchants. Farmers can purchase this information for a fee.

Results suggest that those with an individualistic disposition employ formal enforcement (i.e. the court system) more often than their collectivist counterparts, when the court system is effective. This, in turn, indicates that those with collectivist leanings tend to use the informal enforcement mechanism even in the presence of an effective formal enforcement mechanism. I, also, found that repetition of the game induced use of formal enforcement mechanism in the efficient formal enforcement treatment. Nonetheless, the entrenched underlying cultural effect still compelled subjects high on the collectivism spectrum to use the informal enforcement mechanism significantly more often than those high on individualism spectrum. In the inefficient formal enforcement treatment, individualistic and collectivist groups did not significantly differ in their choice of enforcement mechanism or in their decision to engage in long-distance trade.

Another important piece to this puzzle that is closely related to cultural practices involves placing constraints on the confiscatory power of an extractive, rent-seeking sovereign. In Western Europe, the nobles and merchants successfully spearheaded movements to place such constraints on their governments, and as a result, gained legally enforceable property rights [63, 79]. In contrast, their Middle Eastern counterparts failed to mobilize themselves to negotiate such rights [12]. Specifically, in the third chapter of my thesis I am focusing on how exogenous and egalitarian Islamic inheritance law [2] prevented Islamic

[2] According to Islamic inheritance law, wealth should be divided among heirs regardless of their gender or age. The share of male offspring is, however, twice as much as female offspring.

elites from accumulating landed wealth which in turn lowered their negotiation power and hindered their ability to place credible constraints on the sovereign. This is in stark contrast to Western European and especially English nobilities, who greatly benefited from the practice of primogeniture in both accumulating landed wealth and placing credible constraints on the sovereign's actions.[3]

I constructed a model with three types of agents; the sovereign, landlords/nobles, and landless/peasants. Nobles own firms/estates which, in turn, produce food. Production of food requires three inputs namely labor, capital, and land. Peasants provide the labor force required in the production of food. Furthermore, I assume that capital is the equivalent of the land improvement. That is, a share of hired labor is to maintain/improve the quality of the land and the rest participates in the production of food. In the model, nobles are homogeneous and each one inherits an equal parcel of land that is used in the production of food.

The sovereign levies tax on the nobles' production.[4] There is a conflict over the determination of tax rate between the extractive sovereign and nobles. The conflict resolution process is as follows: each individual noble puts forth an effort to oppose the sovereign. There is a cost attached to such an effort. Furthermore, the tax rate is an inverse function of the total effort of all nobles. [5] This model would predict that individual equilibrium effort level would decrease as the number of nobles increases. That is, from the point of view of the nobles, reductions in the tax rate are a public good; therefore, increase in the number of nobles creates a free rider problem. Without strong opposition, it becomes easier for the sovereign to arbitrarily tax the nobles and peasants.

Consistent with the proposed model, the results of this study showed that under Islamic inheritance laws, equilibrium tax rates were higher as compared to equilibrium tax rates under primogeniture. This finding is also consistent with the idea that having multiple heirs (i.e. landlords), leads to a weakening of bargaining position.

I argue that Islamic scholars, recognizing this bargaining problem, invented the binding contract of "waqf". In this type of contract, a living person, regardless of his or her religion, dedicates the income stream generated by an immovable asset to the provision of a social service in perpetuity (Kuran 2001). The founder of waqf can appoint one of their heirs as the manager with access to a portion of the income stream as a salary. While charitable giving is one of the most celebrated good deeds in the Qur'an, waqf, as a tool of wealth redistribution, is never mentioned in the text. In the 10th century, Islamic scholars reinterpreted Qur'anic verses commanding believers to be charitable in order to invent the sacred contract of waqf. Since other means of charitable giving already existed in the Islamic world, the critical question is "what is the value added of having this new institu-

[3]Primogeniture is a practice in which the firstborn male offspring inherits entire family estates.
[4]The sovereign consumes the extracted portion.
[5]For a detailed theoretical approach to the conflict resolution, see [26].

tion"? The major difference between waqf and other means of charitable giving is the indivisible and forever inalienable sacred asset created by the waqf contract. Such a contract prevents the division of lands among heirs and therefore effectively circumvents Islamic inheritance law.

A waqf asset is sacred and never to be divided. Hence, waqf technically creates a primogeniture-like environment with both lower tax rates and redistribution of wealth from nobles to peasants.

By pursuing this line of inquiry, my aim was to shed light on how cultural and institutional factors influenced the economic development of eastern versus western societies. Results of my research indicate that cultural dispositions to individualism and collectivism not only determine the appetite to pursue and develop long-distance trade but also affects the choice of the formal versus informal enforcement mechanism that governs this type of trade. Finally, I probe into how egalitarian Islamic inheritance law created an environment in which elites were unable to effectively oppose sovereign's arbitrary taxation.

Chapter 2

Individualism, Collectivism, and Trade

Aidin Hajikhameneh *Erik Kimbrough*

> The core element of *individualism* is the assumption that individuals are independent of one another.
> [...]
> The core element of *collectivism* is the assumption that groups bind and mutually obligate individuals.
>
> $\sim$ [65, p. 5, *emphasis added*]

Economists have long emphasized the crucial role of strong formal institutions in facilitating trade [e.g. 62]. In particular, the transition from personal, small-scale exchange to impersonal, large-scale trade is believed to rely on the development of contract enforcement institutions that facilitate trade by reducing the incentive to cheat. Starting with [28] they have also explored how cultural variables may influence the development of long-distance trade. One line of research has focused on how cultural dispositions to individualism and collectivism influence the means by which parties solve the "fundamental problem of exchange", that of contract enforcement [29]. Here we study the relationship between individualism/collectivism and the willingness to seek trade opportunities in the first place.

As [74] notes, "the individualism/collectivism cultural syndrome appears to be the most significant cultural difference [between societies]". Crucially, while individualism and collectivism are often conceived at the societal level [e.g. 38], psychologists recognize these dispositions as personal traits, such that each person lies somewhere on a continuum

from purely individualistic to purely collectivistic [77].[1] This means that we can measure subjects' dispositions to individualism/collectivism and correlate them with decisions in an experiment.

One crucial distinguishing feature of individualists and collectivists is how they view their relationships with others. Individualists are believed to value relationships instrumentally, "[balancing] relationships' costs and benefits, leaving relationships and groups when the costs of participation exceed the benefits and creating new relationships as personal goals shift" [65, p. 5]. Collectivists are believed to value their relationships intrinsically, implying "that (a) important group memberships are ascribed and fixed, viewed as 'facts of life' to which people must accommodate; (b) boundaries between in-groups and out-groups are stable, relatively impermeable, and important; and (c) in-group exchanges are based on equality or even generosity principles" [65, p. 5]. These differences may have implications for individuals' willingness to initiate long-distance trade.

Local, personal exchange is a fact of human life, but the transition to long-distance, impersonal exchange often involves severing (or weakening) ties to local trade partners in order to form new, potentially more lucrative, ties with an unknown party from elsewhere. This implies that, even with effective institutions, there may be differences in the willingness of individualists and collectivists to embrace new trade opportunities. Because collectivists value their relationships intrinsically, they may effectively incur an additional cost when abandoning an existing relationship to seek a new trading partner. We hypothesize that this is one of the channels through which collectivism may dampen the willingness to engage in long-distance trade.

In this paper, we report an experiment in which "farmers" may break off a pre-existing, mutually beneficial exchange relationship with a "local merchant" in order to seek a potentially more lucrative exchange with a stranger ("traveling merchant"), and we compare the behavior of individualistic and collectivistic people who are faced with this choice under different institutional arrangements. Subjects in our experiment interact in a "narrativized" trust game which employs narrative context to induce a pre-existing relationship and embed the decisions in a relevant historical context [64]. As [55] notes, the primary mode of long distance exchange in the pre-modern era involved "a sedentary and passive investor along with active laborer or traveling merchant" (p. 66). [29] points out that such a relationship is readily modeled as a trust game [e.g. 3].

In the narrative, a "farmer" initially faces the (trivial) choice between autarky and risk-free, mutually beneficial exchange with a local partner. After four rounds of local trade, the farmer is approached by a "traveling merchant" who offers to take the farmer's goods and sell them in a foreign market for a tidy profit. If the farmer chooses this option, the

[1] Triandis, in this book, coined the terms *idiocentrism* and *allocentrism* for individual-level analysis of individualism and collectivism. In this paper, however, we use the more familiar terms individualism and collectivism.

merchant may complete the contract or cheat and keep all the profits for himself. Crucially, trading with the traveling merchant necessarily implies abandoning the relationship with the local trade partner, leaving him in autarky. Given the incentive structure of the game, which involves no repeat interaction between farmers and traveling merchants, the subgame perfect Nash equilibrium (SPNE) for risk-neutral, payoff-maximizing agents involves only local trade.

In three experimental treatments, we vary the availability of an exogenous, formal contract enforcement mechanism: a court, in which cheating merchants are punished probabilistically. In the baseline No Enforcement (NE) treatment, there is no court. In the Weak Enforcement (WE) treatment, the court exists but punishes cheaters with a low probability such that trade is still not incentive compatible in the SPNE. In the Strong Enforcement (SE) treatment, punishment is sufficiently likely that the farmer trades in equilibrium, even though the merchant still cheats.

In each of these treatments, we compare the behavior of individualistic and collectivistic farmers. We follow [72] who developed a measure of individualism and collectivism (hereafter, I/C score) that relies on simple choice problems to reveal differences in individual cognition, that are known to be correlated with cultural dispositions to collectivism and individualism.

As noted above, due to the external cost imposed on local merchants, collectivist farmers may be less inclined to trade with traveling merchants. Another channel through which individualism/collectivism tendencies may affect long-distance trade is through collectivists' focus on group-level, rather than individual-level characteristics. Collectivists tend to perceive individuals from a group as *interdependent*. If collectivist farmers understand traveling merchants to be members of the same group, then an act of cheating by one traveling merchant may be perceived as reflecting a group characteristic. Thus, when cheated once, collectivists may be more likely to be deterred from trade in the future.

Implementation of formal enforcement mechanisms is orthogonal to the collectivistic traits that dampen the probability of engaging in long-distance trade. Therefore, we expect that collectivist farmers engage in long-distance trade significantly less often than individualist farmers across the NE, WE and SE treatments.

In a robustness check designed to investigate the effect of external cost imposed on local merchants by farmers' trade decisions, we eliminate the role of the local merchant in the NE treatment (we call this the NoLM treatment). As a result, there is no external cost imposed on the local merchant, so if this cost hindered trade among collectivists in the NE treatment, the differences between collectivists and individualists should weaken or disappear. To further probe the underlying cultural norms that affect long-distance trade, we run incentivized norm and belief elicitation tasks. In the norm elicitation task, we look for the difference in the perceived social appropriateness of each of the farmers' possible actions across the individualism/collectivism spectrum. If individualists view

abandoning trade with the local merchant as simply less wrong than collectivists, this may account for observed treatment differences. In a similar vein, in the belief elicitation task, we investigate the farmers' heterogeneous beliefs about the probability of reciprocation by traveling merchants.

Our findings suggest that individualist farmers are more likely to trade with traveling merchants than collectivist farmers in the NE, WE, and SE treatments. However, we observe no significant difference in long-distance trade between individualists and collectivists in the first period that trade is possible. This indicates that the effect of the negative externality alone is not strong enough to deter collectivist farmers from engaging in long-distance trade. Cheating, understandably, has significant negative effect on future long-distance trade. Collectivists, though, drop out of long-distance trade significantly more often, after being cheated. In the NoLM treatment, long-distance trade is not statistically distinguishable between collectivists and individualists. That is, reversion to local trade after being cheated by collectivist farmers seems to be partially motivated by the external cost imposed on the local merchant. In the belief elicitation task, we find that individualist farmers are significantly more optimistic regarding the probability of traveling merchants' reciprocation than collectivist farmers. This partially explains why individualist farmers engage in the long-distance trade more often that their collectivist counterparts regardless of enforcement mechanisms.

2.1 Related Literature

As in [21], we argue that heterogeneous preferences and beliefs explain differences in the willingness to engage in trade, but we tie this heterogeneity to underlying differences in collectivism and individualism. Collectivists and individualists differ in their preferences over the external cost imposed by trade on local merchants, and in how they update their beliefs after being cheated. Many previous experiments have attempted to measure differences in preferences related to trust and trade [e.g. 60, 16, 17]. In previous experiments, the belief channel has been explored mainly through implementation of either an individual or a group reputation system. Studies have shown that individual reputation systems induce cooperative behavior in repeated trust games [4, 8, 9, 13]. In the same vein, [11] used a continuous double auction setup to compare trade behavior in a known-identity "local" versus an anonymous "distant" market. They find that sharing individual reputation information significantly dampens cheating. [34] shows how the logic of sustaining cooperation via individual reputation [e.g. 51] can be extended to group reputation, so that in the presence of Pareto-improving cooperative outcomes and an inferior equilibrium, cooperation can be sustained until the penultimate period of a finitely repeated game. Recent experiments suggest that group reputation information either encourages cooperative behavior [41] or creates path-dependence [47]. There is no reputation system in our design *per se*;

however, the aforementioned heterogeneity in belief updating after being cheated may be interpreted as collectivist farmers assigning traveling merchants a group reputation.

The link between risk preferences and trust or engaging in long-distance trade is also related to our experiment. Most research on this subject showed that trust and risk are independent [20, 40]; however, there are some evidence that risk preferences can partially explain trust [70, 45]. In a cross country study, [7] compared the minimum accepted probability of reciprocation for player 1 to enter into trades in trust games in which player 2 was either a human or a lottery. The minimum accepted probability in the lottery treatment would offer a risk preferences measure while in the human player 2 the probability includes the trust factor. They find that in all countries, minimum accepted probability is significantly higher in the human treatment suggesting trust cannot be completely explained by risk preferences. Our results show that risk-preferences are not significant in NE, WE, and SE treatments. In the NoLM treatment, however, risk attitude is marginally significant. This suggests that risk is not of the primary concerns of collectivist farmers.

2.2 Experimental Design, Procedures and Hypotheses

To investigate how cultural dispositions affect the decision to engage in impersonal exchange, we study a repeated modified trust game (henceforth RMTG) that captures the important features of the problem faced by prospective traders in history. In the experiment, the RMTG has been narrativized to mimic the historical context in which long-distance trade occurred during the Middle Ages. Subjects, depending on their role and decision, see an interactive screen in which the complete information regarding different decision paths is given, along with a narrative context meant to reinforce certain design elements. See appendix A.1 for full instructions.

A subject plays one of three roles in the economy: farmer, local merchant, or traveling merchant. The farmer sells her products through either a local merchant or a traveling merchant. The narration portrays the local merchant as a trustworthy person with whom the farmer has a long-standing relationship. The traveling merchant offers a higher possible payout; however, he can abscond with the farmer's money.

In addition to the narration, to induce a relationship between the farmer and the local merchant in the lab, the first four periods of the game involve interactions between only the farmer and the local merchant. This portion of the game is the same across treatments; hence, we refer to it as the common stage. In the common stage, the farmer faces a trivial decision between 'Autarky', which yields a payoff of A for everyone, or risk-free 'Local Trade' with the local merchant, which yields a payoff of $2A$ for both the farmer and the local merchant. Traveling merchants are dormant at this stage of the game, and regardless of the farmer's decision, their payoff is A. The extensive form of the RMTG common stage

is depicted in the upper left portion of figure 2.1. The top, middle, and bottom payoffs correspond to the farmer, local merchant, and traveling merchant, respectively.

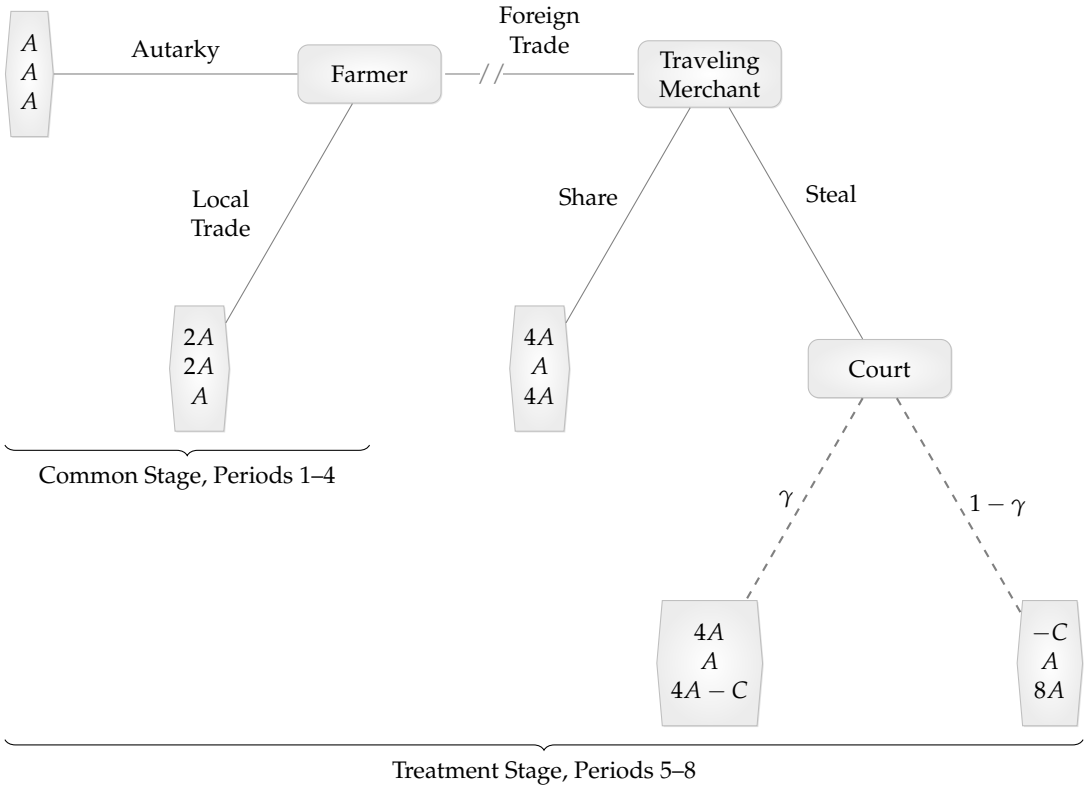

Figure 2.1: **Repeated modified trust game**

After the common stage, in each of periods 5-8, a traveling merchant arrives in the farmer's village and offers to take the farmer's product and sell it on the foreign market. The farmer still has access to the local market which provides a guaranteed payment of $2A$ to the farmer and local merchant and ensures the traveling merchant gets A. If instead the farmer chooses 'Foreign Trade', he abandons his relationship with the local merchant (guaranteeing him a payoff of A) and allows the traveling merchant to sell his goods abroad, creating a surplus of $8A$, which may be shared by the farmer and the traveling merchant. The traveling merchant then decides whether to 'Share' or 'Steal'. If he chooses 'Share', the game ends and the farmer and the traveling merchant each receive $4A$. If he chooses 'Steal', the traveling merchant takes the entire $8A$. However, we have incorporated the idea of a judicial system into the RMTG via a court apparatus which catches the cheating merchant with probability γ and forces him to complete the contract. Appeals to the court impose a litigation cost C which is paid by the farmer if he loses and by the traveling merchant if he wins. This information is summarized in the right portion of figure 2.1.

Given these payoffs, for risk-neutral, money-maximizing merchants, choosing 'Steal' is optimal whenever $\gamma \leq \frac{4A}{4A+C}$, and a risk-neutral, money-maximizing farmer's optimal strategy is to engage in local trade whenever $\gamma \leq \frac{2A+C}{4A+C}$.

2.2.1 Procedures

Upon arriving to the lab, subjects first complete the Triad Task due to [72], which provides a measure of their individualism/collectivism (henceforth I/C score, see appendix A.1.2 for the full task). In this task, subjects answer 20 questions in which they are required to choose the two words from a list of three that are "most closely related". Of the 20 questions, 8 are scored and used to construct the I/C score and 12 are filler questions designed to limit any pattern recognition by subjects. Here is an example of a scored question: "Of the following three things, please indicate which two of the three are most closely related: train, bus, tracks." This is a cognitive test in which individualists are inclined to match on category (train and bus); while, collectivists are inclined to match on relationship (train and tracks). Thus, the task measures a propensity to holistic vs. analytical thinking, which are, respectively, associated with collectivism and individualism:

> *Psychologically, growing up in an individualistic social world biases one toward the use of analytical reasoning, whereas exposure to more collectivistic environments favors holistic approaches. Thinking analytically means breaking things down into their constituent parts and assigning properties to those parts. Similarities are judged according to rule-based categories [...]. Holistic thinking, by contrast, focuses on relationships between objects or people anchored in their concrete contexts. Similarity is judged overall, not on the basis of logical rules.*
>
> [35, p. 593].

In their study of Chinese farmers from two regions, [72] showed that responses to the Triad Task are correlated with collectivistic and individualistic production processes (rice vs. wheat farming) at the individual and societal level.[2] Thus, we are comfortable using this proxy for an individual's underlying degree of collectivism.

After subjects complete the Triad Task, we assign a score of 1 for each individualistic response and a score of -1 for each collectivistic response. We refer to the normalized sum of these scores as the I/C score. The *two most collectivistic* and the *two most individualistic* subjects in a session were assigned the role of farmers. The remaining eight subjects were

[2] Alternative measures of individualism and collectivism are available, but they tend to either require substantially more time to collect or ask contextualized questions that might have undesirable spillovers into our RMTG. E.g. [42] measure I/C scores with a series of questions about how much a subject considers the interests of friends, family, and in-group members when making various decisions. This implicit focus on externalities and social approval could potentially bias results later in our experiment. For details, see appendix A.2

randomly assigned to be either a local merchant or a traveling merchant, so that each session has four farmers, four local merchants and four traveling merchants.

After role assignment, subjects begin the narrative of the RMTG. They first play 4 periods of the Common Stage and then 4 periods of the Treatment Stage in a single treatment. Across all treatments, we set $A = 4$. Our treatments vary the court enforcement power γ and the cost of litigation C. In the No Enforcement (NE) treatment, the court enforcement power and litigation costs are zero. In the Weak Enforcement (WE) treatment, $\gamma = 0.5$ and $C = 5$ so that, while there is a positive probability of the court enforcing the contract, the probability is low enough that choosing 'Foreign Trade' is still a dominated option ($0.5 < \frac{2A+C}{4A+C} < \frac{4A}{4A+C}$). This treatment allows us to test whether the the addition of court *per se*, even when it is ineffective, induces different responses by individualists and collectivists. In the Strong Enforcement (SE) treatment, $\gamma = 0.7$ and $C = 5$. In this treatment, court enforcement is strong enough to induce money-maximizing farmers to choose 'Foreign Trade' while still inducing traveling merchants to choose 'Steal' ($\frac{2A+C}{4A+C} < 0.7 < \frac{4A}{4A+C}$).

Finally, in a fourth treatment designed to test the robustness of our interpretation, we remove the *human* local merchant from the game, so that foreign trade no longer imposes a negative externality (we call this the NoLM treatment). This game reduces to a trust game with the addition of a third dominated action (Autarky). We discuss this treatment in more detail in section 2.3.4 below. Table 2.1 summarizes the experimental design and the SPNE for money-maximizing agents.

	Parameters			SPNE		Data	
	A	γ	C	Trade	Cheat	Sessions	Subjects/Session
No Enforcement (NE)	4	0	0	no	yes	4	12
Weak Enforcement (WE)	4	0.5	5	no	yes	4	12
Strong Enforcement (SE)	4	0.7	5	yes	yes	4	12
No Local Merchant (NoLM)	4	0	0	no	yes	4	8

Table 2.1: **Summary of experimental treatments**

Our matching scheme is a combination of partner matching (between farmers and local merchants) and perfect stranger matching (between farmers and traveling merchants). Throughout the game, the farmer is partner matched with a local merchant, but in each round of the Treatment Stage, the farmer is matched with a *new* traveling merchant. The narration emphasized that farmers were trading with "a new merchant" and that merchants were trading in "another village". The matching scheme is depicted in figure 2.2.

Following this matching scheme, the experiment ends after 8 periods of the RMTG. Since risk-preferences may influence the decision to engage in long-distance trade, independent of individualism and collectivism, at the end of the session, we elicited subjects' risk preferences using a multiple price list mechanism based on [39]. Subjects faced a sequence of ten choices between two lotteries. Lottery 1 had a constant 0.5 probability of

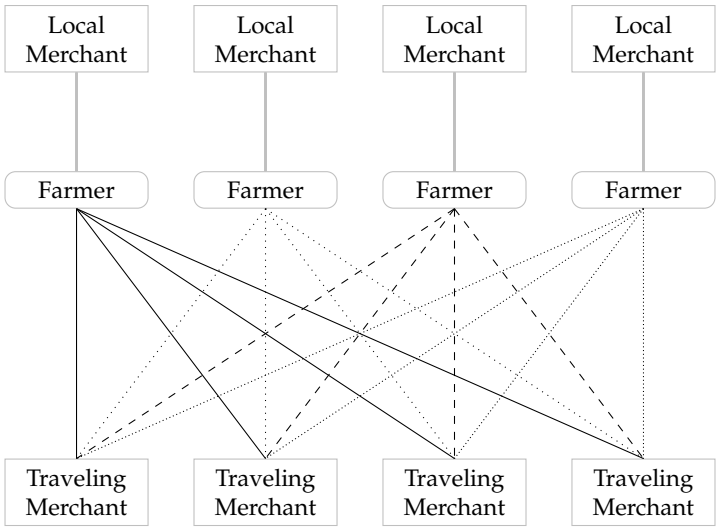

Figure 2.2: **Matching protocol**

paying either \$1 or \$3 while lottery 2 (over \$0.1 and \$4) had an increasing probability of paying \$4 in the sequence. One choice was drawn at random and paid for each subject. The full set of lotteries and the instructions can be found in appendix A.1.3. We use the number of times the subject chose lottery 2 as a measure of risk preference.

The experiment included 16 sessions, 4 per treatment. In each session of the NE, WE and SE treatments, 12 subjects participated, and in each session of the NoLM treatment, 8 subjects participated, for a total of 176 subjects. Experiments were conducted at Simon Fraser University between February and June 2015, and the software was developed using zTree [25]. At the end of the session, the subjects' total ECU from all 8 periods were summed and converted to CAD at a rate 12 ECU = \$1. Then we added the earnings from the risk-preference elicitation. The payment range was from 11CAD to 22CAD including a 7CAD show-up fee. Subjects were recruited for sessions lasting 1 hour, but in practice each session lasted approximately 40 minutes.

2.2.2 Hypotheses

As noted above, in the SPNE of the NE, WE and NoLM treatments, money-maximizing farmers will never trade, while in the SE treatment, they will always trade. Moreover, independent of treatment, money-maximizing traveling merchants will cheat in equilibrium. Experimental evidence from trust games, on the contrary, reveals extensive trust and reciprocity, inconsistent with pure money-maximizing behavior [44]. We further hypothesize that individualistic and collectivistic tendencies may affect the willingness to engage in long-distance trade through two distinctive channels.

To reiterate, individualists value their relationships instrumentally "[balancing] relationships' costs and benefits, leaving relationships and groups when the costs of participation exceed the benefits and creating new relationships as personal goals shift" [65, p. 5] while collectivists value their relationships intrinsically, implying "that (a) important group memberships are ascribed and fixed, viewed as 'facts of life' to which people must accommodate; (b) boundaries between in-groups and out-groups are stable, relatively impermeable, and important" [65, p. 5]. In the context of this experiment, farmers may regard their history of trades with local merchants as merely a trade opportunity that was preferable to autarky (i.e. from an individualistic view) or as a personal relationship that also offered a trade opportunity (i.e. from a collectivistic view). In the narration, traveling merchants are portrayed as a potential better trade opportunity; however, trade with them imposes a negative externality on local merchants. Therefore, we have the following two hypotheses:

> *I/C Hypothesis 1a*: Since collectivists value their relationships intrinsically, they will be less willing to engage in long-distance trade than individualists, due to the negative externality this imposes on local merchants in the NE, WE and SE treatments.

> *I/C Hypothesis 1b*: In the NoLM treatment, which eliminates the negative externality of long-distance trade, this effect should disappear.

Another channel through which individualism and collectivism may affect long-distance trade is through differences in the way that traveling merchants' trade behavior influences farmers' beliefs. The pillar of collectivism is that individuals are *interdependent*. Hence, after being cheated once, collectivist farmers may expect all traveling merchants to be "cheaters" and may be deterred from future long-distance trade, despite the perfect stranger matching protocol used in the experiment. The pillar of individualism, on the other hand, "is the assumption that individuals are *independent* of one another" [65, p. 5, *italics* added]. Thus when cheated, individualist farmers may not be deterred from future long-distance trade, since the action of one is not perceived as an indication of future actions by others.

> *I/C Hypothesis 2*: Since collectivists tend to focus on salient features of groups rather than individuals, their willingness to trade at time t after being cheated at time $t-1$ will be lower than individualists, as collectivists are prone to assume the behavior of one traveling merchant is representative of the behavior of others.

2.3 Experimental Results

2.3.1 I/C scores

Using the Triad Task, we elicited I/C scores for each subject and used these to assign them to roles. In particular, we sampled all the people in the role of the farmer from the tails of the distribution. We have normalized the data so that a score of 0 means that a subject's responses to the triad task were 100% consistent with collectivism and a score of 1 means that the subject was 100% individualist. Figure 2.3 shows the overall distribution of I/C scores in the sample. As the distribution is clearly skewed towards collectivism, this supports our decision to sample from the tails in order to ensure that we have both individualistic and collectivistic subjects in the most important role. Finally, we note that there is no significant correlation between I/C scores and risk preference or gender (two-sided Spearman's rank correlation test p-values $= 0.84$ and 0.41, respectively, when we look at the entire sample, and p-values = 0.13 and 0.52, respectively, when we focus on subjects in the role of farmer).[3]

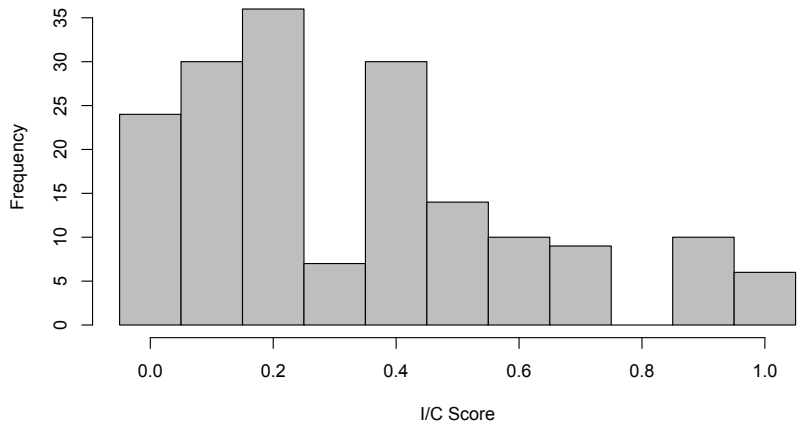

Figure 2.3: **Histogram of I/C scores.**

2.3.2 The common stage

The common stage was designed to induce a history between the farmers and local merchants. Hence, the decision for the farmers was a trivial one, either to keep their harvest and earn A or trade with the local merchant and generate a payoff of $2A$ for both parties with no risk of being cheated. The common stage also served as a test for both the clarity of the narrations and the rationality of the farmers.

[3]Figure A.1 in appendix A.3 displays the distribution of choices in the risk preference elicitation for the curious reader.

After twelve sessions, farmers collectively faced this decision 192 times and kept the harvest only three times. This shows that the gains from trading with the local merchant were salient to the farmers and that the farmers preferred more to less. As we will see below, this stage also appears to have succeeded in building a salient relationship between collectivistic farmers and the local merchant.

2.3.3 The treatment stage

Overall we observed 33 long-distance trades in the NE treatment, 32 trades in the WE treatment, and 42 trades in the SE treatment. Comparing at the session level, a Wilcoxon rank-sum test reveals no statistically significant difference in the amount of trade between the NE and WE treatments (p-value=1, two-sided test).

Pooling WE and NE which are predicted to be equivalent and compare them to SE, we find significantly more trade in SE, consistent with the comparative statics of the payoff-maximizing SPNE (p-value=0.05, one-sided test).

Our main hypothesis pertains to the relationship between an individual's I/C score and her willingness to trade.[4] Pooling the NE, WE and SE treatments, there is a positive and significant correlation between the I/C score and the number of times that a subject engaged in long-distance trade (Spearman's $\rho = 0.33$, p-value=0.01, one-sided test). Figure 2.4 shows the relationship between I/C score and willingness to trade, by treatment. Each line represents the predicted probability of trade in a single treatment and colored bands represent 90% confidence intervals from a logistic regression.

To provide statistical support for an effect of individualist/collectivist culture on trade decisions, we estimate a panel regression model where the dependent variable is a dummy that takes a value of 1 if the farmer traded with the traveling merchant at time t and 0 otherwise. The dependent variables include a constant term, the I/C score, and WE and SE treatment dummies. A second specification includes interactions between treatment and I/C score, and a third specification includes individual risk preferences, a female dummy, and risk times treatment interactions. In each specification, we include random effects for each subject to control for repeated observations and we cluster standard errors at the session level. The results are reported in columns (1)-(3) of Table 2.2.

In all three specifications, once we control for I/C score the treatment effects are insignificant. Moreover, the more individualistic a farmer, the higher her probability of engaging in long-distance trade.[5]

[4]Our hypotheses focus on farmers' behavior, and the I/C score distribution for traveling merchants is compressed due to our role assignment algorithm. Thus we relegate analysis of traveling merchant decisions to appendix A.3.

[5]Since e.g. risk-averse agents may still prefer not to trade in the SPNE of the SE treatment, and risk-lovers may prefer to trade, even in the WE treatment, we included the risk $\times$ treatment interactions. Lower values of the variable "risk" imply more risk-aversion. Wald tests indicate that there is no statistically significant effect of risk preferences in the NE, WE, or SE treatment, p-values = 0.70, 0.11, and 0.31, respectively.

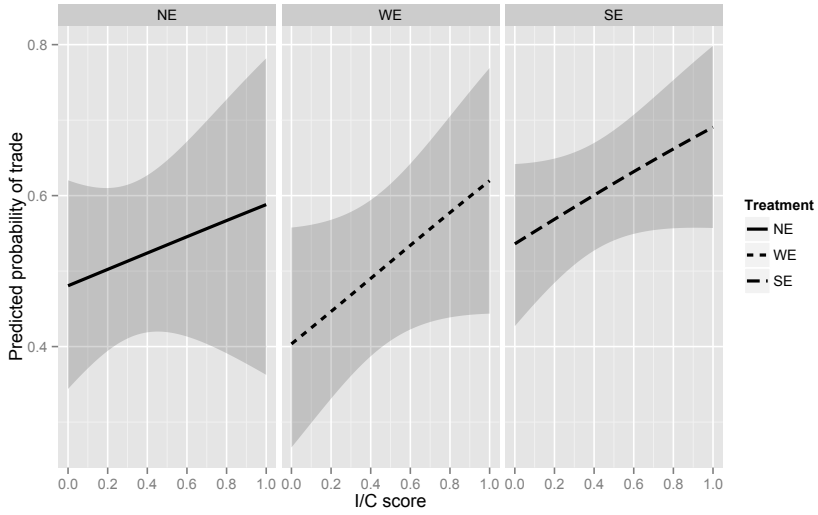

Figure 2.4: **The relationship between I/C score and willingness to trade, by treatment.** Each line represents the predicted probability of trade in a single treatment and colored bands represent 90% confidence intervals from a logistic regression.

Finding 1: Overall, individualists are more likely to trade than collectivists.

What drives these differences in behavior? If individualism encourages long-distance trade *per se*, as predicted by I/C Hypothesis 1a, then this difference should show up in the first period. In columns (4) and (5) of Table 2.2, we estimate the effect of I/C score and the treatments on first period trade using OLS and clustering standard errors at the session level. In column (4) we find no significant relationship between I/C score and trade but there is a significantly more trade in the first round of SE. When we include interactions, as in column (5), the main effect of the SE treatment is no longer significant. Moreover, Wald tests cannot reject the null hypotheses that the I/C score and I/C $\times$ treatment interactions sum to 0 (p-values > 0.3), suggesting that there is no effect of the treatments in period 1.

Finding 2: In the first period of long-distance trade, there is no significant difference in the behavior of individualistic and collectivistic farmers, suggesting that if individualists and collectivists value the relationship with the local merchant differently, this effect is not strong enough to lead to differences in *initial* trade.

One possible confound is that there are initially systematic differences in the beliefs of individualists and collectivists about the probability that a traveling merchant will reciprocate (i.e. differences in trust). Thus, it is possible that collectivists value the relationship with the local merchant but also have more optimistic beliefs about the behavior of traveling merchants. Our NoLM treatment, which we discuss below, allows us to address this confound.

	(1) Trade$_t$	(2) Trade$_t$	(3) Trade$_t$	(4) Trade$_1$	(5) Trade$_1$	(6) Trade$_{t>1}$	(7) Trade$_{t>1}$
I/C Score	0.234**	0.108**	0.105**	0.096	-0.219	0.056	0.019
	(0.098)	(0.046)	(0.051)	(0.153)	(0.293)	(0.140)	(0.169)
Weak Enforcement	-0.044	-0.077	-0.384	-0.012	-0.146	-0.278	-0.380*
	(0.089)	(0.089)	(0.268)	(0.138)	(0.209)	(0.288)	(0.215)
Strong Enforcement	0.118	0.028	-0.088	0.241**	0.069	-0.128	-0.267
	(0.090)	(0.139)	(0.293)	(0.095)	(0.179)	(0.346)	(0.302)
WE × I/C		0.109	0.060		0.388	0.017	0.030
		(0.116)	(0.081)		(0.362)	(0.139)	(0.198)
SE × I/C		0.241	0.247		0.480	0.164	0.298
		(0.231)	(0.277)		(0.380)	(0.323)	(0.348)
Risk			0.011			0.030	0.025
			(0.028)			(0.048)	(0.046)
WE × Risk			0.070			0.038	0.038
			(0.067)			(0.071)	(0.062)
SE × Risk			0.024			0.028	0.022
			(0.047)			(0.062)	(0.055)
Female			0.011			0.026	0.024
			(0.096)			(0.089)	(0.080)
Cheat$_{t-1}$						-0.249*	-0.595***
						(0.138)	(0.111)
Cheat$_{t-1}$ × I/C						0.519***	0.698**
						(0.161)	(0.323)
Cheat$_{t-1}$ × WE							0.559**
							(0.260)
Cheat$_{t-1}$ × SE							0.708***
							(0.165)
Cheat$_{t-1}$ × I/C × WE							-0.273
							(0.468)
Cheat$_{t-1}$ × I/C × SE							-0.545
							(0.397)
Intercept	0.440***	0.481***	0.439***	0.469***	0.571***	0.403***	0.499***
	(0.076)	(0.065)	(0.113)	(0.110)	(0.145)	(0.123)	(0.113)
Observations	192	192	192	48	48	144	144
R^2	0.05	0.06	0.09	0.06	0.09	0.10	0.19

Clustered standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 2.2: **Regression Analysis of the Decision to Trade**

Given that we find no *per se* differences in trade behavior in the first round, we examine the second potential source of correlation between trade and I/C score. According to I/C Hypothesis 2, differences between the types develop dynamically through their histories of interaction with traveling merchants. In particular, when trading, both types may be cheated, but the effect of being cheated on their subsequent willingness to trade may vary across types. To test for these dynamic effects, we estimate two additional regression specifications in which we include a dummy variable that takes a value of 1 when a farmer was cheated in the previous period and 0 otherwise. In column (6), we estimate the same

model as in column (3) and add this variable and an I/C $\times$ Cheat$_{t-1}$ interaction; while, in column (7) we also include interactions between the lagged cheating variable, the I/C score, and the treatments.

In column (6), the overall effect of cheating is negative and significant, while the interaction with I/C score is positive and significant. This indicates a heterogeneous reaction to being cheated by individualists and collectivists. Specifically, when cheated, collectivists are less likely to trade in the future, while individualists remain just as likely, or moreso, to trade. In column (7), we find positive and significant interactions between Cheat$_{t-1}$ and the WE and SE treatments, suggesting that the presence of exogenous enforcement increases the likelihood of trading after having been cheated in those treatments. The triple interactions with I/C are insignificant, and the overall higher likelihood of trading for individualists, conditional on having been cheated, remains (i.e. we see a positive and significant coefficient on the I/C $\times$ Cheat$_{t-1}$ interaction).

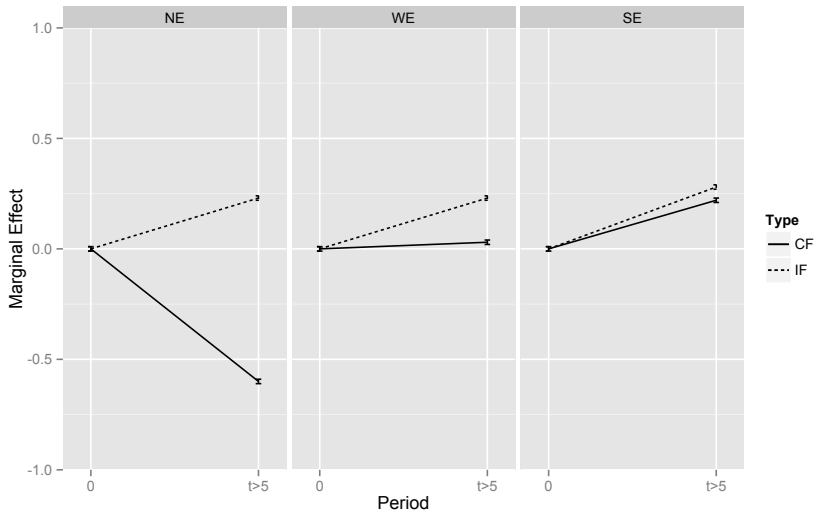

Figure 2.5: **The marginal effect of cheating on trade, by treatment and I/C score.** Each panel plots the data for one treatment. The left side shows the origin. The right side shows the marginal effect on trade probability of having been cheated in the previous period for each type in periods 6-8. Using column (7) of table 2.2, we compute the marginal effect from a logistic regression at the upper and lower quartiles of the farmers' I/C score distribution for individualists (IF) and collectivists (CF), respectively.

Figure 2.5 summarizes these findings graphically. The figure reveals that, when cheated, collectivists substantially reduce their future willingness to trade, while individualists, on the whole, do not. In keeping with our opening quote, this evidence suggests that individualists treat traveling merchants in isolation, as if their behavior is independent of one another, while collectivists appear to assign blame to the entire set of traveling merchants for the misbehavior of one.

Finding 3: Consistent with I/C Hypothesis 2, individualists and collectivists react differently to being cheated when engaging in long-distance trade. Individualists are less deterred from future trade than collectivists.

In the NE treatment the negative effect of being cheated is at its peak to the point that collectivists almost completely opt out of long-distance trade after being cheated. However, interestingly, both the negative coefficients on the triple-interaction terms (Cheat$_{t-1}\times$ I/C $\times$ Treatment) in column (7) of table 2.2 and the marginal effects depicted in figure 2.5 suggest that the court system mitigates this difference. This is along the same line as historical evidence [29] in which the role of the formal enforcement is to mitigate the "fundamental problem of exchange".

2.3.4 Robustness

No Traveling Merchant

To better understand the source of our findings, we ran the NoLM treatment in which there was no human local merchant who was harmed by the decision of a farmer to trade with a traveling merchant. We retained the framing of the game as the decision to trade in a local or foreign market, and we retained the initial 4 periods in which the farmer makes a trivial decision between autarky (A) and local "trade" ($2A$). In each of periods 5-8, a new traveling merchant appeared just as before, and the pair played a standard, extensive form trust game, with no court (i.e. $\gamma, C = 0$).

This treatment helps illuminate two aspects of the data. First, it allows us to address the concern that the initial lack of differences between types in the NE, WE, and SE treatments is driven by offsetting effects of different beliefs and different values of the relationship with the local merchant. In NoLM, there is no human local merchant, so different beliefs, if they exist, should now lead to different trade behavior. Second, there is the possibility that the two mechanisms interact, which was not captured in our initial hypotheses. If collectivists revert to local trade after being cheated due, in part, to their higher value for the relationship with the local merchant, then removing this local merchant should reduce the dynamic differences between types.

Overall, in NoLM we observe 35 instances of trade, and there is no significant difference in trade at the session level between the NoLM and NE treatments (two-sided Wilcoxon test, p-value = 0.88). Moreover, within the NoLM treatment we find no significant correlation between I/C score and the number of times a subject traded with the foreign merchant (Spearman's ρ = -0.09, p-value = 0.75). To test whether eliminating the human local merchant influences initial propensity to trade, we estimate the effect of I/C score and the treatments on trade in period 1 using OLS and clustering standard errors at the session level. To compare the dynamic effect of cheating in the NE and NoLM treatment, we estimate a panel GLS model in which the dependent variable takes a value of 1 if

	(1) Trade_1	(2) Trade_t
I/C Score	-0.219	0.026
	(0.299)	(0.175)
NoLM	-0.040	-0.428
	(0.235)	(0.342)
I/C Score × NoLM	0.144	-0.019
	(0.315)	(0.331)
Risk		0.011
		(0.050)
NoLM × Risk		0.108*
		(0.065)
Female		-0.057
		(0.176)
Cheat_{t-1}		-0.596***
		(0.117)
I/C Score × Cheat_{t-1}		0.593**
		(0.295)
NoLM × Cheat_{t-1}		0.463
		(0.367)
I/C Score × NoLM × Cheat_{t-1}		-0.745
		(0.456)
Intercept	0.571***	0.589***
	(0.147)	(0.204)
Observations	32	96
R^2	0.01	0.19

Clustered standard errors in parentheses.
* p<0.1, ** p<0.05, *** p<0.01.

Table 2.3: **Regression Analysis of the Decision to Trade After Being Cheated, NE and NoLM**

the farmer traded and a value of 0 otherwise. The independent variables include, an Intercept, the I/C score, a NoLM dummy, individual risk preferences, a female dummy, a risk times treatment interaction, a dummy that takes a value of 1 when the farmer was cheated in the previous period and 0 otherwise, and all possible interactions between I/C, NoLM and lagged cheating. We include random effects for each subject to control for repeated observations and we cluster standard errors at the session level.

Regression output is reported in Table 2.3. In column (1), we find no evidence of initial differences in the willingness to trade across types suggesting that differences in initial beliefs cannot explain our observations above. In column (2), as before, we find a negative and significant overall effect of being cheated in the previous period on current period trade. Moreover, this is offset among individualists in the NE treatment, and a Wald test cannot reject the null hypothesis that the coefficients on lagged cheating and the Cheat_{t-1} × I/C Score interaction sum to 0 (p-value = 0.99). However, the three-way interaction of Cheat_{t-1} × I/C Score × NoLM is large and negative. Alone it is not statistically significant,

but a Wald test cannot reject the null that the sum of the Cheat$_{t-1}$ $\times$ I/C Score interaction and the three-way interaction is equal to 0 (p-value = 0.67). Taken together, this indicates that the dynamic effects of cheating on individualists and collectivists are not statistically distinguishable in the NoLM treatment.

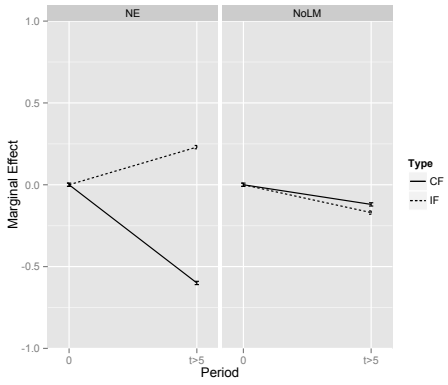

Figure 2.6: **The marginal effect of cheating on trade in the NoLM treatment, by I/C score.** The left side shows the origin. The right side shows the marginal effect on the probability of trade of having been cheated in the previous period for each type in periods 6-8 . Using column (2) of table 2.3, we compute the marginal effect from a logistic regression at the upper and lower quartiles of the farmers' I/C score distribution for individualists (IF) and collectivists (CF), respectively.

Figure 2.6 summarizes these observations graphically. The figure reveals no substantial behavioral differences between the types in the NoLM treatment. Finally, a positive and marginally significant coefficient on the Risk $\times$ NoLM variable indicates that subjects who are willing to take more risk trade more often in the NoLM treatment, which provides some evidence that beliefs drive decision-making in the NoLM treatment. Risk was insignificant in every other treatment.

> *Finding 4:* In the NoLM treatment, there are no substantial behavioral differences between individualist and collectivist farmers.

Thus far, we have established that individualists are more likely to trade than collectivists in the NE, WE, and SE treatments and that in the absence of human local merchants, in the NoLM treatment, we observe no significant behvioral differences between individualists and collectivists. However, the channel through which individualism encouraged long-distance trade is still ambiguous. To clarify what aspects of individualism are conducive to long-distance trade we run two additional incentivized tasks.

Norm Elicitation and Belief Elicitation

Do subjects high on the individualism spectrum believe that long-distance trade, regardless of the negative externality imposed on local merchants, is more normatively appealing

as compared to their collectivist counterparts? Are individualists more optimistic regarding traveling merchants' cooperation than collectivists? In an attempt to describe the underlying mechanisms which shape trade behavior, and to further probe the heterogeneity of social norms and beliefs across the individualism/collectivism spectrum, we ran incentivized norm and belief elicitation tasks [52, 48, 46].

To provide answers to the aforementioned questions, we elicit norms and beliefs about trade behavior in two separate tasks. In task 1/appropriateness task, we elicit beliefs about social norms. That is, we measure the social appropriateness of each one of the farmers' available actions. According to [28] cultural/social norms are "the ideas and thoughts common to several individuals that govern interaction between [them]" (p.915). Hence, in the context of this experiment, individualists and collectivists may have different injunctive social norms about the appropriateness of farmers' actions. To reiterate, in each round of treatment, farmers have the following three options: "keep the harvest", "trade with the local merchant", and "trade with the traveling merchant". Subjects, in this task, read the farmer's narration[6] and had to evaluate each action on a four-point scale (that is, "very inappropriate", " somewhat inappropriate", " somewhat appropriate", and " very appropriate") with the simple instruction that they would get paid $8 only if their answers correspond to the most frequent response given by other subjects in the lab. Otherwise, they would get $0. This payment method captures the idea of injunctive social norms as it incentivizes subjects to reveal their beliefs about what others believe is socially appropriate (what ought to be done). For this task's payment, one of the three questions was randomly drawn by the computer and subjects were paid accordingly.

Furthermore, in task 2/belief elicitation task, we elicit beliefs of the likelihood of reciprocation by traveling merchants. Subjects, after reading the traveling merchants' narration,[7] had to decide "what is the probability that the traveling merchant shares the profit?" We employ a random reward lottery method such that it is optimal under weak conditions for subjects to report truthfully [46]. That is, this method is truth revealing as long as subjects have monotonic preferences over money, are probabilistically sophisticated (such that they make their choice based only on the "implied probability distribution over outcomes") and have no ulterior stake in any particular outcome [46, p.604].

We observe no significant correlation between the perceived social appropriateness of farmers' actions and I/C score. This may suggest that individualists are not socially less sensitive to their local merchants' plight compared to collectivists.[8] The result of the belief elicitation task, however, indicates that individualists are significantly more opti-

[6]Subjects, from the farmers' point of view, see the common stage narration. They are informed that this stage lasted for four periods in the sessions conducted in the same laboratory a year ago. Next, subjects read the NE treatment narration. For details, see appendix A.2.

[7]Subjects see the same sequence of the narration as a traveling merchant would in the NE treatment. For details, see appendix A.2.

[8]However, since subjects are paid based on whether their response corresponds to that of others in the room, this task may not incentivize them to reveal *their own* normative beliefs if they think others have different

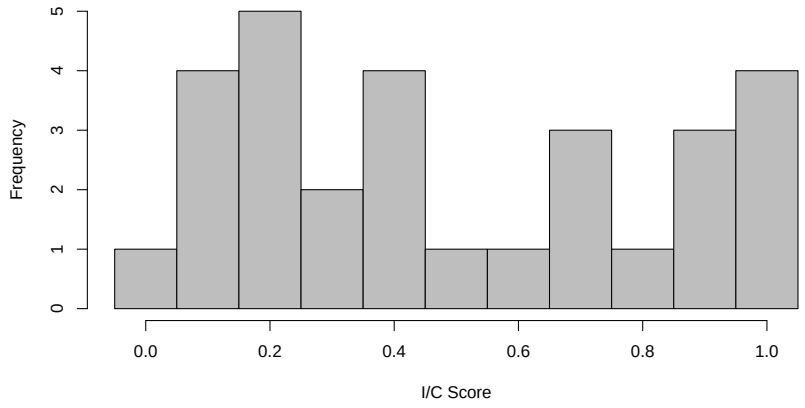

Figure 2.7: **Histogram of I/C scores in the norm and belief elicitation tasks.**

mistic regarding the probability of traveling merchants' reciprocation (Spearman's $\rho = 0.41, p - value = 0.03$).

> *Finding 5:* Overall, individualists perceive traveling merchants to be more cooperative than collectivists.

2.4 Discussion and Conclusion

In this paper, using a laboratory experiment, we examined how individualism and collectivism affect the propensity to engage in long-distance trade under various formal enforcement mechanisms. Our findings suggest that individualists tend to be more willing to trade than collectivists. Two channels through which collectivism dampens long-distance trade are the external cost imposed on local merchants and the stereotyping of traveling merchants. In particular, we find that individualist farmers are less deterred from trade by cheating than are collectivist farmers. The formal enforcement mechanism, however, mitigates this difference. The imposed external cost is not strong enough to cause a significant behavioral difference in the first period of any treatment; however, upon eliminating the role of local merchant in the NoLM treatment, the behavioral difference after being cheated observed in the NE, WE, and SE treatments, disappears. This indicates the importance of context to the collectivist farmers. The norm and belief elicitation tasks also established that individualists perceive traveling merchants to be more cooperative than collectivists. Our findings suggest that cultural dispositions take precedent to exogenous enforcement mechanisms' power in the farmers' decision-making process. That is, cultural

views. That is, unfortunately, we may observe only the overall average of normative beliefs and not how such beliefs vary with dispositions to individualism or collectivism.

dispositions have clear economic consequences by influencing the probability of engaging in long-distance trade.

Studies of collectivism and individualism have mainly employed field experiments [72, 58]. We believe that this experiment provided a useful tool to bring the study of the effect cultural dispositions on economic variables into the laboratory setting. Our findings suggest that exogenous third party enforcement could not eliminate the economic implications of individualism and collectivism. The endogenous choice of third party enforcement [24, 23], however, could possibly lead to less cheating and consequently more long-distance trade. We did not probe into the choice of enforcement mechanisms and its effect on the long-distance trade. however, this could prove to be a promising path for future research.

Chapter 3

Individualism, Collectivism and Alternative Enforcement Mechanisms in Exchange

Long-distance trade is a building block of economic prosperity. However, our understanding of the selection process of different enforcement mechanisms that govern long-distance trade is surprisingly limited. What is known about long-distance trade is that trade parties generate credible commitment via either formal third party enforcement or informal exploitation of communal ties. One prominent explanation for institutional differences is that they are rooted in cultural differences, namely individualistic versus collectivistic cultural orientations [e.g. 28, 29, 31].

It can be argued that cultural orientation has historically played an important role in the selection of enforcement mechanisms in long-distance trade. For example, Genoese traders who come from a more individualistic culture, employed a formal patron system that later evolved into an extensive judicial system that emphasized individual traders' reputation in order to mitigate the probability of being cheated in long-distance trade [29]. In contrast, *Maghribi* traders whose cultural orientation was more collectivistic, devised an informal coalition network to collectively punish a cheating merchant and credibly enforce long-distance trade. It is important to note that the choice of informal enforcement mechanism by the *Maghribis* was not necessarily due to the lack of formal enforcement mechanism as "the Jews in the Muslim world had a well-developed legal system... and its decisions were enforced... hence, it is misleading to consider the *Maghribis'* coalition as reflecting a lack of legal options." [29, p. 275]. This choice stems from their underlying cultural history; therefore, Grief (2000) suggests that the formation of *Maghribis'* coalition was likely a by-product of their immigration to North Africa and their collectivism.

A precise working definition of collectivism and individualism is warranted here. Here, I define collectivism as the cultural orientation that emphasizes the needs and welfare of

the in-group as being more important than that of the individual [10]. In contrast, individualism is defined as the worldview that the needs and welfare of the individual supersedes that of the social group to which one belongs [65]. Considerable variation exists in the type of cultural orientation across societies, with Western cultures typically being considered more individualistic while Eastern cultures being considered more collectivistic [36]. That said, individuals within any given culture can and do endorse qualities that reflect individualism (e.g., competitiveness or hedonism) and/or collectivism (e.g., harmony or interdependence), regardless of the cultural orientation of their in-group [75]. For example, while being in harmonious relationship with the other members of the group is a necessity in collectivistic cultures, some level of competition among members might be also promoted. At the individual level of analysis, [77] proposed the use of "idiocentricism" and "allocentricism" to refer to personality-level manifestations of individualism and collectivism. These two attributes are often perceived as inherently orthogonal because "Idiocentrics emphasize self-reliance, competition, uniqueness ... [while] allocentrics emphasize interdependence, sociability, and family integrity" [74, p. 140]. This paper is concerned with the individual-level analysis of individualism and collectivism.

Due to lack of historical data and possibility of testing counterfactuals, I use a laboratory experiment to explore the choice of enforcement mechanisms by individuals who engage in long-distance trade. In this paper subjects play a two-player repeated modified trust game, mimicking long-distance trade in the Middle Ages. To further induce the historical context, I utilized a narrativized trust game [64, 33] in which the "farmer" (that is, sender/investor) has the option of engaging in trade either in a "local market " or with a "traveling merchant" (i.e. receiver/investee). In this paradigm, the local market is portrayed as the safer option where the farmer trades with known community members. In contrast, engaging in long distance trade with the traveling merchant represents a more impersonal and high-risk option, given that the possibility of higher gains and being cheated are both greater in this scenario. Farmers are offered an endogenous choice between informal and formal enforcement mechanisms to conduct long-distance trade. This allows us to observe the development path of enforcement mechanisms along distinctive cultural orientations. The primary question is, in the presence of institutional alternatives, how does one's choice of enforcement mechanism to conduct long-distance trade depend on cultural background?

The formal enforcement mechanism is operationalized in the narration via a court system. Farmers could ex-ante register their transaction with traveling merchant in the court for a fee. The court probabilistically catches a cheating traveling merchant ex-post. Importantly, I prob into how the efficiency of court system relates to the selection of the enforcement mechanism across the cultural spectrum. Hence, I define two treatment conditions, varying the probability of catching of the cheating traveling merchant. In the inefficient formal enforcement treatment, the probability of being caught by the court is low

whereas in the efficient formal enforcement treatment, this probability is high. Given the low probability of getting caught in the inefficient formal enforcement treatment, it would be predicted that, in the unique subgame perfect Nash equilibrium (henceforth, SPNE) with money-maximizing agents, risk-neutral traveling merchants would cheat and that farmers would avoid long-distance trade. In contrast, given the high probability of getting caught in the efficient formal enforcement treatment, it would be predicted that risk-neutral farmers would engage in long-distance trade though traveling merchants would still cheat. The informal enforcement mechanism, in the narration, is operationalized as a knowledgeable elder who has information about the past dealings of traveling merchants. Farmers can purchase this information for a fee.

In measuring individualistic/collectivistic characteristics, I follow [72] in which subjects participate in a cognition based triad task. In this task, subjects see a series of three words with the instruction that they have to simply match two out of three words that they deem to be more "related". According to the social psychology literature, collectivists analyze matters based on "similarity of relations" [50]. Individualists, however, are "more likely to rely on rules over similarity of relations in reasoning and categorization" [36, p. 72]. Therefore, in the matching of the following three words: Train, Bus, Tracks, people with collectivistic qualities tend to pick Train and Tracks as they are more concerned with conceptual relations between words, whereas people with individualistic qualities who are more concerned with categories the words belong to, tend to select Train and Bus. After participating in the triad task, subjects with the highest individualist/collectivists propensities will be assigned as the farmers and the remaining subjects will be assigned as the traveling merchants.

Further, I divide each session into two groups of 8. Each group contains 4 farmers and 4 traveling merchant. I, also, split the treatment stage into two distinct phases. In the phase 1, farmers and traveling merchants are perfect stranger matched within their group .That is, farmers play with a new traveling merchant each period. In phase 2, I switch the traveling merchants' group and expunge history of their previous trades. In this phase, I use a random matching protocol to match farmers and traveling merchant within a group. This way subjects play the same game with new trade partners for 10 periods allowing us to investigate effect of experience on the choice of enforcement mechanism.

Results showed that in the efficient formal enforcement treatment, individuals with a collectivist orientation used the informal enforcement mechanism to conduct long-distance trade more often than their individualistic counterparts. That is, those with a collectivist orientation continually employ a reputation system despite the presence of efficient court system, significantly more frequently than their individualistic counterparts. This is consistent Greif's (2000) argument that *Maghribis* opted for a reputation system over a coexisting reliable court system. Interestingly, in the experience phase of the efficient formal enforcement treatment, farmers substituted the court for the reputation system to conduct

long-distance trade. The underlying cultural effect, however, compelled individuals with a collectivistic orientation to use the reputation system significantly more than their individualistic counterparts.

In both the perfect stranger matching phase and random matching phase of the inefficient formal enforcement treatment, the difference observed in the choice of enforcement mechanism across cultural orientations disappeared. Taken together, these findings suggest that those with individualistic orientation substituted the court system for the reputation system almost completely (when the court became efficient), while their collectivist counterpart kept using the reputation system.

All in all, these results indicate that collectivists have a systemic preference for the use of informal enforcement mechanisms. Therefore, even in the presence of an efficient and reliable formal enforcement mechanism, a reputation system never becomes obsolete.

3.1 Environment and Institution

To capture distinct institutional paths that different cultural orientations induce, I design a modified trust game (MTG) in which both informal and formal enforcement mechanisms are simultaneously available to conduct long-distance trade. Similar to the classic trust game [3], the MTG includes two players, namely farmer and traveling merchant. These roles are embedded in an interactive story with complete information.

The farmer (that is, FA in figure 1) always has access to the local safe option (that is, Local Trade in figure 1) which pays the reservation payoff A_0 . In the narration, this option is presented as a local market in which the farmer frequently sells her product for a certain price. The traveling merchant (that is, TM in figure 3.1) portrayed as a potentially better trade opportunity; however, he has the option of taking the farmer's share and run (that is, Steal in figure 3.1).

To engage in long-distance trade with a traveling merchant, farmer has access to both informal and formal enforcement mechanisms. A local knowledgeable elder who has reliable information about the past conducts of the traveling merchant (that is, Elder in figure 3.1) and offers his services for a price (that is, B in figure 3.1) is the proxy for informal enforcement mechanism. History is a binary signal in which a traveling merchant is labeled as "trustworthy" if he has never cheated or "untrustworthy" if he has cheated at least once. After obtaining the history, the farmer decides either to engage in long-distance trade (that is, Long-distance Trade via Elder in figure 3.1) or not (that is, Local Trade Elder in figure 3.1).

The proxy for the formal enforcement mechanism is a court (that is, CO in figure 3.1) that catches a cheating traveling merchant with the probability α. The farmer can register her transaction in the court ex-ante (that is, Long-distance Trade via Court in figure 3.1) for a price (that is, B in figure 3.1) to oversee the traveling merchants conduct ex-post. In case

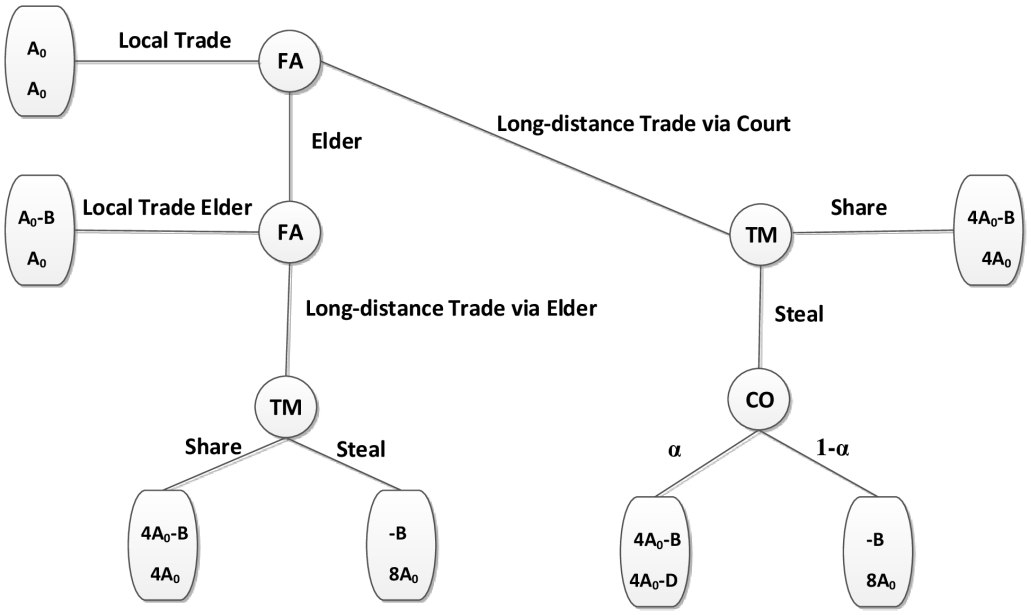

Figure 3.1: **The game tree**

the traveling merchant shares the profit, terms of contract are met and the court is inactive (that is, Share in figure 3.1). However, when the traveling merchant takes the money and run, two outcomes are possible. First, the court tries the case and with probability α finds the cheating traveling merchant guilty, returns the farmer's share to her and charges the traveling merchant a fee (that is, D in figure 3.1). Second, with probability of $1-\alpha$, the cheating traveling merchant escapes.

This game would be trivial, if the court power were high to the degree that sharing would be the optimal choice of traveling merchants. Simple backward induction reveals that seeking the counsel of the elder is never an equilibrium path. On the other hand, parameter variation could make employing the court either an optimal choice of farmers or not. Considering all these constraints, I design the treatments to either have efficient formal enforcement (henceforth, EFE) in which the SPNE for farmers is to engage in long-distance trade via the court system or inefficient formal enforcement (henceforth, IFE) in which the SPNE for farmers is to opt out of long-distance trade.

In order to cheating to be profitable for traveling merchants, I should always have $\alpha \leq \frac{3A_0}{3A_0+D}$. The court power that makes farmers indifferent toward long-distance trade is $\alpha = \frac{A_0+B}{3A_0}$. Therefore, in the EFE treatment $\frac{A_0+B}{3A_0} < \alpha < \frac{3A_0}{3A_0+D}$ and in the IFE treatment $\alpha < \frac{A_0+B}{3A_0}$. Setting A_0 equal to 8, B equal to 5, and D equal to 6, for traveling merchants to cheat, the court power should be less than 80%. For farmers, the admissible range of the court power in the IFE treatment is $\alpha < 54\%$ and in the EFE treatment is $54\% < \alpha < 80\%$.

3.2 Experimental Design and Procedures

This experiment includes four stages. In stage one (that is, sorting stage), using the triad task by Talhelm et.al (2014) the cultural propensities of subjects are measured through a cognitive test (for details, see the appendix A.1.2) . Following the sorting stage, in the second stage, subjects exclusively play one of the treatments. To control for risk attitude, in the third stage, after playing MTG, a risk-aversion test is conducted. In the final stage, subjects fill out a survey (for details, see the section 3.3.1).

A total of 4 sessions, which are equally divided between treatments, were conducted at Simon Fraser University. 16 subjects participate in each session. 8 subjects with the highest individualist/collectivist (I/C) score were assigned as farmers. The remaining 8 subjects were assigned as traveling merchants.

In the treatment stage, first, farmers and traveling merchants are divided into two groups of 8 containing 4 farmers and 4 traveling merchants each. I split the treatment stage into two separate phases. In the first phase, farmers are perfect stranger matched with traveling merchants in their group and play the MTG for 4 periods. In the second phase of the treatment, I switch traveling merchants' group so that farmers are matched with a new group of traveling merchants. Matching, in this phase, follows a random protocol in which farmers are randomly matched with a traveling merchant each period. The second phase lasts 10 periods. Furthermore, in the random matching phase, histories of previous trades of traveling merchants are expunged. That is, the elder does not carry over the trade records of the perfect matching phase into the random matching phase. My aim is to capture the behavioral differences in the choice of the enforcement mechanisms across subjects in the series of one-shot games (that is, the perfect stranger matching phase) and then, after subjects acquired the experience, test the persistency of such behavior in the random matching phase.

In the beginning of each phase, there is a history gathering period in which traveling merchants make a decision to share or cheat in a prearranged trade with a computerized farmer.[1] That is to be certain that the elder can signal the trustworthiness of a traveling merchant in the first period of each phase.

Farmers always have access to the local market which yields the payoff A_0 for both farmers and traveling merchants. Long-distance trade is readily available to the farmer; however, traveling merchants could take the farmer's share and run. To avoid this undesirable outcome, in case the farmer is willing to engage in long-distance trade, two institutional arrangements are available. An informal enforcement mechanism implemented through an omnipotent elder. The elder has the trade history of all traveling merchants at hand and provide farmers with her knowledge conditioning on receiving a fee. This

[1] In the narration, traveling merchant are being informed about the MTG and that they are engaged in a trade with a computerized farmer overseen by the elder.

dissemination of information about the history of past dealings of merchants is similar to what [32] described as an uncoordinated reputation system. According to standard assumptions about preferences, consulting the elder is never an equilibrium path since, in the absence of punishment, traveling merchants cheat. On the other hand, predictions on whether the farmer should engage in long-distance trade hinge on the court power.

In the IFE treatment, the court power is 50% which translates to the act of cheating being the SPNE action of traveling merchants. In this treatment, due to inefficiency of the formal enforcement, farmers' SPNE path is to sell the product in the local market. In the EFE treatment, the court's power is increased to 70% . Although cheating is still the SPNE action of traveling merchants in the EFE treatment, farmers' SPNE path is to engage in long-distance trade.

In the experiment, farmers' local safe option pays 8 experimental currency unit. The elder and/or court fee is equal to 5 experimental currency unit, and court punishment is equal to 6 experimental unit. The exchange rate is 15 experimental currency unit for 1 Canadian dollar. For the first phase of the treatment, subjects are paid the sum of their earnings; however, for the second phase of the treatment, one period is picked randomly and the earning of that period is added to subjects total earning.

Due to the probabilistic nature of the court in this experiment, attitudes toward risk might be of significance. To control for the effect of risk-aversion, following Holt and Laury (2002), a risk-aversion test is conducted after the MTG (for details, see the appendix A.1.3).

3.2.1 Hypotheses

Various scholars have argued about how people of various regions in the world and therefore of different cultural backgrounds chose to conduct long-distance trade [59, 27, 18, 19]. In particular, as presented in the introduction, Greif (2000, P.275) asserts that "the Jews in the Muslim world had a well-developed legal system... and its decisions were enforced... hence, it is misleading to consider the *Maghribis'* coalition as reflecting a lack of legal options". In a similar vein, I argue that in this laboratory experiment, in conducting long-distance trade, I should observe a positive correlation between collectivism and the choice of the informal enforcement mechanism when the court is reliable. Hence, I offer the following main hypothesis:

- *Hypothesis*: Considering the historical evidence, in the EFE treatment, collectivists will employ the reputation system more often than individualists.

This distinction in the choice of enforcement mechanism between individualist and collectivist farmers might be independent of the court power. That is to say, needless of any institutional trigger, cultural dispositions determine the choice of enforcement mechanisms to conduct long-distance trade. During the Middle Ages in Europe, however, clan

members traded together with the knowledge of other party's clan. That is, in the absence of a reliable third party enforcement, a reputation system was installed to minimize the probability of cheating [29]. To further probe the preferences over enforcement mechanisms, I vary the court power. In the IFE treatment the court is not reliable. Hence, the individualists may employ a reputation system to conduct trade. There is no clear indication in either theory or history that how the magnitude of employing informal enforcement mechanism relates to cultural dispositions to individualism and collectivism when the court system is unreliable. In case that collectivists' trade behavior persists in the IFE treatment, the distinction is independent of the court enforcement power. This is the indication of embeddedness of cultural characteristics in the choice of enforcement mechanism. In case that individualists use the reputation system either more often or at same level as collectivists in the IFE treatment, the distinction depends on the court enforcement power.

Is the choice of enforcement mechanism robust over time? To investigate the effect of experience on the choice of enforcement mechanism I add the random matching phase to the experiment. In this phase, farmers play the same game with a new group of traveling merchants. Hence, farmers have the opportunity to change their choice of enforcement mechanisms. According to the main hypothesis, if collectivist farmers have preferences for the reputation system in the perfect matching phase of the EFE treatment then the shift to the random matching phase and gaining experience should not effect their choice. If the choice of reputation system is, however, driven by inexperience or beliefs over reciprocation of traveling merchants then the shift to the random matching phase should give farmers the opportunity to switch to either the court system or opt out of long-distance trade.

3.3 Experimental Results

3.3.1 Individualism and Collectivism Measure

Figure 3.2 depicts the distribution of I/C score of the sample. The I/C score is normalized such that in the horizontal axis of figure 3.2, 0 represents the maximum collectivism while 1 represents the maximum individualism. The uneven distribution of individualism and collectivism in the sample supports the non-random role assignment in which farmers were selected from the tails of the I/C distribution. This is because the bulk of the subjects manifested collectivistic tendencies and a random role assignment would have resulted in a disproportionately low number of individualistic farmers.

In the triad task, as noted by [72], individualists tend to match the word pairs "categorically/analytically" while collectivist tend to match the word pairs "relationally/holistically" . [43] also found that Chinese Americans are more inclined to "organize objects" based on

their relationships more frequently than their European Americans counterparts (for alternative methods of measuring individualism and collectivism, see appendix A.2). To investigate the relationship between I/C scores and other potentially influential factors, a demographics questionnaire was administered after the experiment, which measured variables including gender, birthplace, ethnicity, and the number of years they have lived in Canada. The correlation between I/C score and risk preferences[2], gender, years spent living in Canada, ethnic background [3] and/or birthplace [4] are all insignificant (two-sided Spearman's rank correlation test $p - value = 0.8, 0.94, 0.41, 0.51, 0.42$ respectively).

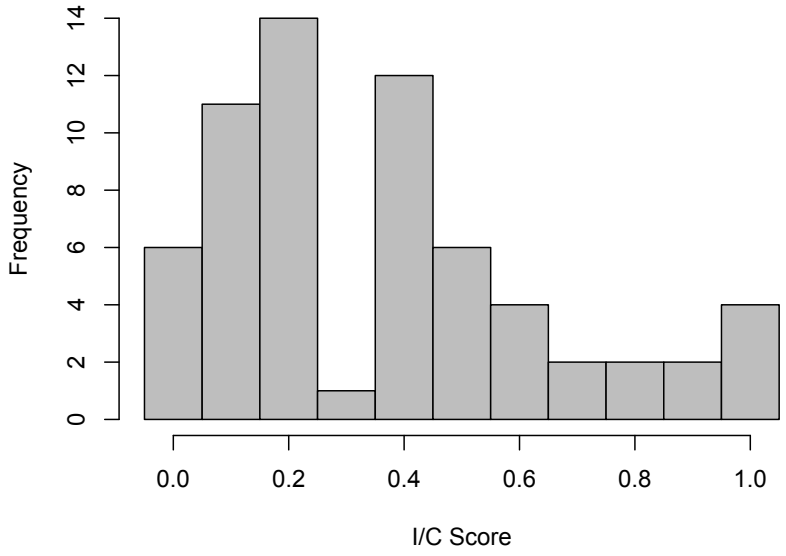

Figure 3.2: **Histogram of I/C scores.**

[2]To control for the effect of risk-aversion, I run a Holt and Laury (2002) risk aversion test. I normalized the risk score so 0 represents a subject with the maximum risk-aversion while 1 represents the opposite.

[3]To analyze the correlation between ethnicity and I/C score, I used the country specific individualism score obtained from The Hofstede Centre. The measure is a number in a 0 to 100 scale for each country. 0 represents maximum collectivism while 100 represents maximum individualism. The insignificant correlation between I/C score and ethnic background is mostly driven by the fact that India's Hofstede score is 48 which means Indians are very neutral. In contrast, within this sample, Indians were found to be highly collectivistic.

[4]It is important to note that ethnicity and birthplace could have varying relationships with I/C scores. This is because for much of the sample, heritage could be traced back to the Indian subcontinent (i.e. India, Pakistan and Bangladesh) or East Asia (i.e. China, South Korea, Taiwan, and Japan), despite the fact that they were born in Canada. This, in turn, creates a diverse environment which is especially amenable to the study of individualism and collectivism. To contrast the relationship between ethnicity vs. birthplace with I/C scores, a dummy variable for birthplace was also created. A value of 0 represented a measure of individualism less than 50, while a value of 1 indicated a measure of individualism greater than or equal to 50.

3.3.2 Choice of Enforcement Mechanism

In the SPNE of both treatments, farmers[5] should never employ the elder; however, whether to register their long-distance trades in the court depends on the treatment condition. That is, for the farmers, SPNE action in the IFE treatment is to opt out of long-distance trade completely while the SPNE of the EFE treatment would be to engage in long-distance trade via registering in the court all the time. In the perfect stranger matching phase of the experiment, altogether, farmers employ the elder in 21/64 instances in the IFE and in 13/64 instances in the EFE. Moreover, in the experience phase, farmers employ the elder in 35/160 instances in the IFE treatment and in 9/160 instances in the EFE treatment. Taken together, in the perfect stranger matching phase, I observe 37/64 instances of registering in court in the IFE treatment and 42/64 instances in EFE. The corresponding numbers in the experience phase are 81/160 and 141/160 respectively.

	PSM phase		Experience phase	
Farmers' decision	*EFE*	*IFE*	*EFE*	*IFE*
No trade	9	6	10	44
The court	42	37	141	81
The elder	13	21	9	35
Total	64	64	160	160

Table 3.1: **Summary of frequency of farmers' choice**

While Pearson's chi-squared test cannot reject the null hypothesis that there is no significant difference in the distribution of farmers' choice across treatments in the perfect stranger matching phase ($p - value = 0.24$), it strongly rejects that the farmers' choice follow the same distribution across treatments in the experience phase ($p - value = 0.00$). Note that this analysis only considers the distribution of farmers' choice and does not account for the effect of the experience. The regression analysis in section 3.3.2 addresses this confound.

The Perfect Stranger Matching Phase

The following analysis is focused on the perfect stranger matching (henceforth, PSM) phase of the experiment. Figure 3.3 depicts a stack plot of farmers' choice across treatments and I/C scores in the PSM phase. The horizontal axis is the normalized I/C score where 0 represents the maximum collectivism while 1 represents the maximum individualism. Note that there is a finite set of possible I/C scores and that this representation exhausts the set. Each bar is divided into three categories representing the choices available to the

[5]Behavior of traveling merchants, however not the focus of this paper, might be of interest. For details see appendix B.2.3.

farmer: no trade, the court, and the elder. Furthermore, the vertical axis represents the relative frequency of each category per farmers' I/C score. The lack of employment of the elder by subjects with higher individualistic tendencies in the EFE panel of this figure indicates that I/C score is correlated with the choice of enforcement. To test the significance of this correlation, I examine the difference in the choice of enforcement mechanisms among farmers who opted to engage in long-distance trade. However, focusing solely on the instances in which farmers opted to engage in long-distance trade could potentially, due to selection bias, distort the estimations. That is, selection bias may arise due to the correlation between the choice of opting out of long-distance trade and the choice of the enforcement mechanism. Notably, in the PSM phase, the no trade category constituted 12% of the farmers' choice. To avoid empirical inconsistency in the estimations, in the investigation of correlation between the choice of the enforcement mechanism and cultural dispositions to individualism and collectivism, I employ a probit model with sample selection[6][78].

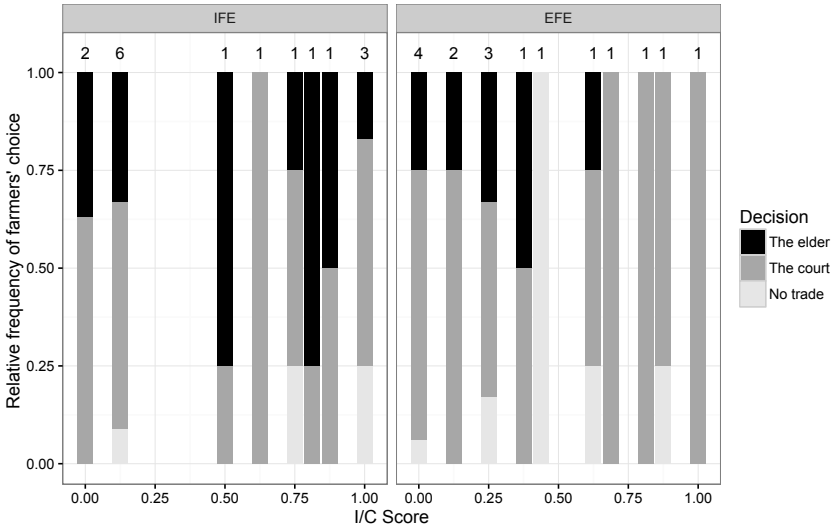

Figure 3.3: **The stack plot of the relative frequency of the farmers' choice and I/C score, by treatment in the PSM phase.** Numbers on the top of each bar represent the number of farmers with that specific I/C score.

The bottom panel of table 3.2 shows the choice of farmers to engage in long-distance trade regardless of the choice of enforcement mechanism. In this panel, I ran a probit model where the dependent variable is a dummy variable representing intended trade [7], with 0 representing the decision to opt out of long-distance trade (that is, subjects who choose Local Trade in figure 3.1) and 1 indicating the decision to engage in long-distance

[6]Multinomial logistic regressions are also possible. Results are, however, similar to the Heckman probit model (for details, see appendix B.2.2).

[7]Farmers who have the intention to trade pay either the information cost to the elder or the registration cost to the court. Note that the choice of the enforcement mechanism is only observed when farmers had the intention to trade. Therefore, to get unbiased estimations, use of the probit model with sample selection is warranted.

trade. I controlled for the I/C score, treatment, a female dummy, risk [8]and the interaction between the I/C score and risk. Furthermore, in the column 2, due [33] finding that, in certain contexts, individualists and collectivists react differently to being cheated, I added the dummy Cheat_{t-1} and its interaction with the I/C score. This dummy takes value of 1 when a farmer is being cheated at time $t-1$ and 0 otherwise.

In both specifications of intended trade in the PSM phase (that is, columns 1 and 2 in the bottom panel of table 3.2), risk is the only significant factor[9]. The direction of this correlation, however, is opposite to what decision theory predicts. That is, risk-loving farmers tend to drop out of long-distance more often than risk-averse farmers in the EFE treatment [10]. One possible explanation for such a behavior could be boredom aversion of risk-loving farmers, however; future research may shed a light on this matter.

Columns 1 and 2 of in the top panel of table 3.2 report a probit model with sample selection in which the sample is limited to subjects who intended to engage in long-distance trade via either employing the elder (that is, subjects who choose Elder in figure 3.1) or registering in the court (that is, subjects who choose Court in figure 3.1). That is, this analysis is limited to subjects who paid cost B. With this sample selection, 12% of data in the PSM phase is excluded . In this panel, the dependent variable is the dummy that takes the value of 1 if the contract is registered in the court and the value of 0 if the elder was employed. Hence, it reports the results of the model for the choice of enforcement mechanism. The I/C score coefficient is positively and significantly correlated with the frequency with which long-distance trade is registered in the court in the EFE treatment ($p-values = 0.05$ and 0.05). Since the sample is limited to the farmers who intended to trade, this also means that collectivists employ the elder/reputation system to conduct long-distance trade more often than individualists in the same treatment.

> *Finding 1:* Collectivists employ the elder/reputation system more often than individualists in the EFE treatment.

To investigate that whether the distinction in the choice of the enforcement mechanism extends over the IFE treatment, I control for the summation of the coefficients of the I/C score and the interaction between I/C score and IFE, I find that this summation to be insignificant (Wald test $p-value = 0.33$). This indicates that individualists do not employ the court system more often than collectivists in the IFE treatment.

[8]Risk attitude might be of significance since for example a risk-loving farmer may prefer to engage in long-distance trade in the IFE treatment or an extremely risk-averse farmer may refrain from long-distance trade in the EFE treatment.

[9]Although, in the extant literature, risk is mostly not a significant factor in the senders/farmers' decision [20, 40], there is some evidence in favour of a potential correlation between risk aversion and trust [70, 45].

[10]A Wald test was conducted and the result indicated that the null hypothesis that the summation of coefficients of *Risk* and $Risk \times IFE$ is zero could not be rejected ($p-value = 0.66$). This, in turn, indicates that the effect of risk aversion on the farmers' trade choice is limited to the EFE treatment.

	(1) PSM	(2) PSM	(3) Experience	(4) Experience
Court				
I/C Score	1.426*	1.424*	0.752***	0.645**
	(0.733)	(0.734)	(0.227)	(0.259)
IFE	-0.811	-0.812	-0.622	-0.434
	(0.935)	(0.935)	(0.924)	(0.864)
IFE × I/C Score	-1.080	-1.074	-0.786***	-0.653**
	(0.815)	(0.815)	(0.248)	(0.316)
Risk	-0.118	-0.118	0.014	0.019
	(0.168)	(0.167)	(0.108)	(0.109)
IFE × Risk	0.164	0.165	-0.055	-0.103
	(0.203)	(0.202)	(0.200)	(0.180)
Intercept	0.940	0.938	1.131*	1.197*
	(0.865)	(0.865)	(0.636)	(0.614)
Intended Trade				
I/C Score	-0.272	-0.323	5.737**	4.868*
	(0.430)	(0.446)	(2.645)	(2.772)
IFE	-0.132	-0.102	-2.034	-2.432
	(0.790)	(0.758)	(1.981)	(1.930)
IFE × I/C Score	-0.496	-0.604	-5.600**	-5.075*
	(0.655)	(0.673)	(2.789)	(2.911)
Risk	-0.140**	-0.143**	-0.006	-0.047
	(0.070)	(0.065)	(0.452)	(0.437)
IFE × Risk	0.088	0.085	0.620	0.697
	(0.132)	(0.125)	(0.518)	(0.491)
Female	-0.408	-0.399	0.575	0.495
	(0.393)	(0.377)	(0.464)	(0.461)
Cheat_{t-1}		0.029		-0.612***
		(0.866)		(0.226)
Cheat_{t-1} × I/C Score		0.272		1.470**
		(0.869)		(0.725)
Trade_{PSM}			0.984***	0.936***
			(0.296)	(0.272)
Intercept	2.160***	2.165***	-2.538	-1.891
	(0.349)	(0.349)	(1.952)	(2.038)
Observations	128	128	320	320
Uncensored observations	113	113	266	266

Clustered standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 3.2: **Regression analysis of the enforcement mechanism selection**

Finding 2: The distinction in the choice of the enforcement mechanism between collectivists and individualists does not persist in the IFE treatment. Hence, individualists' preferences over the choice of the court/formal enforcement mechanism depends on the court efficiency.

The Random Matching/Experience Phase

In this phase, I switch the traveling merchants between the groups and give them a clean slate. Both farmers and traveling merchants know that they are participating in the same game but with new trade partners. Now, I control for the effect of experience by investigating whether the difference in the choice of enforcement mechanism persists over time. Figure 3.4 depicts a stack plot of the farmers' choice across treatments and I/C scores in the experience phase. To reiterate, the horizontal axis is the normalized I/C score where 0 represents the maximum collectivism while 1 represents the maximum individualism. The vertical axis represents the relative frequency of each category per farmers' I/C score. Each bar is divided into three categories representing the farmers' choice. In this phase of the experiment farmers are randomly matched with traveling merchants for 10 periods.

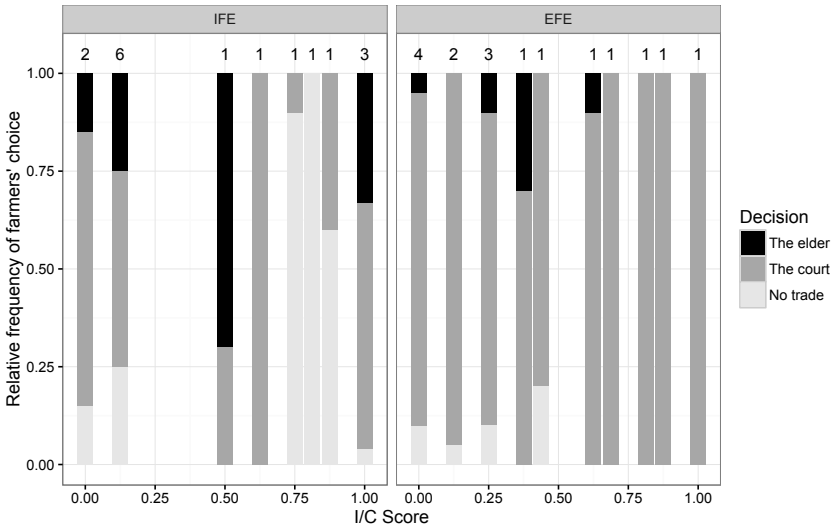

Figure 3.4: **The stack plot of the relative frequency of the farmers' choice and I/C score, by treatment in the experience phase.** Numbers on the top of each bar represent the number of farmers with that specific I/C score.

Similar to the previous section, I began by analyzing the intention to trade. To control for the past trade behavior, I added the variable $Trade_{PSM}$ which was operationalized as the occasions that a farmer did engage in long-distance trade in the PSM phase[11]. Column 3 in the bottom panel of table 3.2 indicates the I/C score has a positive significant correlation with the intended trade in the EFE treatment. The summation of the coefficient of I/C score and the interaction between I/C score and the IFE treatment is insignificant (wild test $p - value = 0.69$) indicating that there is no significant correlation between I/C score and the intention to trade in the IFE treatment.

[11] I have not reported some of the specifications in which I, also, controlled for the number of times a farmer was being cheated and the total profit per farmer in the PSM phase. In all of the omitted specifications, once controlled for the $Trade_{PSM}$, neither of aforementioned controls were significant.

By the inclusion of $Cheat_{t-1}$ and its interaction with I/C score in column 4, the effect of I/C score weakened yet it is remained statistically significant. While, understandably, being cheated has a negative significant effect on the long-distance trade, the dynamic effect is similar to what [33] reported. Specifically, the more individualistic farmers get, the smaller the probability becomes of them dropping out of long-distance trade after being cheated. Furthermore, the positive significant effect of $Trade_{PSM}$ suggests that farmers who tend to trade more often in PSM phase do the same in the experience phase[12].

Columns 3 and 4, in the top panel of table 3.2, report the results of selection model in the experience phase. Due to the selection condition in which I only consider those farmers who intended to trade, 17% of data was excluded in the experience phase. Results indicate that individualist farmers positively and significantly registered in the court more often than collectivists farmers in the EFE treatment. That is, individualists' pattern of employing formal enforcement mechanism in the EFE treatment is robust and unchanged with respect to experience. This effect, similar to intended trade, was insignificant in the IFE treatment. That is, the summation of I/C score and the interaction between I/C sore and IFE is insignificant (Wald test $p - value = 0.96$).

Due to the increase in the usage of the court system from 64% in the PSM phase to 88% in the experience phase, the distribution of farmers' choice significantly changed in the EFE treatment (Pearson's chi-squared test $p - value = 0.00$). That is, experience leads to the substitution of the elder/reputation system by the court/formal enforcement mechanism when the court is effective[13]. The positive and significant correlation between the I/C score and the choice of court system in columns 3 and 4 of table 3.2, however, suggests that the underlying individualism and collectivism cultural effect creates a disparity in the choice of the enforcement mechanism. That is, collectivists choose the elder/reputation system to conduct long-distance more often than individualists even when both the formal enforcement mechanism works efficiently and the experience has taken place.

> *Finding 3:* Although experience induces use of the court/formal enforcement mechanism by both individualist and collectivists subjects in the EFE treatment, the underlying cultural effect persists over time.

The persistence of usage of informal enforcement mechanisms such as reputation systems suggests that the choice of enforcement mechanism is directly linked the cultural dispositions to individualism and collectivisms. That is similar to what [28, 29] describes,

[12]It is noteworthy that the effect of cultural background on the intended trade is robust with respect to exclusion of the $Trade_{PSM}$.

[13]In the IFE treatment, opting out of long-distance trade increases from 9% in the PSM phase to 28% in the experience phase. Hence, experience induces higher rate of dropping out of long-distance trade. Taken together, as mentioned in the section 3.3.2, the varying effect of experience leads to the rejection of the null hypothesis that there is no significant difference in the distribution of farmers' choice across treatments in the experience phase (Pearson's chi-squared test $p - value = 0.00$).

Maghribi collectivists were employing a reputation system to conduct long-distance trade despite of having had access to a reliable court system.

3.4 Discussion and Conclusion

This paper offers experimental evidence on the effect of individualistic/collectivistic cultural dispositions on the choice of enforcement mechanism to conduct trade. This experiment was designed such that access to both a formal and an informal enforcement mechanism was simultaneously available.

Results suggest that regardless of experience, those with an individualistic disposition employ the court system (i.e. formal enforcement) more often than their collectivist counterparts, when the court system is effective. This, in turn, indicates that those with collectivist leanings tend to use the informal enforcement mechanism even in the presence of an effective formal enforcement mechanism. I also found that experience induced use of formal enforcement mechanism in the efficient formal enforcement treatment. Nonetheless, the entrenched underlying cultural effect still compelled subjects high on the collectivism spectrum to use the informal enforcement mechanism significantly more often than those high on individualism spectrum. In both the perfect stranger matching phase and the experience phase of the inefficient formal enforcement treatment, individualistic and collectivist groups did not significantly differ on their choice of enforcement mechanism or in their decision to engage in long-distance trade.

The implications of having a systematic preference for enforcement mechanisms based on cultural orientation are vast. From a historical point of view, evidence from this experiment is consistent with the idea that cultural predispositions are important for institutional choice similar to account that *Maghribi* traders who lived in a collectivistic community selected a reputation system over a court system during the early Middle Ages. With respect to policy prescription, it suggests that merely importing the legal apparatus would not encourage the transition from impersonal to personal trade. That said, many questions with respect to cultural orientation and enforcement mechanisms remain unanswered. For example, I assumed the simultaneous presence of formal and informal enforcement mechanisms in the experimental environment such that it was not possible to examine the relationship of cultural disposition to the endogenous development of enforcement mechanisms. Exploring this relationship may be a fruitful avenue for the future research.

Chapter 4

Testamentary Power and Welfare: Islamic Inheritance Law versus Primogeniture

> "Landed wealth with administrative functions enabled the western European nobility to resist royal absolutism in its most extreme forms."
>
> [66, p. 177]

From a historical perspective, it is widely accepted that placing constraints on the confiscatory power of an extractive, rent-seeking sovereign is one of the cornerstones of economic development. In Western Europe, the nobles and merchants successfully spearheaded a movement to place such constraints on their government, and as a result gained legally enforceable property rights [63, 79]. In contrast, their Middle Eastern counterparts failed to mobilize themselves to negotiate such rights [69, 5]. The nobles' bargaining power came from their accumulated landed wealth across generations [12]. Without the land that they inherited from preceding generations, the nobles may not have been able to establish the bargaining power necessary to successfully gain legally enforceable property rights. Therefore, it can be argued that the state's inheritance laws, which allow for intergenerational landed wealth transfer, played a crucial role in shaping these conflict dynamics.

The question of why Western Europe prospered while the Middle East stagnated, has long intrigued many scholars. To answer this question, however, many researchers focused on Western Europe [63] or solely sought the roots of this divergence in the late Middle Ages [1]. There have been some comparative studies of the institutional differences between the two regions in the early Middle ages. For example, [28] investigated how Mediterranean merchants of Islamic versus Christian regions conducted long-distance trade. More recently, [5] probed the effect of military structures on the negotiations between the sovereign and elites. They argue that in the Islamic regions, due to imported military

slaves, sovereigns did not need to rely on the elites to finance their war efforts and therefore the elites were unsuccessful in their efforts to create enforceable property rights. From the Islamic perspective, [54, 55, 57] argues that Islamic institutions such as the Islamic variant of trust (that is, waqf) created "evolutionary bottlenecks" that hindered the economic development of the Middle East[1]. The aim of this paper is to probe the impact of inheritance laws on economic development of Western Europe as compared to the Middle East. Specifically, this paper seeks to explain how differences in the practice of inheritance law affected the conflict between nobles and sovereign and how outcomes of this process affected the welfare of nobles and peasants.

A brief overview of inheritance laws practiced in Western Europe versus the Middle East is warranted here. At the time of these conflicts, some Western European countries practiced primogeniture: a system of inheritance law that favors the firstborn son. In contrast, throughout the Islamic world, an inheritance law derived from the Qur'an was practiced wherein the inheritance is shared by all heirs. Utilizing a general equilibrium model, I examined the effects of these differing laws on the outcome of tax negotiations between nobles and the sovereigns. Specifically, I examined the impact of absolute primogeniture [15, 73] in which all the land and family title is bestowed to the firstborn son and compared it to the effects of Islamic inheritance law according to which Muslims have to divide their wealth among heirs[2].

I constructed a model with three types of agents: the sovereign, landlords/nobles, and landless/peasants. Nobles own firms which, in turn, produce food. Production of food requires three inputs namely labor, capital, and land. Peasants provide the labor force required in the production of food. Furthermore, I assume that capital is equivalent to the land improvement. That is, a part of hired labor is dedicated to maintaining and improving the quality of the land while the rest of the labor force participates in the production of food. In the model, nobles are homogeneous and each one inherits an equal parcel of land that is used in the production of food.

The sovereign extracts a portion of the nobles' production through tax[3]. There is a conflict over the determination of the tax rate between the extractive sovereign and nobles. The conflict resolution process is as follows: each individual noble puts forth an effort to oppose the sovereign. There is a cost attached to such an effort. Furthermore, the tax rate is an inverse function of the total effort of all nobles [4]. This model would predict that individual equilibrium effort level would decrease as the number of nobles increases. That is because, considering a constant amount of land with equal shares, each noble owns a

[1]Kuran also mentioned Islamic inheritance law as one of the bottlenecks. He, however, emphasizes how it prevented long lasting economic partnership and capital accumulation. In this paper, I mainly focus on the effect of the Islamic inheritance law in the conflict between nobles and the sovereign.

[2]The share of male offspring is twice as much as female offspring. Nevertheless, in the model, I assume equal shares since the land/wealth division is pivotal to this paper.

[3]The sovereign consumes the extracted portion.

[4]For a detailed theoretical approach to this type of conflict resolution see [26].

smaller parcel of land, making the marginal benefit of opposition smaller. In other words, from the point of view of the nobles, reductions in the tax rate amount to a public good, such that an increase in the number of nobles creates a free rider problem. Without strong opposition, it becomes easier for the sovereign to arbitrarily tax the nobles and peasants.

Consistent with the proposed model, the results of this study showed that under Islamic inheritance laws, equilibrium tax rates were higher as compared to equilibrium tax rates under primogeniture. This finding is also consistent with the idea that identification of multiple heirs (i.e. landlords), leads to a weakening of bargaining positions.

The effect of an increase in the population of peasants on an individual peasant is negative but only if the number of peasants is over a certain threshold. The change in the total welfare of peasants[5], however, depends on the elasticity of wages with respect to the number of peasants in the economy. In the case of an elastic function (that is, the absolute value of this elasticity to be bigger than 1), there is an inverse relationship between the population of peasants and their total welfare.

The extractive sovereign's welfare increases as the population of nobles and peasants increases. As the number of nobles increases, the total effort exerted by nobles to oppose the sovereign falls. Therefore, the sovereign could extract a bigger portion of the production via higher tax rates. The total production of the economy has a direct relationship with the number of peasants. Therefore, as the number of peasants increases, the sovereign's portion of the economic pie increases as well.

As for the nobles, their welfare is an inverse function of their number. That is, assuming a fixed quantity of total land in the economy with equal shares, as the number of nobles increases the marginal benefit of opposing the sovereign decreases. This leads to less total resistance by the nobles (that is, a free rider problem) and eventually higher tax rates. Increases in the number of peasants, however, leads to lower wages for peasants and therefore higher benefit for the nobles.

I also examined the effect of technological progress on the agents' welfare. I modeled capital as the labor required to maintain/improve the land. Hence, technological progress manifested as land maintenance/improvement requires a smaller portion of hired labor. Technological advances lead to a lower equilibrium wage which unambiguously harms peasants. On the other hand, lower wages increase the labor demand and therefore induce a higher equilibrium production level that, in turn, favors the sovereign's and nobles' welfare.

Under Islamic inheritance laws each landlord possessed a progressively smaller piece of land as land got divided across generations. This of course creates a problem wherein the landlords are forever placed at a disadvantage with respect to bargaining negotiations with the sovereign. I argue that Islamic scholars, recognizing this bargaining problem, invented the binding contract of "waqf". In this type of contract, a living person, regardless

[5]Total welfare of peasants defined as the number of peasants multiplied by wage.

of his or her religion, dedicates the income stream generated by an immovable asset to the provision of a social service in perpetuity (Kuran 2001). The founder of the waqf can appoint one of their heirs as the manager with access to a portion of the income stream as a salary. While charitable giving is one of the most celebrated good deeds in the Qur'an, waqf, as a tool of wealth redistribution, is never mentioned there. In the 10th century, Islamic scholars reinterpreted Qur'anic verses commanding believers to be charitable in order to invent the sacred contract of waqf. Since other means of charitable giving already existed in the Islamic world, the critical question is "what is the value added of having this new institution?" The major difference between waqf and other means of charitable giving is the indivisible and forever inalienable sacred asset created by the waqf contract. Such a contract prevents the division of lands (that is, immovable assets in Islamic jurisprudence's jargon) among heirs and therefore effectively circumvents Islamic inheritance law.

A waqf asset is sacred and never to be divided. Hence, waqf technically creates a primogeniture-like environment with both lower tax rates and redistribution of food from nobles to peasants.

4.1 The model

4.1.1 Production function

There are three types of agents in this model, namely the sovereign, nobles, and peasants. The number of people in each category is , 1, N, and M respectively. Unlike the peasants, nobles own land. Nobles also own firms that produce food. A representative firm produces food y employing inputs; capital k , labor l and land z . The amount of the total land is constant and normalized to 1. Further, nobles are identical and each own an equal parcel of land $z = \frac{1}{N}$. There is no land market and nobles inherit their land.The input market is perfectly competitive and production occurs according to Cobb-Douglas technology:

$$y = f(k, l, z) = k^{\alpha} l^{\beta} z^{1-\alpha-\beta} \quad where \;\; \alpha > 0, \beta > 0, \alpha + \beta < 1 \tag{4.1}$$

The total capital is the summation of inherited capital $\underline{k}$ and the new capital ($\Delta k \geq 0$) added by the noble (that is, $k = \underline{k} + \Delta k$).

Nobles maximize the following profit function:

$$\max_{k,l} (1-\tau) k^{\alpha} l^{\beta} z^{1-\alpha-\beta} - r(k - \underline{k}) - wl \tag{4.2}$$

Where $\tau \in [0, 1]$ is the tax rate on food production (for details on the determination of the tax rate see section 4.1.2). Price of food is normalized to 1. w represents the wage per unit

of labor[6] and r represents the rent per unit of capital. First order conditions are as follows[7]:

$$(1-\tau)\alpha k^{\alpha-1} l^{\beta} z^{1-\alpha-\beta} - r = 0 \tag{4.3}$$

$$(1-\tau)\beta k^{\alpha} l^{\beta-1} z^{1-\alpha-\beta} - w = 0 \tag{4.4}$$

Dividing equation 4.4 by equation 4.3, I have:

$$\frac{k}{l} = \frac{\alpha w}{\beta r} \tag{4.5}$$

I define the total demand for capital and labor to be $K = Nk$ and $L = Nl$ from equation 4.5 and therefore I have:

$$\frac{K}{L} = \frac{\alpha w}{\beta r} \tag{4.6}$$

4.1.2 Determination of the tax rate

Tax collection has played a crucial role in the survival of sovereigns throughout history. In a comparative study between the Ottoman empire and France, [2] suggest that the two empires employed essentially similar methods of tax collection up until the end of 17^{th} century. Therefore, historical evidence supports the assumption that societies under Islamic and Christian rule employed a similar taxation method. In this model, the sovereign put forth an effort to extract a portion of the food production of the nobles. This entails a conflict over the tax rate between nobles and the sovereign. The sovereign's effort in this conflict is normalized to 1. The total effort E of nobles in resisting taxes is the summation of their individual effort e_i, $E = \sum_{i=1}^{i=N} e_i$. I assume the conflict resolution function is of the following form:

$$\tau(E) = \frac{1}{1+E} \tag{4.7}$$

The above function follows the seminal paper of conflict resolution by [37]. It is important to note that if nobles do not put any effort into the conflict at all, the sovereign will take everything (that is, $\tau(0) = 1$). In case nobles put the same effort as the sovereign (that is, $E = 1$) then the tax rate will be 50% ($\tau(1) = \frac{1}{2}$). Finally, as the effort of nobles increases the tax rate goes to zero (that is, $\tau(\infty) = 0$).

[6] Although serfdom was commonplace in feudalistic era, even serfs could keep a part of their revenue.
[7] Assuming interior solution or $\Delta k > 0$.

Therefore, for an individual noble choosing his own effort level, maximization changes to the following:

$$\max_{k,l,e}(1-\tau(E))k^{\alpha}l^{\beta}z^{1-\alpha-\beta}-r(k-\underline{k})-wl-ce \tag{4.8}$$

Where c is the marginal cost of effort to oppose the sovereign. While the first order conditions for capital and labor are the same as in 4.3 and 4.4, the first order condition for effort is as follows:

$$(\frac{1}{(1+E)^2})k^{\alpha}l^{\beta}z^{1-\alpha-\beta}-c=0 \tag{4.9}$$

Since nobles are identical, in the symmetric Nash equilibrium, each individual noble exert the same effort level e^*:

$$e^*=\frac{1}{N}\left[\left(\frac{k^{\alpha}l^{\beta}z^{1-\alpha-\beta}}{c}\right)^{\frac{1}{2}}-1\right] \tag{4.10}$$

And therefore, the equilibrium total effort E^*:

$$E^*=\left(\frac{k^{\alpha}l^{\beta}z^{1-\alpha-\beta}}{c}\right)^{\frac{1}{2}}-1 \tag{4.11}$$

The necessary assumption is that the value of production measured in food is bigger than the marginal cost of effort (that is, $k^{\alpha}l^{\beta}z^{1-\alpha-\beta}>c$).

4.1.3 Capital and labor market

Soil improvement was a crucial factor in the production of food and the "agricultural revolution" during the early Middle Ages [80]. Hence, this model assumes that the capital is the equivalent of land improvement. This process has a technological parameter γ, which is the labor required to create a unit of capital/land improvement. In this case, the cost per unit of new capital is $r=\gamma w$. This changes equations 4.5 and 4.6 to the following:

$$\frac{k}{l}=\frac{K}{L}=\frac{\alpha}{\beta\gamma} \tag{4.12}$$

The interpretation of this assumption is that nobles hire some labor to build the additional capital stock while the rest of the labor is directed toward producing food.

The supply of the labor is constant and equal to M. The demand has two separate parts: one consists of a labor force that was hired to build the new capital $\gamma\Delta K$ and the other consists of a labor force that directly produces the food L. Hence, the labor market clearing condition is as follows:

$$\gamma\Delta K+L=M \tag{4.13}$$

Having $K = \underline{K} + \Delta K$ and factoring out L, I have:

$$L(\frac{\gamma K}{L} + 1) = M + \gamma \underline{\mathrm{K}} \tag{4.14}$$

In the equilibrium, using the equation 4.12, I have:

$$L^*(\frac{\alpha}{\beta} + 1) = M + \gamma \underline{\mathrm{K}} \tag{4.15}$$

$$L^* = \frac{\beta(M + \gamma \underline{\mathrm{K}})}{\alpha + \beta} \tag{4.16}$$

Using equations 4.12 and 4.16, the optimal level of the total capital is:

$$K^* = \frac{\alpha(M + \gamma \underline{\mathrm{K}})}{\gamma(\alpha + \beta)} \tag{4.17}$$

As for the optimal individual effort level of each landlord, knowing that $z = \frac{1}{N}$, I can rewrite equation 4.10 as follows:

$$e^* = \frac{1}{N}\left[\left(\frac{(Nk)^\alpha (Nl)^\beta}{Nc}\right)^{\frac{1}{2}} - 1\right] \tag{4.18}$$

Considering that $L = lN$ and $K = kN$, I have:

$$e^* = \frac{1}{N}\left[\left(\frac{K^\alpha L^\beta}{Nc}\right)^{\frac{1}{2}} - 1\right] = \frac{1}{N}\left[\left(\frac{(\frac{K}{L})^\alpha L^{\alpha+\beta}}{Nc}\right)^{\frac{1}{2}} - 1\right] \tag{4.19}$$

Plugging back $\frac{K}{L}$ and L^* from equations 4.12 and 4.16, I have:

$$e^* = \frac{1}{N}\left[\left(\frac{\alpha}{\beta\gamma}\right)^{\alpha/2}\left(\frac{\beta(M + \gamma \underline{\mathrm{K}})}{\alpha + \beta}\right)^{\frac{\alpha+\beta}{2}} (Nc)^{-\frac{1}{2}} - 1\right] \tag{4.20}$$

And therefore the total effort of nobles E^* is:

$$E^* = \left(\frac{\alpha}{\beta\gamma}\right)^{\alpha/2}\left(\frac{\beta(M + \gamma \underline{\mathrm{K}})}{\alpha + \beta}\right)^{\frac{\alpha+\beta}{2}} (Nc)^{-\frac{1}{2}} - 1 \tag{4.21}$$

4.1.4 Comparative statics

To reiterate, the key difference in the inheritance law practiced in Western Europe versus Middle East is that under primogeniture the nobles' land remain intact in the hand of their firstborn son while under Islamic inheritance law the land was divided among heirs.

In the context of this model, under primogeniture number of nobles is constant and equal to N^P. Under Islamic inheritance law, however, number of landlords $N^I$is increasing over time. So, if I assume both an identical initial population structure and a constant

population growth rate, at any cross section of time, number of nobles under Islamic inheritance law is more than number of nobles under primogeniture (that is, $N^I > N^p$).

Following the same argument, the number of peasants is higher under primogeniture due to the downward mobility associated with this system (that is, $M^P > M^I$).

To find the effect of having these different inheritance laws in place, I compare the optimal level of wage, labor, and nobles effort under each practice.

The wage

Rewriting equation 4.4, the wage needed to support a given level of labor demand is as follows:

$$w = (1 - \tau(E))\beta(\frac{K}{L})^{\alpha} L^{\alpha+\beta-1} \tag{4.22}$$

It is important to note that the above equation has an economically relevant solution (for details see appendix C.1). Plugging back the optimal total effort of nobles E^* from the equation 4.21 into the equation 4.7, I also have:

$$\tau^* = \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}} \left(\frac{\beta(M + \gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}} (Nc)^{\frac{1}{2}} \tag{4.23}$$

Therefore, in the equilibrium, using equations 4.12, 4.16, and 4.23, I have:

$$w^* = \left(1 - \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}} \left(\frac{\beta(M + \gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}} (Nc)^{\frac{1}{2}}\right) \beta \left(\frac{\alpha}{\beta\gamma}\right)^{\alpha} \left(\frac{\beta(M + \gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta-1} \tag{4.24}$$

To make the notation less bearing, I use reduced forms where $\phi_1 \equiv \beta\left(\frac{\alpha}{\beta\gamma}\right)^{\alpha}$ and $\phi_2 \equiv \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}} (NC)^{\frac{1}{2}}$ [8]. Taking partial derivative of wage with respect to M, I have:

$$\frac{\partial w^*}{\partial M} = w^*_M = \left(\frac{\beta(\alpha+\beta-1)}{\alpha+\beta}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta-2} - \left(\frac{\beta(\alpha+\beta-2)}{2(\alpha+\beta)}\right)\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}-2}\phi_2\right)\phi_1 \tag{4.25}$$

Notice that $\alpha + \beta - 1 < 0$. Hence, there are two contradicting forces here. The direct effect of an increase in M that manifests as a rightward shift in the supply of labor work decreases the equilibrium wage. Through higher total effort by nobles, however, the equilibrium wage should indirectly increase. That is, as an increase in the number of peasants and therefore food supply occurs, nobles put more effort into resisting the sovereign. Hence, tax falls, labor demand increases, and eventually wage level rises. Under the following condition, the abovementioned partial derivative is negative:

[8] Both ϕ_1 and ϕ_2 are positive.

$$M > \frac{\alpha+\beta}{\beta}\left(\left(\frac{\alpha+\beta-2}{2(\alpha+\beta-1)}\right)\phi_2\right)^{\frac{2}{\alpha+\beta}} - \gamma\underline{K} \tag{4.26}$$

If I assume that $\psi = 1-\alpha-\beta$ (ψ is the output elasticity of land.), then I have; $\left(\frac{\alpha+\beta-2}{2(\alpha+\beta-1)}\right) \equiv (\frac{1}{2})(\frac{\psi+1}{\psi})$ where $\psi \in (0,1)$. As $\psi \to 0$ the term $(\frac{\psi+1}{\psi}) \to \infty$ and as $\psi \to 1$ the term $(\frac{\psi+1}{\psi}) \to 2$. Therefore, $(\frac{1}{2})(\frac{\psi+1}{\psi}) \in (1,\infty)$. Having this, I can rewrite equation 4.26 as:

$$M > \frac{1-\psi}{\beta}\left(\left(\frac{\psi+1}{2\psi}\right)\phi_2\right)^{\frac{2}{1-\psi}} - \gamma\underline{K} \tag{4.27}$$

The above equation indicates that there should be enough peasants in the economy to make food production a viable option. This is in accordance with [14] findings in which he argues that there is an inverse relationship between the population and wage "in the Malthusian era".

The only channel through which the number of nobles could affect the equilibrium wage is the tax rate. This effect could be calculated from the following partial derivative:

$$\frac{\partial w^*}{\partial N} = w^*_N = \left(-\frac{1}{2}N^{-\frac{1}{2}}\left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}}c^{\frac{1}{2}}\right)\phi_1\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta-1} < 0 \tag{4.28}$$

As the number of nobles increases, each individual noble owns a smaller parcel of land, thereby leading to a lower marginal benefit for resisting the sovereign. Lower effort by nobles (see section 4.1.4 for details), in turn, leads to higher tax rates, lower labor demand, and a lower equilibrium wage.

Nobles' effort

Now the question is how the change in the number of peasants M affects the effort of nobles E or what is the sign of $E_M = \frac{\partial E}{\partial M}$. To determine the sign of the above partial derivative I employ equation 4.21.

$$\frac{\partial E}{\partial M} = (\frac{\alpha}{\beta\gamma})^{\frac{\alpha}{2}}(\frac{\beta}{2})\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}-1}(Nc)^{-\frac{1}{2}} > 0 \tag{4.29}$$

Consequently, I have $E_M = \frac{\partial E}{\partial M} > 0$. The interpretation is very intuitive. As the number of peasants grows, wage drops, and hired labor grows, and nobles make more profit. Hence, they put a higher level of effort to oppose the sovereign and therefore protect their profit. As for the effect of a change in the number of nobles on the the total effort, again, employing equation 4.21 I have:

$$\frac{\partial E}{\partial N} = (-\frac{1}{2})N^{-\frac{3}{2}}c^{-\frac{1}{2}}\left(\frac{\alpha}{\beta\gamma}\right)^{\alpha/2}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}} < 0 \tag{4.30}$$

From the nobles point of view, opposing the sovereign to reduce taxes is a public good. Hence, an increase in the number of nobles leads to a free rider problem.

The labor

To analyze the effect of change in both the number of peasants and nobles on the equilibrium labor, I go back to FOCs. From equation 4.4, I have:

$$w = (1-\tau)\beta(\frac{K}{L})^{\alpha}L^{\alpha+\beta-1} \tag{4.31}$$

Substituting from equation 4.12 and moving L to the left hand side, I have:

$$L = \left((1-\tau)\frac{\beta}{w}(\frac{\alpha}{\beta\gamma})^{\alpha}\right)^{\frac{1}{1-\alpha-\beta}} \tag{4.32}$$

Considering equation 4.32, I investigate the effect of the change in the supply of labor M on the equilibrium labor. This effect works through two specific channels namely tax rate τ and wage w. The direct effect of a change in supply of labor on the equilibrium labor is through changes in the equilibrium wage. Mathematically speaking, $L\big(w(M),\tau(M)\big)$ and therefore the partial derivative with respect to M is $L_M = \frac{\partial L}{\partial M} = \frac{\partial L}{\partial \tau}\frac{\partial \tau}{\partial M} + \frac{\partial L}{\partial w}\frac{\partial w}{\partial M}$.

Using equation 4.23, I investigate how a change in the labor supply M affect the equilibrium tax rate τ.

$$\frac{\partial \tau}{\partial M} = \left(\frac{-\beta}{2}\right)\left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}-1}(Nc)^{\frac{1}{2}} < 0 \tag{4.33}$$

Considering that $\frac{\partial L}{\partial \tau} < 0$ the total effect of the tax rate channel on the equilibrium labor is positive or $\frac{\partial L}{\partial \tau}\frac{\partial \tau}{\partial M} > 0$. As for the wage channel I have the following:

$$\frac{\partial L}{\partial w} = (-\frac{1}{1-\alpha-\beta})w^{(-\frac{1}{1-\alpha-\beta})-1}\left((1-\tau)\beta(\frac{\alpha}{\beta\gamma})^{\alpha}\right)^{\frac{1}{1-\alpha-\beta}} < 0 \tag{4.34}$$

Assuming the population of peasants is large enough or the condition of the inequality 4.26 is satisfied, then the following holds: $\frac{\partial w}{\partial M} < 0$ and therefore $L_M = \frac{\partial L}{\partial M} > 0$. The interpretation is simple, as M or supply of the labor increases, nobles put forth more effort to oppose the sovereign, the equilibrium tax rate decreases, the equilibrium wage drops, and eventually the equilibrium labor increases.

4.1.5 Welfare

In this section, I investigate the effect of change in the population structure (that is, M and N in the model) on the welfare of agents namely the sovereign, peasants, and nobles.

Peasants

For an individual peasant who earns the wage w^* in the equilibrium, the direction of welfare change would be the same as w^*. In the condition that inequality 4.26 holds, wage is a decreasing function of the number of peasants. The question, however, is, how the total welfare of peasants η^L would react to a change in the number of peasants:

$$\eta^L = wM \tag{4.35}$$

Taking the derivative with respect to M, I have:

$$\frac{d\eta^L}{dM} = \eta^L_M = \frac{\partial w^*}{\partial M} M + w^* \tag{4.36}$$

$$\frac{d\eta^L}{dM} = \eta^L_M = w^* \big[\frac{\partial w^*}{\partial M} \frac{M}{w^*} + 1 \big] \tag{4.37}$$

For the total welfare of peasants to be positively affected by the increase in the population of peasants, the absolute value of the below elasticity should be less than 1:

$$\Big| \frac{\partial w^*}{\partial M} \frac{M}{w^*} \Big| < 1 \tag{4.38}$$

What about the effect of the number of nobles? The following equation shows that the partial derivative of peasants' total welfare with respect to the number of nobles is unambiguously negative.

$$\frac{\partial \eta^L}{\partial N} = \eta^L_M = \frac{\partial w^*}{\partial N} M < 0 \tag{4.39}$$

The details are as follows:

$$\frac{\partial \eta^L}{\partial N} = \eta^L_N = \Bigg(-\frac{1}{2} N^{-\frac{1}{2}} \bigg(\frac{\alpha}{\beta\gamma} \bigg)^{-\frac{\alpha}{2}} \bigg(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta} \bigg)^{-\frac{\alpha+\beta}{2}} c^{\frac{1}{2}} \Bigg) \phi_1 \bigg(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta} \bigg)^{\alpha+\beta-1} M < 0 \tag{4.40}$$

That is, as the number of nobles increases, the total effort of nobles to oppose the sovereign decreases, the equilibrium wage decreases, and therefore the total welfare of peasants decreases.

The sovereign

The sovereign, in this model, taxes the food production of nobles. Therefore, his total welfare is as follows:

$$\eta^S = N\tau k^\alpha l^\beta z^{1-\alpha-\beta} \tag{4.41}$$

Plugging back $z = \frac{1}{N}$ and rewriting the equation 4.41, I have:

$$\eta^S = \tau K^\alpha L^\beta = \tau(\frac{K}{L})^\alpha L^{\alpha+\beta} \tag{4.42}$$

Plugging back from equations 4.12, 4.16, and 4.23, I have:

$$\eta^S = \left(\frac{\alpha}{\beta\gamma}\right)^{\frac{\alpha}{2}} \left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}} (Nc)^{\frac{1}{2}} \tag{4.43}$$

As for the partial derivatives, I have:

$$\frac{\partial\eta^S}{\partial M} = \eta^S_M = (\frac{\beta}{2})\phi_2^{-1}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}-1} > 0 \tag{4.44}$$

$$\frac{\partial\eta^S}{\partial N} = \eta^S_N = \frac{1}{2}N^{-\frac{1}{2}}\left(\frac{\alpha}{\beta\gamma}\right)^{\frac{\alpha}{2}} \left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}} c^{\frac{1}{2}} > 0 \tag{4.45}$$

Clearly, as the number of either peasants or nobles increases, the sovereign's welfare increases as well.

Nobles

For an individual noble the profit function η^n is as follows:

$$\eta^n = (1-\tau)k^\alpha l^\beta z^{1-\alpha-\beta} - r(k-\underline{k}) - wl - ce \tag{4.46}$$

Plugging back $z = \frac{1}{N}$, I have:

$$\eta^n = N^{-1}(1-\tau)(Nk)^\alpha(Nl)^\beta - r(k-\underline{k}) - wl - ce \tag{4.47}$$

The total profit of nobles η^N is:

$$\eta^N = N\eta^n = (1-\tau)K^\alpha L^\beta - r(K-\underline{K}) - wL - cE \tag{4.48}$$

Rewriting equation 4.48, I have:

$$\eta^N = (1-\tau)(\frac{K}{L})^\alpha L^{\alpha+\beta} - w\gamma(K-\underline{K}) - wL - cE \tag{4.49}$$

Plugging back from equation 4.4, I have:

$$\eta^N = \frac{1}{\beta} wL - w\gamma(K - \underline{K}) - wL - cE = (\frac{1}{\beta} - 1)wL - w\gamma(K - \underline{K}) - cE \tag{4.50}$$

Through manipulation of equation 4.50, I have:

$$\eta^N = (\frac{\psi}{\beta})wL + w\gamma\underline{K} - cE \tag{4.51}$$

In general, as the number of peasants M grows the equilibrium wage decreases. This, in turn, leads to a higher level of profit η^N. Due to the increase in efforts to oppose the sovereign and therefore keep the bigger portion of the profit, the effect of an increase in the number of peasant would be partially offset. However, according to the Envelope theorem, the indirect effects cancel each other out, and therefore I have:

$$\frac{\partial \eta^N}{\partial M} = \eta^N_M = (\frac{\psi}{\beta})\frac{\partial wL}{\partial M} + \gamma\underline{K}\frac{\partial w}{\partial M} - c\frac{\partial E}{\partial M} > 0 \tag{4.52}$$

Considering equation 4.51, as the number of nobles increases, the profit directly decreases due to $\frac{\partial wL}{\partial N} < 0$ [9] and $\frac{\partial w}{\partial N} < 0$. This effect is partially offset by the lower level of total effort that occurs due to the free rider problem. That is, as the number of nobles increases, the total effort exerted by nobles to oppose the sovereign decreases. However, due to the Envelope theorem, I have :

$$\frac{\partial \eta^N}{\partial N} = \eta^N_N = (\frac{\psi}{\beta})\frac{\partial wL}{\partial N} + \gamma\underline{K}\frac{\partial w}{\partial N} - c\frac{\partial E}{\partial N} < 0 \tag{4.53}$$

Notice that if I divide both side of equation 4.51, I have the welfare for an individual noble:

$$\eta^n = (\frac{\psi}{\beta})wl + w\gamma\underline{k} - ce \tag{4.54}$$

According to the Envelope theorem the total effect of an increase in number of nobles on an individual noble is equal to the partial effect. Therefore, similar to equation 4.53, I have:

$$\frac{\partial \eta^n}{\partial N} = \eta^n_N = (\frac{\psi}{\beta})\frac{\partial wl}{\partial N} + \gamma\underline{k}\frac{\partial w}{\partial N} - c\frac{\partial e}{\partial N} < 0 \tag{4.55}$$

---

[9] $wL = \left(1 - \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}}(Nc)^{\frac{1}{2}}\right)\beta\left(\frac{\alpha}{\beta\gamma}\right)^{\alpha}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta}$

The partial derivative with respect to N is: $\frac{\partial wL}{\partial N} = \left(-\frac{1}{2}N^{-\frac{1}{2}}\left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2}}\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{-\frac{\alpha+\beta}{2}}c^{\frac{1}{2}}\right)\phi_1\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta} < 0$

The partial derivative with respect to M is: $\frac{\partial wL}{\partial M} = \left(\beta\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\alpha+\beta-1} - (\frac{\beta}{2})\left(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta}\right)^{\frac{\alpha+\beta}{2}-1}\phi_2\Big)\phi_1$

The above equation is always positive when $\frac{\partial w}{\partial M} < 0$.

A change in an individual noble's welfare follows the same direction as the total welfare of the nobles. Hence, an increase in the number of peasants M and a decrease in the number of nobles N will increase individual nobles' welfare.

Considering the structure of the population under each inheritance system, there are more nobles/landlords under Islamic inheritance law compared to primogeniture (that is, $N^I > N^p$). In the case that both types of societies started with the same population and population growth rate, the number of peasants under Islamic inheritance law is lower than the number of peasants under primogeniture (that is, $M^P > M^I$) due to the downward mobility under primogeniture.

There are fewer nobles and more peasants in a society under primogeniture compared to a society under Islamic inheritance law. More peasants, according to equation 4.52, leads to higher equilibrium profit for nobles. Furthermore, fewer nobles, according to equation 4.53, increases nobles' profit. Taken together, primogeniture unambiguously increases the welfare of nobles.

Although the sovereign benefits from a higher number of peasants in the economy, this effect is offset by the nobles' effort to resist higher tax rates. The overall effect on the sovereign's welfare depends on the magnitude of change in the number of both peasants and nobles. While an individual peasant, due to the lower equilibrium wage, suffers from the primogeniture, the change in the total welfare of peasants depends on the elasticity of wage with respect to the number of peasants. The total welfare of peasants would fall in case that the absolute value of the aforementioned elasticity is bigger than 1.

In a society under primogeniture compared to a society under Islamic inheritance law there are less nobles. Hence, in the conflict between nobles and the sovereign, primogeniture created stronger constraints on the sovereign's tax behavior.

4.2 The Muslims' solution: Waqf

I argue that Islamic jurists, recognizing the handicap that the division of land creates in the conflict between the sovereign and nobles, invented a new form of contract, namely waqf, to keep the lands undivided. In general, "a waqf is an unincorporated trust established under Islamic law by a living man or woman for the provision of a designated social service in perpetuity. Its activities are financed by revenue-bearing [immovable] assets that have been rendered forever inalienable (Kuran, 2001, p.842)." As noted before, the founder of a waqf can appoint anybody as the manager of the waqf. "Family waqf"[10] is the case in which either the manager or the residual claimant of the waqf is a family member of the founder. Otherwise, when neither the manager nor the residual claimant of the waqf is a

[10] According to [56] , in the 17^{th} Ottoman Empire, around 21 percent of registered waqf cases were family waqf.

family member, waqf is considered to be a "charitable" one. In both cases, however, the waqf asset will remain undivided under the supervision of a manager.

It has been estimated that, after the First World War, toward the end of the Ottoman Empire, around 75% of its farming land were owqaf [53]. Another estimate indicates that, at the end of 18^{th} century, the income stream generated by owqaf was around 33% of the Ottoman Empire's total revenue [81]. Thus, the importance of waqf is evident in the economic cycle of the Ottoman Empire, as the superpower of the Islamic world.

It is important to note that the word waqf is not mentioned in the Qur'an. The invention of the waqf contract hinged on the Islamic scholars' reinterpretation of Qur'anic verses emphasizing charitable giving. As [53] claims, most of the verses that served as the basis for waqf could also "be interpreted as instructing believers to be charitable or to pay the Islamic taxes known as zakat." This indicates that the invention of waqf contracts is not a charitable driven cause as the other tools for charitable giving already existed.

Considering the confiscatory appetite of extractive sovereigns coupled with the bargaining problem that Islamic inheritance law creates, Islamic jurists had to come up with a solution which guarantees property rights and lower taxes. In the conflict between nobles and the sovereign, the free rider problem worsens as the number of nobles increases. Therefore, the very first mission of Islamic jurists was to somehow avoid the Islamic inheritance law. Through waqf contracts, Islamic jurists successfully created sacred assets that are forever indivisible.

Another example of a waqf contract being used to sidestep Islamic laws is a cash waqf. In the early centuries of Islam, owqaf [11] were limited to immovable assets. To circumvent the interest ban, Islamic jurists invented the cash waqf under which a person could pledge a certain amount of cash to be loaned with a predetermined interest rate. Of the income stream generated via the interest both a public service would have been provided and a salary would have been paid to a manager. Lending money through a cash waqf was ubiquitous in the 17^{th} century Ottoman Empire to the point that more than a third of waqf registries in the Istanbul's court involved cases of cash waqf [56]. In this paper, however, I focus on the waqf of immovable assets since it is essential to the conflict process.

A family waqf effectively circumvents the Islamic inheritance law and keeps the land intact in the hands of one of the heirs. In turn, this creates a primogeniture-like environment with income redistribution from landlords to peasants. Historically, owqaf were the source of public good provision in Islamic countries. Hence, a sovereign had two main reasons to not confiscate a waqf. First, the redistribution of income through provision of public goods would keep the populous content, and therefore lower the probability of rebellion. Second, confiscating a waqf was to go against the religious authority. Religious authority, as [68] argues, provided protection against probable rebellions. Therefore, in the long-run, undermining religious legitimacy would harm the sovereign.

[11] Plural of waqf

Under waqf portion θ of landed wealth is redistributed among peasants. That is, the nobles problem changes to the following:

$$\max_{k,l}(1-\theta)(1-\tau)k^{\alpha}l^{\beta}z^{1-\alpha-\beta} - r(k-\underline{k}) - wl - ce \tag{4.56}$$

This only creates a steady stream of income from nobles to peasants which, in turn, improves the welfare of peasants under Islamic law.

4.2.1 Waqf rigidities

Waqf creates an environment in which not only the lower tax rate is achieved, but also the welfare gap between nobles and peasants is arguably smaller. As noted before, a waqf dedicates an asset to a specific cause in perpetuity.In today's dynamic world, as time goes by, new technologies may come to effect. In this model, the positive technology shocks are interpreted as decrease in γ.

As in section 4.3, "in the Malthusian era", needing a smaller labor force for the land improvement (that is, technological progress) favored the sovereign and nobles while putting peasants at a disadvantage. Hence, in such a context, waqf rigidities worked in favor of peasants.

Examples of rigidities are abundant. Searching through Kuran's 17^{th} century Istanbul' s court documents[12], I found many cases in which either the founder or the manager of the waqf filed for annulment of the waqf contract. Without exception, Istanbul's courts ruled to uphold the original stipulations of the founder stating that a waqf contract cannot be annulled.

In one of the cases adjudicated by the Istanbul court in 1605, a woman named *Gulhamr Hatun* filed for annulment of the house that she had given away as part of a waqf contract. The following is an excerpt from the court case:

> *"Gulhamr Hatun endowed a house in the Muyetzade neighborhood on condition that it would be used by her as long as she lives... After the completion of the registration procedure, Gulhamr Hatun claims, based on the views of an Islamic jurist, that the waqf deed is invalid and should be annulled. The waqf's mutawali counters that, based on views of other Islamic jurists, the waqf is valid. In conclusion, agreeing with the mutawali, the court decides that the waqf deed cannot be annulled."*
>
> [56, p. 264].

In the same vein, another waqf founder unsuccessfully sued the mutawali that he had appointed to annul the waqf contract. The following is from the court case:

[12] These documents were published by [56].

"El-Hac Bilal, a resident of Gatala, endows his house in the Breketzade neighborhood on the following condition. He himself will use the house for the rest of his life, to be followed by his wife Zamane and his children. After the end of his line, his emancipated slaves and their children will use the house ... After the recording of these stipulations, Bilal claims, involving the views of certain Islamic jurists, that the waqf deed is invalid and sues the mutawali that he himself has appointed to the waqf. The mutawali counters that the waqf is valid, based on views of other Islamic jurists. In conclusion, agreeing with mutawali, the court decides that the waqf deed cannot be annulled. "

[56, p. 190].

The abovementioned cases are indicative of the pattern of inflexible rulings in which the stipulation of a waqf founder was never to be altered, even if the founder herself wishes to change the waqf contract. In the section below, I investigate the effect of technological progress combined with waqf rigidities on the economic agents' welfare.

4.3 Technological progress

From a historical perspective, how technological progress affected the welfare of peasants, nobles, and the sovereign is a critical question. To provide an answer, I first examined the effect of technological progress on the equilibrium wage, labor, and nobles' effort. Notice that in the context of this model, technological progress manifests as lower level of γ.

In this model, technological progress translates to needing fewer laborers for land improvement or smaller γ. Intuitively, technological progress should lower labor demand and equilibrium wage. Therefore, the effect of technological progress on the equilibrium wage is negative (that is, $\frac{\partial w}{\partial \gamma} > 0$).

Here the important question is how technological progress affects the equilibrium tax rate. To answer this, I take partial deravative from equation 4.23 with respects to γ.

$$\frac{\partial \tau}{\partial \gamma} = \left((\frac{\alpha}{2}) \gamma^{\frac{\alpha}{2}-1} (\frac{\alpha}{\beta})^{-\frac{\alpha}{2}} \big(\frac{\beta(M+\gamma \underline{K})}{\alpha+\beta}\big)^{-\frac{\alpha+\beta}{2}} - (\frac{\beta \underline{K}}{2}) \big(\frac{\alpha}{\beta\gamma}\big)^{\frac{-\alpha}{2}} \big(\frac{\beta(M+\gamma \underline{K})}{\alpha+\beta}\big)^{-\frac{\alpha+\beta}{2}-1} \right) (NC)^{\frac{1}{2}} \tag{4.57}$$

To determine the sign of the above partial derivative, I only need to focus on the term in the parenthesis. This term could be simplified to the following:

$$\frac{K}{L} > \frac{\underline{K}}{L} \tag{4.58}$$

Assuming interior solution or $\Delta K > 0$, I always have $\frac{\partial \tau}{\partial \gamma} > 0$. Now, the effect of technological progress on the equilibrium L is:

$$\frac{\partial L}{\partial \gamma} = \frac{\partial L}{\partial \tau} \frac{\partial \tau}{\partial \gamma} + \frac{\partial L}{\partial w} \frac{\partial w}{\partial \gamma} \tag{4.59}$$

From section 4.1.4, I know that the partial derivatives of the labor with respect to both the equilibrium wage and equilibrium tax rate are negative. Taken together with the positive relationship of both the tax rate and wage with the technological progress, I have, $\frac{\partial L}{\partial \gamma} < 0$.

From equation 4.7 I know that there is an opposite relationship between nobles level of total effort and the equilibrium tax rate. Hence, I have $\frac{\partial E}{\partial \gamma} < 0$.

4.3.1 Welfare

Peasants

For an individual peasant, welfare is the wage that he receives. Therefore, changes in the welfare of an individual peasant with respect to γ is equal to changes in the equilibrium wage. The total welfare of peasants follows equation 4.35:

$$\frac{\partial \eta^L}{\partial \gamma} = \eta^L_\gamma = \frac{\partial w^*}{\partial \gamma} M > 0 \tag{4.60}$$

To reiterate, technological progress manifests as smaller γ. Hence, it leads to a lower level of individual and total welfare for peasants.

The sovereign

To determine the effect of the technological progress on the sovereign's welfare, I take a partial derivative of equation 4.43 with respect to γ.

$$\frac{\partial \eta^S}{\partial \gamma} = \left((\frac{\alpha}{2})(-\frac{\alpha}{\beta\gamma^2})(\frac{\alpha}{\beta\gamma})^{\frac{\alpha}{2}-1}(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta})^{\frac{\alpha+\beta}{2}} + (\frac{\alpha+\beta}{2})(\frac{\beta\underline{K}}{\alpha+\beta})(\frac{\alpha}{\beta\gamma})^{\frac{\alpha}{2}}(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta})^{\frac{\alpha+\beta}{2}-1} \right)(NC)^{\frac{1}{2}} \tag{4.61}$$

The sign of equation 4.61 depends on the term in the parenthesis. I will show that this term is always negative and therefore the above partial derivative is always negative:

$$(\frac{\alpha}{2})(\frac{\alpha}{\beta\gamma^2})(\frac{\alpha}{\beta\gamma})^{\frac{\alpha}{2}-1}(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta})^{\frac{\alpha+\beta}{2}} > (\frac{\alpha+\beta}{2})(\frac{\beta\underline{K}}{\alpha+\beta})(\frac{\alpha}{\beta\gamma})^{\frac{\alpha}{2}}(\frac{\beta(M+\gamma\underline{K})}{\alpha+\beta})^{\frac{\alpha+\beta}{2}-1} \tag{4.62}$$

After some simplifications, I have:

$$(\frac{\alpha}{\beta\gamma}) > \frac{\underline{K}}{L} \tag{4.63}$$

Substituting from equation 4.12, I have:

$$K > \underline{K} \tag{4.64}$$

Assuming interior solution for nobles problem or $\Delta K > 0$, the above equation always holds and therefore $\frac{\partial \eta^S}{\partial \gamma} = \eta^S_\gamma < 0$. Hence, technological progress increases the sovereign's welfare.

Nobles

The direct effect of technological progress on the nobles' profit is through lower equilibrium wages, and therefore higher level of equilibrium labor. This effect is partially offset by the higher effort that nobles put forth to oppose the sovereign. According to the Envelope theorem, the total effect of technological change would be equal to the direct effect of technological progress. Hence, in this model, technological progress favors nobles.

Interestingly, technological progress increases the welfare of nobles and the sovereign while it harms the peasants. Although during " the Malthusian era" waqf rigidities worked in favor of the peasants, outside of this era it may have reduced the adaptation rate of new technologies contributing to the future divergence between Western Europe and Middle East.

4.4 Discussion and Conclusion

Having enforceable property rights that prevent arbitrary taxation is the bedrock of economic development. Such rights, in a historical context, are commonly the outcome of the conflicts between the extractive sovereign and nobles. In this paper, I investigated the effect of Islamic inheritance law and primogeniture on the economic paths that they create in the Middle East and Western Europe. In the presence of an extractive sovereign, I found that the Islamic inheritance law generates an environment in which nobles are unable to effectively oppose the sovereign's tax behavior. This is due to the lower effort exerted by the nobles. On the other hand, under primogeniture, nobles, due to their smaller number and therefore better coordination, successfully opposed the sovereign and achieved a lower tax rate. This, in turn, led to a higher wealth level for nobles compared to the level produced under Islamic inheritance law. Furthermore, increases in the number of peasants favor both nobles and the sovereign. An individual peasant is, however, worse off.

I argued that Islamic jurists, recognizing the problem created by land division, invented the waqf contract through the reinterpretation of Qur'anic verses. This contract renders income-generating immovable assets such as farming lands forever indivisible and inalienable. Also, a waqf contract mandates that the income stream generated by the waqf asset must be used towards a public service. In this way, waqf contracts circumvent the Islamic inheritance law that mandates the sharing of inheritance, and redistributed wealth from nobles to peasants by mandating public service. Study of this institution and how it affects

the conflict between the extractive sovereign and nobles may prove to be a fruitful future research avenue.

Chapter 5

Conclusion

In the first chapter, using a laboratory experiment, we studied the effect of cultural dispositions to individualism and collectivism on the tendency to seek trade opportunity. Our findings suggest that individualists tend to be more willing to trade than collectivists. Two channels through which collectivism dampens long-distance trade are the external cost imposed on local merchants and the stereotyping of traveling merchants. In particular, we find that individualist farmers are less deterred from trade by cheating than are collectivist farmers. The formal enforcement mechanism, however, mitigates this difference. The imposed external cost is not strong enough to cause a significant behavioral difference in the first period of any treatment; however, upon eliminating the role of local merchant in the NoLM treatment, the behavioral difference after being cheated observed in the NE, WE, and SE treatments, disappears. This indicates the importance of context to the collectivist farmers. The norm and belief elicitation tasks also established that individualists perceive traveling merchants to be more cooperative than collectivists. Our findings suggest that cultural dispositions take precedent to exogenous enforcement mechanisms' power in the farmers' decision-making process. That is, cultural dispositions have clear economic consequences by influencing the probability of engaging in long-distance trade.

The implications of having a higher tendency to engage in the local trade are vast. In particular, such a tendency structures the economy to be more regionalized and therefore dampens the probability to engage in long-distance trades. Furthermore, this potentially leads to not only loss of a mutually beneficial outcome for trade parties but also hinders the development of the institutions required for impersonal trades.

The second chapter offers experimental evidence on the effect of individualistic and collectivistic cultural dispositions on the choice of enforcement mechanism to conduct trade. This experiment was designed such that access to both a formal and an informal enforcement mechanism was simultaneously available. Results suggest that regardless of experience, those with an individualistic disposition employ the court system (i.e. formal enforcement) more often than their collectivist counterparts, when the court system

is effective. This, in turn, indicates that those with collectivist leanings tend to use the informal enforcement mechanism even in the presence of an effective formal enforcement mechanism. I also found that experience induced use of formal enforcement mechanism in the efficient formal enforcement treatment. Nonetheless, the entrenched underlying cultural effect still compelled subjects high on the collectivism spectrum to use the informal enforcement mechanism significantly more often than those high on individualism spectrum. In both the perfect stranger matching phase and the experience phase of the inefficient formal enforcement treatment, individualistic and collectivist groups did not significantly differ on their choice of enforcement mechanism or in their decision to engage in long-distance trade.

Having a systemic preferences for reputation system over a court system changes the institutional trajectory of a collectivistic society. That is, the court system, as it seen in some Middle Eastern countries even today, remain in a primitive form in which one person plays the role of judge, prosecutor, and jury. Taken together with higher tendency to trade at the local level, Middle Eastern countries have been put in an economic disadvantage compared to their Western European counterparts.

Having enforceable property rights that prevent arbitrary taxation is the bedrock of economic development. Such rights, in a historical context, are commonly the outcome of the conflicts between the extractive sovereign and nobles. In the third chapter, I investigated the effect of Islamic inheritance law and primogeniture on the economic paths that they create in the Middle East and Western Europe. In the presence of an extractive sovereign, I found that the Islamic inheritance law generates an environment in which nobles are unable to effectively oppose the sovereign's tax behavior. This is due to the lower effort exerted by the nobles. On the other hand, under primogeniture, nobles, due to their smaller number and therefore better coordination, successfully opposed the sovereign and achieved a lower tax rate. This, in turn, led to a higher wealth level for nobles compared to the level produced under Islamic inheritance law. Furthermore, increases in the number of peasants favor both nobles and the sovereign. An individual peasant is, however, worse off. I argued that Islamic jurists, recognizing the problem created by land division, invented the waqf contract through the reinterpretation of Qur'anic verses. This contract renders income-generating immovable assets such as farming lands forever indivisible and inalienable. Also, a waqf contract mandates that the income stream generated by the waqf asset must be used towards a public service. In this way, waqf contracts circumvent the Islamic inheritance law that mandates the sharing of inheritance, and redistributed wealth from nobles to peasants by mandating public service.

Overall, the collectivist tendency to engage in local trades using a reputation system as the enforcement mechanism restrained trade relationships at the personal level. That is, not only some opportunities for mutually beneficial trade were lost but also the formation of a strong third party enforcement was laggard. Moreover, waqf rigidities, outside

of " the Malthusian era", had reduced the adaptation rate of new technologies. Taken together waqf rigidities along with the collectivist tendencies to trade at the personal level contributed to the future divergence between Western Europe and Middle East.

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Appendix A

Individualism, Collectivism, and Trade

A.1 Experiment Instructions

This part presents what subjects see on their screens during the experiment. Information would be given to the subjects in the sequential manner based on their decisions. Subjects will assume their roles (i.e. farmer, local merchant, or traveling merchant) in the beginning of the experiment according to the triad task results. The only difference between WE and SE treatments is the court enforcement power. Therefore, here we only give the WE narration.

A.1.1 The Narrations

The common stage

Farmers' narration (period 1) You are a farmer in a small county. You have to work hard around the clock to harvest your products. You can do two things with your harvest. First, you can give your harvest to a local merchant who sells some of it for you. This is a long-standing relationship, and each time you deal with the local merchant, both of you make 8ECU.

Second, you can keep your harvest and try to sell everything yourself. In this case both you and the local merchant payoff are equal to 4ECU.

You can either keep your harvest or let a local merchant sell it in the local market.

Keep your harvest *Trade with local merchant*

Local merchants' narration (period 1) You are a merchant who sells goods in a local market. You have a long-standing relationship with a farmer who often gives you his harvest to sell at the market. When the farmer gives you the harvest, each of you gets 8ECU.

If farmer decides to not deal with you then you have to live off of your garden and both of you get 4ECU.

Ready to go on

Travelling merchants' narration (period 1) You are a travelling merchant accustomed to dealing with different people and markets. To make your living selling merchandise, you have to travel all year long. Farmers work hard around the clock to collect their harvest. If you travel to a village and find a farmer who is willing to trade you his harvest, you both can possibly gain from trade. But if you do not find a farmer or if the farmer is unwilling to trade with you, then you will have no opportunity to trade. Your payoff will be 4ECU.

Ready to go on

Traveling merchants' narration (Period 2 to 4) You traveled this period but you were unsuccessful in finding a farmer to trade with.

Ready to go on

Farmers' narration (periods 2 to 4) You have two options. Keeping your harvest for yourself, this pays you 4ECU, or giving your products to a local merchant who sells them and pays you 8ECU.

Keep your harvest *Trade with local merchant*

The NE treatment

Farmers' narration (periods 5) A travelling merchant has arrived in your county. Travelling merchants know different people and foreign markets. They travel all year long selling merchandise to the highest bidder. This merchant has offered to take your harvest and sell it in a foreign market.

After selling the harvest for 32ECU, the travelling merchant could either share the profit with you or take all the money and run.

If the travelling merchant shares, you both get 16ECU. But if the travelling merchant takes the money and runs, then you will get 0ECU (the travelling merchant gets 32ECU).

However, if you give your products to the travelling merchant, you can't also trade with the local merchant. The local merchant will only get 4ECU since you are no longer their trade partner.

All your previous options are still available to you. You can keep your harvest for yourself, trade the harvest with the local merchant or let the travelling merchant take the products to the foreign market.

Keep your harvest *Trade with local merchant* *Trade with the traveling merchant*

Farmers' narration (periods 6 to 8) You still can keep your harvest for yourself or to trade it to the local merchant. If you keep the harvest for yourself then you will get 4ECU. If you trade with the local merchant you get 8ECU.

A new travelling merchant has approached you offering the same potential as the previous travelling merchant. This merchant can sell your harvest for a profit of 32ECU in a foreign market.

If you decide to trade with the new travelling merchant and he/she shares the profits you both get 16ECU. But if he/she takes the money and runs, you get 0 (i.e. travelling merchant gets 32ECU).

Remember, if you give your products to the travelling merchant, you can't also trade with the local merchant. The local merchant will only get 4ECU since you are no longer their trade partner. You have three options.

Keep your harvest *Trade with local merchant* *Trade with the traveling merchant*

Travelling merchants' narration (periods 5 to 8) when traded with You have arrived in a small county and found a farmer who is willing to let you sell the harvest on the foreign market. You can sell this harvest for 32ECU.

You successfully sold the harvest, and you can either split the profit and each one of you gets 16 ECU or you can take all the money and run.

If you take the money you will get 32ECU and the farmer will get 0ECU.

Split the profit *Take the money and run*

Traveling merchants' narration (periods 5 to 8) when not traded with You traveled this period but the farmer of this village decides to not trade with you. You will travel to another village to find another farmer to trade with.

OK

Local Merchant's narration (Period 5) You are a merchant who sells goods in a local market. You have a long-standing relationship with a farmer who often gives you his harvest to sell at the market. When the farmer gives you the harvest, each of you gets 8ECU.

The Farmer has three options: 1) Keep the product, 2) give the product to you, 3) give the product to a traveling merchant.

If farmer decides to keep the product or give it to the traveling merchant, then you will get 4ECU. If he decides to deal with you, then you both get 8ECU.

OK

The WE treatment

Farmers' narration (periods 5) A travelling merchant has arrived in your county. Travelling merchants know different people and foreign markets. They travel all year long selling merchandise to the highest bidder. This merchant has offered to take your harvest and sell it in a foreign market.

After selling the harvest for 32 ECU, the travelling merchant could either share the profit with you or take all the money and run.

If the travelling merchant shares, you get 16ECU, but if the travelling merchant takes the money and runs, then you will take the merchant to court.

With a probability of 1/2 (one out of two times), the court finds the merchant guilty, gives you back 16ECU, and charges the merchant 5ECU in court fees, leaving the merchant with 11ECU.

With the probability of 1/2 (one out of two times), the court does not find the merchant guilty and charges you 5ECU in court fees. In this case, the travelling merchant keeps all the money.

However, if you give your products to the travelling merchant, you can't also trade with the local merchant. The local merchant will only get 4ECU since you are no longer their trade partner. All your previous options are still available to you. You can keep your harvest for yourself, trade the harvest with the local merchant, or let the travelling merchant take the products to the foreign market.

Keep your harvest *Trade with local merchant* *Trade with the traveling merchant*

Farmers' narration (periods 6 to 8) You still can keep your harvest for yourself or to trade it to the local merchant.

If you keep the harvest for yourself then you will get 4ECU. If you trade with the local merchant you get 8ECU. A new travelling merchant has approached you offering the same potential as the previous travelling merchant. This merchant can sell your harvest for a profit of 32ECU in a foreign market.

If you decide to trade with the new travelling merchant and he/she splits the gains from trade, you get 16ECU but if he takes the money and runs, then a court will try your case.

With a probability of 1/2 (one out of two times), the court finds the merchant guilty, gives you back 16ECU, and charges the merchant 5ECU in court fees, leaving the merchant with 11ECU.

With the probability of 1/2 (one out of two times), the court does not find the merchant guilty and charges you 5ECU in court fees. In this case, the travelling merchant keeps all the money.

If you give your products to the travelling merchant, you will also impact the local merchant who will only get 4ECU since you are no longer their trade partner. You have three options.

Keep your harvest *Trade with local merchant* *Trade with the traveling merchant*

Local Merchant's narration (Period 5) You are a merchant who sells goods in a local market. You have a long-standing relationship with a farmer who often gives you his harvest to sell at the market. When the farmer gives you the harvest, each of you gets 8ECU.

The Farmer has three options: 1) Keep the product, 2) give the product to you, 3) give the product to a traveling merchant.

If farmer decides to keep the product or give it to the traveling merchant, then you will get 4ECU. If he decides to deal with you, then you both get 8ECU.

OK

Travelling merchants' narration (periods 5 to 8) You have arrived in a small county and found a farmer who is willing to let you sell the harvest on the foreign market. You can sell this harvest for 32ECU.

You successfully sold the harvest, and you can either split the profit and each one of you gets 16 ECU or you can take all the money and run.

If you decide to take the money and run, a court will try the case. With a probability of 1/2 (one out of two times), the court finds you guilty. In this case, the court charges you 5ECU in court fees so you will get 11ECU and give the farmer 's share (16ECU) back.

With a probability of 1/2 (one out of two times), the court does not find you guilty, you keep all the money (32ECU), and the farmer pays 5ECU in court fees (the farmer's profit is -5ECU).

You have two options:

Split the profit *Take the money and run*

The NoLM treatment's common stage

Farmers' narration (period 1) You are a farmer in a small county. You have to work hard around the clock to harvest your products.

You can do two things with your harvest.

First, you can sell your harvest in the local market. If you sell your harvest in the local market you make 8ECU.

Second, you can keep your harvest and consume everything yourself. In this case your payoff is equal to 4ECU.

You can either keep your harvest or sell it in the local market.

Keep your harvest *Sell in the local market*

Farmers' narration (periods 2 to 4) You have two options.

your harvest for yourself, this pays you 4ECU, or selling your products in the local market which pays you 8ECU.

Keep your harvest *Sell in the local market*

Traveling merchants' narration (period 1) You are a travelling merchant accustomed to dealing with different people and markets. To make your living selling merchandise, you have to travel all year long.

Farmers work hard around the clock to collect their harvest. If you travel to a village and find a farmer who is willing to trade you his harvest, you both can possibly gain from trade. But if you do not find a farmer or if the farmer is unwilling to trade with you, then you will have no opportunity to trade. Your payoff will be 4ECU.

OK

Traveling merchants' narration (periods 2 to 4) You traveled this period but you were unsuccessful in finding a farmer to trade with.

OK

The NoLM treatment

Farmers' narration (period 4) A travelling merchant has arrived in your county. Travelling merchants know different people and foreign markets. They travel all year long selling merchandise to the highest bidder.

This merchant has offered to take your harvest and sell it in a foreign market.

After selling the harvest for 32ECU, the travelling merchant could either share the profit with you or take all the money and run.

If the travelling merchant shares, you both get 16ECU. But if the travelling merchant takes the money and runs, then you will get 0ECU (the travelling merchant gets 32ECU).

All your previous options are still available to you.

You can keep your harvest for yourself (which pays you 4ECU), sell the harvest in the local market (which pays you 8ECU) or let the travelling merchant take the products to the foreign market.

Keep your harvest *Sell in the local market* *Trade with the traveling merchant*

Farmers' narration (periods 5 to 8) You still can keep your harvest for yourself or to sell in the local market.

If you keep the harvest for yourself then you will get 4ECU.If you sell your harvest in the local market you get 8ECU.

A new travelling merchant has approached you offering the same potential as the previous travelling merchant. This merchant can sell your harvest for a profit of 32ECU in a foreign market.

If you decide to trade with the new travelling merchant and he/she shares the profits, you both get16ECU. But if he/she takes the money and runs you get 0ECU (i.e. travelling merchant gets 32ECU).

You have three options.

Keep your harvest *Sell in the local market* *Trade with the traveling merchant*

Traveling merchants' narration (periods 5 to 8) if engaged in long-distance trade You have arrived in a small county and found a farmer who is willing to let you sell the harvest on the foreign market. You can sell this harvest for 32ECU.

You successfully sold the harvest, and you can either split the profit and each one of you gets 16ECU or you can take all the money and run.

If you take the money you will get 32ECU and the farmer will get 0ECU.

Split the profit *Take the money and run*

Traveling merchants' narration (periods 5 to 8) if not engaged in long-distance trade You traveled this period but the farmer of this village decides to not trade with you.

You will travel to another village to find another farmer to trade with.

OK

A.1.2 The Triad Task

The beginning At this stage of the experiment you will be asked a number of questions. There is no right or wrong answer. Please answer them as best you can.

In the following lists, among the three things listed together, please indicate which two of the three are most closely related.

1.	Seagull	Sky	Dog
2.	Black	White	Blue
3.	Doctor	Teacher	Homework
4.	Apple	Orange	Pear
5.	Shoes	Boots	Slippers
6.	Train	Bus	Tracks
7.	Computer monitor	Antenna	Television
8.	Hospital	Bank	Cinema
9.	Carrot	Eggplant	Rabbit
10.	Cloud	Wind	Rain
11.	Panda	Banana	Monkey
12.	Shirt	Hat	Pants
13.	Kite	Basketball	Tennis
14.	Farmer	Corn	Bread
15.	Shampoo	Hair	Beard
16.	Bridge	Tunnel	Highway
17.	Piano	Violin	Guitar
18.	Child	Man	Woman
19.	Postman	Policeman	Uniform
20.	Letter	Stamp	Postcard

(In the experiment, subjects saw the questions one by one. The questions used to compute the I/C score are 1,3,6,7,9,11,14,15. For example, in (1) a collectivist would choose {seagull, sky}, focusing on a holistic relationship between a bird and the sky, while an individualist would choose {seagull, dog}, focusing on the category "animal".)

The end Now you will go to the next phase. In this phase of the experiment you will be assigned a certain role in a narrative. Then you will make decisions that affect the narrative you observe as well as the narrative observed by others. Together all players' decisions will determine their payoffs. Please read the text carefully. Be aware that outcomes may depend on other player's action as well. The narratives are simple, and if you follow them carefully, you may earn a considerable amount of money which will be paid to you in cash at the end of the experiment.

This phase will last for several periods, and you will be paid the sum of your earnings from all periods.

Every 12 experimental currency unit (henceforth ECU) will be converted to 1 CAD.

A.1.3 Risk preference elicitation instructions

In the questions that follow, you are going to be asked to make ten decisions. Each decision will be between Option A and Option B. One of the ten choices you make will be randomly selected to determine your earnings for this part of the experiment.

Options		
A	B	Your Choice
\$1 or \$3 each with probability 1/2	\$0.1 with probability 9/10 or \$4 with probability 1/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 8/10 or \$4 with probability 2/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 7/10 or \$4 with probability 3/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 6/10 or \$4 with probability 4/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 5/10 or \$4 with probability 5/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 4/10 or \$4 with probability 6/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 3/10 or \$4 with probability 7/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 2/10 or \$4 with probability 8/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 1/10 or \$4 with probability 9/10	A or B
\$1 or \$3 each with probability 1/2	\$0.1 with probability 0/10 or \$4 with probability 10/10	A or B

A.2 Measuring individualism and collectivism

Following the seminal study of individualism and collectivism by [38], various scholars have tried to provide different methods to measure these cultural traits. These methods, in general, could be divided into two categories; questionnaires and cognitive tests. Triandis and his colleagues utilized the questionnaire method in various research [42, 76, 77]. In this approach, people are to answer how they would act, behave, or think in a series of different situations.[1] Since the role assignment protocol in this experiment was based on the individualism/collectivism score, we had to measured it prior to the treatments. Priming subjects would have been a real concern if we had to ask them to think about their relationship with their family and friends immediately before they play the game. Hence, we eschewed the questionnaire method.

[61] argued that cognitive orientations are influenced by "the considerable social differences that exist among different cultures". That is, people of the East Asian origin to have a holistic view of the world,"attending to the entire field and assigning causality to it" while people of the Western European origin to have an analytic view, "paying attention primarily to the object and the categories to which it belongs and using rules"(p.291). For example, to capture such cognitive differences, [49, 50] employed a framed line task. In the first stage of this task, subjects see a square with a line inside it. In the next stage, they see an empty square which might be larger, smaller, or the same size as the original square. They repeat this task for a limited number of times with one of the following instructions, draw a line which is the same length as the original line (that is, absolute task) or draw a line that has the same relative proportions as the original line (that is, relative task). Authors argue that the analytic minded subjects should perform better in the absolute task since this "task requires attention to be focused on the target line" while holistic minded subjects should perform better in the relative task since it "requires attention to be allocated broadly to both the target line and the surrounding square"[50, p.242]. Results of this task showed that American subjects are more analytic minded compared to Japanese subjects.

The implicit focus of the questionnaire method on the externality imposed on family, friends, and in-group members along with the time consuming nature of the framed line test propelled us to employ the Triad Task. The advantages of this task are threefold. First, according to [72], it captures the difference in the cognitive orientations successfully. Second, the abstract nature of this task eliminates the priming effect. Third, it can be conducted in a short amount of time with a high accuracy.

[1] For example, "You are about to make an important decision (e.g. marriage, carrier choice). How often you are likely to spend time considering the implications of the decision (e.g. economic, emotional) on your relatives? 1=all the time; 5=never ".

A.3 Additional Analysis

A.3.1 Risk Preferences

Figure A.1 shows the relative frequency of the safe choice for each pair of lotteries. As is often the case in multiple price list elicitations, our subjects are risk averse on average. As is also common, we observe a small set of subjects whose preferences are inconsistent with EU.

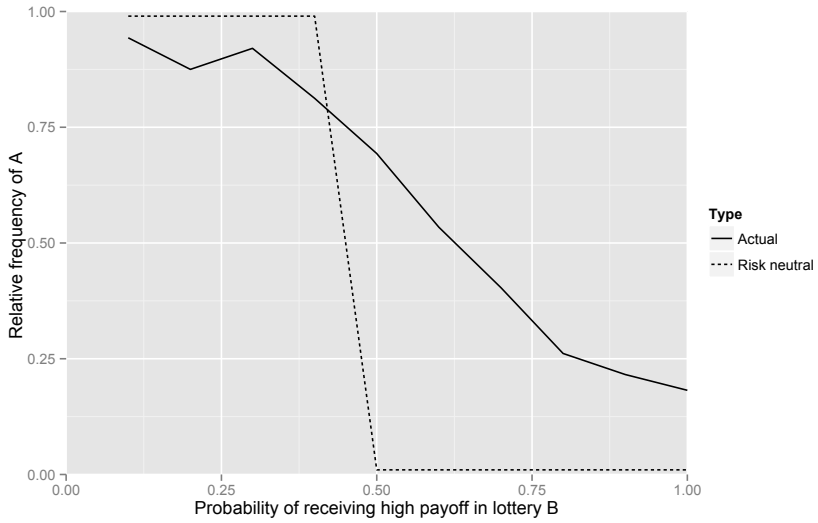

Figure A.1: **The distribution of choices in the risk preference elicitation.** The solid line plots the data, and the dashed line plots the risk-neutral, expected utility maximizing choices.

A.3.2 Traveling Merchants' Behavior

In the subgame perfect Nash equilibrium of all four treatments, a payoff maximizing traveling merchant cheats the farmer with probability 1; however, we observe substantial reciprocation in all treatments: the merchant cheats in only 14/33 (42%) instances in the NE treatment, 19/32 (59%) instances in the WE treatment, 16/42 (38%) instances in the SE treatment, and 14/35 (40%) in the NoLM treatment. This is consistent with two decades of the experimental evidence revealing positive reciprocity in trust games [e.g. 44].

Although our interpretation of the individualism/collectivism distinction does not have direct implications for traveling merchants' behavior, we look for any behavioral pattern that emerges in the experiment. Note that, due to the role assignment rule, which assigned the most and least collectivistic subjects to the role of the Farmer, the distribution of traveling merchants' I/C scores is compressed and away from the extremes. In fact, in the NE treatment there is no traveling merchant with individualistic tendencies (that is, I/C scores ≤ 0.5 for all traveling merchants). Figure A.2 displays histograms of the I/C distribution for traveling merchants in each treatment.

Nevertheless, for completeness, we report regression analysis of the determinants of the decision to cheat. We restrict attention to the observations in which the farmer chose long-distance trade. The dependent variable takes a value of 1 when the merchant cheated the farmer and 0 otherwise. In our first specification, the independent variables include a constant term, the merchant's I/C score, and treatment dummies. In a second specification, we include interactions between the treatments

	(1) Cheat$_t$	(2) Cheat$_t$
I/C Score	0.096	1.873**
	(0.315)	(0.832)
Weak Enforcement	0.256***	0.972***
	(0.092)	(0.215)
Strong Enforcement	0.033	0.588**
	(0.075)	(0.252)
No Local Merchant	0.074	0.652**
	(0.140)	(0.256)
WE × I/C		-2.263***
		(0.870)
SE × I/C		-1.851*
		(0.967)
NoLM × I/C		-1.940**
		(0.868)
Intercept	0.328***	-0.206
	(0.114)	(0.203)
Observations	142	142
R^2	0.02	0.08

Clustered standard errors in parentheses.
* p<0.1, ** p<0.05, *** p<0.01.

Table A.1: **Regression Analysis of Cheating by Traveling Merchants**

and I/C score. We include random effects for each subject to control for repeated observations, and we cluster standard errors at the session level. Table A.1 reports GLS regression results. In column (1), we observe no effect of I/C score on cheating, though there is more cheating overall in the WE treatment. Perhaps this is driven by the weakening of the cooperative signal sent by the farmer's trade decision. In column (2), we observe a positive and significant coefficient on the I/C score among those in the NE treatment. However, due to the compressed distribution, this reflects differences only within subjects who were somewhat collectivistic. In the other treatments, where we observe traveling merchants with individualistic tendencies, this effect is offset. Wald tests cannot reject the null hypothesis that the sum of the coefficient on the I/C score and the I/C treatment interaction is equal to 0 for any treatment (p-values = 0.12, 0.96 and 0.79 for the WE, SE and NoLM treatments, respectively).

In previous experiments, to alleviate the problem of cheating, different formal enforcement mechanisms have been incorporated into the trust game. In general, these formal enforcement mechanisms are either imposed by the second party (that is, player 1/the "farmer" in the trust game) or by a third party (that is, a contract enforcement/court system)[2]. Considering second party enforcement, one possibility is to add a retaliation opportunity for player 1 after being cheated [71] or to let player 1 credibly threaten player 2 with a fine *ex ante* which will be imposed in case of cheating [24, 23]. Interestingly, both of these two methods led to increased cheating by player 2. [6] add a court with different enforcement power to the trust game. They find that cheating occurs less often in the weak and strong court system treatment compare to the medium enforcement power. This is

[2]Third party enforcement is mainly imposed through a court that probabilistically punishes non-sharing behavior. [22], however, used *human* third party enforcement in both a dictator and prisoner's dilemma game. They find that *human* third party enforcement punishes selfish behavior roughly 60% of time at a cost to herself and therefore encourages sharing/cooperation.

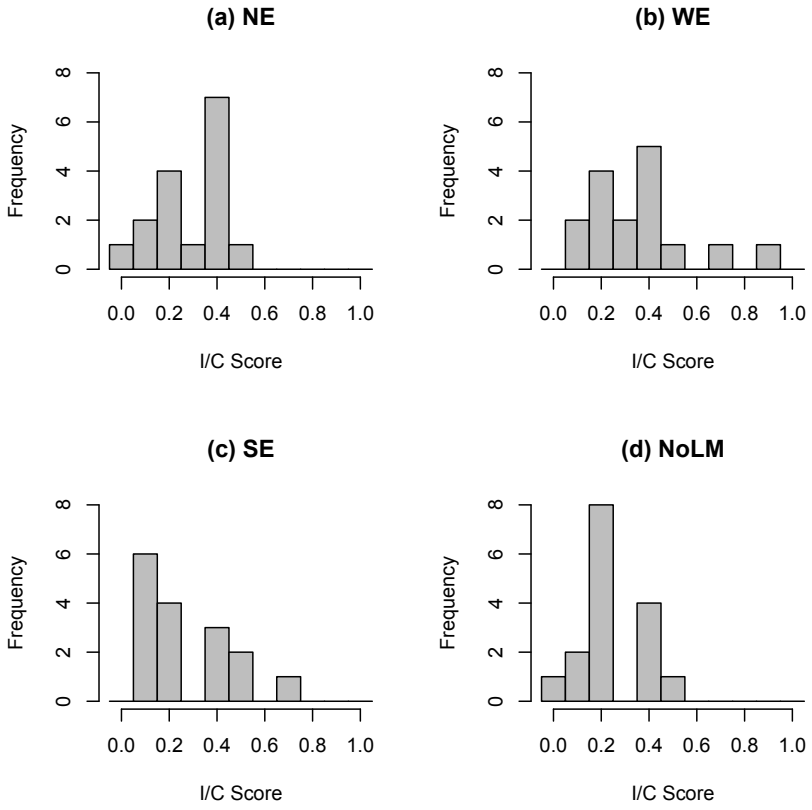

Figure A.2: **Histograms of traveling merchants' I/C scores, by treatment.** Each panel displays the data for one treatment. Note that the distribution is compressed away from the extremes; in particular the sample contains very few individualists.

consistent with our findings which show that cheating occurred significantly more often in the WE treatment than the NE, SE, and NoLM treatments.

Appendix B

Individualism, Collectivism and Alternative Enforcement Mechanisms in Exchange

B.1 Experiment Instructions

This section presents what subjects see on their screens during the experiment. Information would be given to the subjects in the sequential manner based on their decisions. Subjects will assume their roles (i.e. farmer or traveling merchant) in the beginning of the experiment according to the triad task results. The only difference between treatments is the court enforcement power. Therefore, here I only give the narration of the IFE treatment.

B.1.1 The Narrations

The Perfect Stranger Matching

Farmers' narration (period 1) You are a farmer in a small county. You have to work hard around the clock to harvest your products. You can do two things with your harvest. First, you can sell your harvest in the local market. Or you can give your products to a traveling merchant to sell them for you in a foreign market.

Travelling merchants know different people and foreign markets. They travel all year long selling merchandise to the highest bidder.

You know that your harvest is worth more in the foreign market than the local market. When you trade with a travelling merchant, after selling your harvest, he/she could either share the profit with you or take all the money and run.

There are two ways to trade with a traveling merchant. First you can seek advice of the village elder (played by the computer). The elder has information about the past dealings of all the traveling merchants. The elder gives you information about the traveling merchant for a fee. The elder will tell you whether or not the traveling merchant has ever cheated a farmer in the past. After seeing whether this traveling merchant has cheated or not, you can decide to trade with him/her or to sell your product in the local market.

The second way to deal with the traveling merchant is to register your exchange with a court for a fee. If the travelling merchant splits the profit with you, the court does nothing, but if the travelling merchant takes the money and runs, then you will take your case to court. The court may catch the traveling merchant and return your money or the traveling merchant may keep the money without punishment.

There is no merchant for you to trade with in this period. However, at this time, the village elder is collecting information about the past dealings of the traveling merchant. In the meanwhile, you sell your harvest in the local market for 15ECU.

OK

Traveling merchants' narration (Period 1) You are a travelling merchant accustomed to dealing with different people and markets. To make your living selling merchandise, you have to travel all year long.

Farmers work hard around the clock to collect their harvest. If you travel to a village and find a farmer who is willing to trade you his harvest, you both can possibly gain from trade. But if you do not find a farmer or if the farmer is unwilling to trade with you, then you have other goods to sell and you get 8ECU (farmer gets 8ECU).

If a farmer decides to trade with you, you always have the option of splitting the profit or taking the money and run.

There are two ways that farmers trade with you.

First, the farmer asks the elder of the village about your past trades for a fee of 5ECU (the farmer pays this money). If you never took the money and ran in any previous exchange, then the elder will tell the farmer that you are "trustworthy". If you have taken the money and run once or more, then the elder says that you are "untrustworthy".

The second way is that the farmer registers the exchange with you in a court for a fee of 5ECU (the farmer pays this money). If you split the profit, court does nothing, but if you take the money and run, then the farmer will take the case to court. Court may catch and punish you and return the farmer's money or you may escape.

You have arrived in a small village.

From a previous trade with a (computerized) farmer you made 20ECU. You can either split the profit and get 10ECU or you can take all the money and run.

If you take the money you will get 20ECU and that farmer will get 0ECU.

Know that the elder observes what you do and may share what you did with others (for a fee) and this information might affect your future trades with other farmers.

Split the profit *Take the money and run*

Farmers' narration (periods 2 to 5) You can sell your product in the local market for 8ECU. In this case, the traveling merchant sells the goods that he/she already has and gets 8ECU.

You know that your harvest is worth 48ECU in the foreign market. The travelling merchant, however, after selling your harvest, could either share the profit with you or take all the money and run.

A new travelling merchant has approached you and offered to take your product to a foreign market. This merchant can sell your harvest for a profit of 48ECU in a foreign market. There are two ways to trade with a traveling merchant. First you can seek advice of the village elder (i.e. played by the computer). The elder has information about the past dealings of all the traveling merchants. The elder gives you information about one traveling merchant for a fee of 5ECU. The elder gives you the following information:

- The elder says a traveling merchant is trustworthy if he/she never took the money and ran in previous trades with others.
- The elder says a traveling merchant is untrustworthy if he/she took the money and ran once or more in previous trades with others.

After getting the information you can decide either to sell your product in the local market which pays 3ECU (8ECU- elder's fee) or to deal with the traveling merchant.

If the travelling merchant splits the profit, you get 19ECU, but if the travelling merchant takes the money and runs, then you will get -5ECU (elder's fee).

The second way to trade with the traveling merchant is to register your exchange in a court for a fee of 5ECU.

If the travelling merchant splits the profit, you get 19ECU (24 - court fee), but if the travelling merchant takes the money and runs, then you will take your case to the court.

With a probability of 1/2 (one out of two times), the court finds the merchant guilty, gives you back 19ECU, and charges the merchant 6ECU in court fees, leaving the merchant with 18ECU.

Sell your product in the local market *Ask the elder* *Register in the court and then trade with the merchant*

Farmers' narration (periods 2 to 5) after asking the elder Now, you have asked the elder. The elder says that this traveling merchant is ...

You can decide either to sell your product in the local market which pays 3ECU (8ECU- elder's fee) or to deal with the traveling merchant.

If the travelling merchant splits the profit, you get 19ECU (the traveling merchants gets 24ECU), but if the travelling merchant takes the money and runs, then you will get -5ECU (elder's fee).

Sell your market in the local market *Trade with the traveling merchant*

Travelling merchants' narration (periods 2 to 5) when traded with using informal enforcement/the elder You have arrived in a small county and found a farmer who, after talking to the elder, is willing to let you sell the harvest on the foreign market. You can sell this harvest for 48ECU.

You successfully sold the harvest, and you can either split the profit and get 24 ECU (the farmer will get 19ECU (24 - elder's fee)) or you can take all the money and run.

If you take the money you will get 48ECU and the farmer will get -5ECU (the farmer has paid the elder's fee).

You have two options:

Split the profit *Take the money and run*

Traveling merchants' narration (periods 2 to 5) when traded with using formal enforcement/the court You have arrived in a small county and found a farmer who, after registering your deal exchange in court, is willing to let you sell the harvest on the foreign market. You can sell this harvest for 48ECU.

You successfully sold the harvest, and you can either split the profit and get 24ECU (the farmer gets 19 (24 court's fee)) or you can take all the money and run.

If you decide to take the money and run, a court will try the case.

With a probability of 1/2 (one out of two times), the court finds you guilty. In this case, the court charges you 6ECU in court fees so you will get 18ECU and give the farmer 's share (19ECU) back.

With a probability of 1/2 (one out of two times), the court does not find you guilty, you keep all the money (48ECU), and the farmer pays 5ECU in court fees (the farmer gets -5ECU).

You have two options:

Split the profit *Take the money and run*

Traveling merchants' narration (periods 2 to 5) when not traded with You have traveled this period but the farmer of this village decides to not trade with you. You will travel to another village to find another farmer to trade with.

OK

Traveling merchants' narration (periods 2 to 5) when not traded with after consulting the elder You have traveled this period but the farmer of this village, after consulting the elder, decides to not trade with you. You will travel to another village to find another farmer to trade with.

OK

Instruction before the random matching stage

Please read the text carefully. Now, you will move onto the next stage. In this stage you will never trade with traveling merchants and farmers that you have been trading so far. There will be new farmers and traveling merchants. Nobody has the history of what you did so far.

This phase will last for several periods. One round will be randomly picked, and you will be paid according to your earning in that specific period.

Every 15 experimental currency unit (henceforth ECU) will be converted to 1 CAD.

Random Matching Stage

Narration is similar to perfect stranger matching stage, only the word "new" is removed from the phrase "new traveling merchant".

Instruction before risk elicitation task

Next is the final stage of the experiment. The outcome of this phase only depends on your individual decision. The payoff is in Canadian dollar. Please read the instruction carefully.

B.2 Additional Analysis

B.2.1 Risk Preferences

Figure B.1 demonstrates the relative frequency of the safe choice for each pair of lotteries. On average, subjects are risk averse which mostly corresponds to the expected utility theorem.

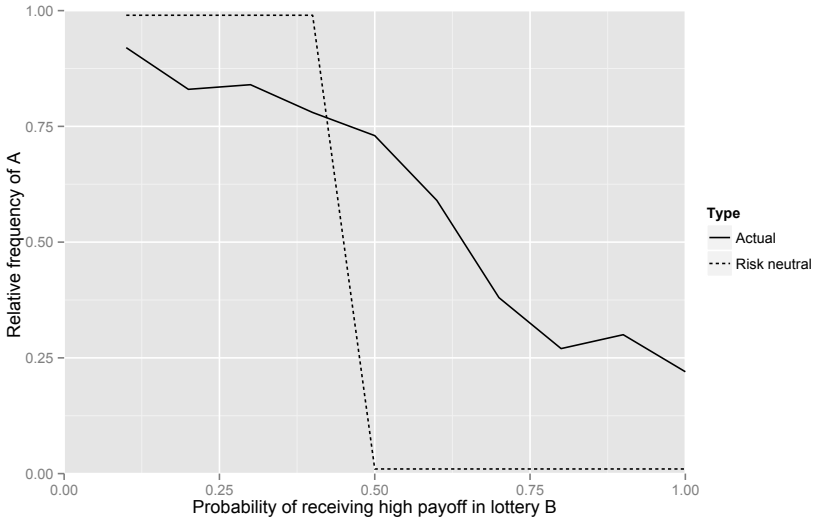

Figure B.1: **The distribution of choices in the risk preference elicitation.** The solid line plots the data, and the dashed line plots the risk-neutral, expected money maximizing choices.

B.2.2 Multinomial logistic regressions

To test for the sensitivity of my findings with respect to the estimation method, I, also, run multinomial logistic regressions. In these regressions, I define a farmer's decision dummy which takes value of 0 when farmers opt out of long distance trade (that is, Local trade in figure 3.1), 1 when farmers register in the court (that is, Long-distance Trade via Court in figure 3.1), and 2 when farmers consult the elder (that is, Elder in figure 3.1). Since I am interested in the enforcement mechanism selection, I set no trade as the base outcome. I, further, control for the I/C score, the treatment, the risk aversion, the interactions between them, and the gender. In both regressions, standard errors are clustered at the group level. Column 1 of the table B.1 reports the result of the multinomial regression for the PSM phase while column 2 of the same table correspond to the result of the experience phase.

In the PSM phase, consulting the elder has a significant negative correlation with the I/C score in the EFE treatment suggesting that collectivists, similar to *finding 1*, employ the reputation system more often than individualists when the court system is efficient. As the switch to the experience phase occurs, in the EFE treatment, individualists significantly register their long-distance trade in the court more than their collectivist counterparts. In the experience phase of IFE treatment, this effect disappears. All in all, results of the multinomial logistic regression method are aligned with the Heckman probit model.

	(1) Farmers' decision PSM	(2) Farmers' decision Experience
No trade/Base outcome		
The court		
I/C Score	0.035	2.689***
	(0.939)	(0.761)
IFE	-0.514	-3.622*
	(1.292)	(2.039)
IFE × I/C Score	-1.666	-3.251***
	(1.503)	(1.104)
Risk	-0.309***	-0.073
	(0.087)	(0.361)
IFE × Risk	0.284*	0.770
	(0.153)	(0.490)
Female	-0.908	-0.096
	(0.738)	(0.642)
Intercept	3.644***	2.333
	(0.795)	(1.820)
The elder		
I/C Score	-2.694**	1.591
	(1.327)	(1.268)
IFE	1.454	-2.957**
	(1.824)	(1.337)
IFE × I/C Score	0.864	-2.212
	(1.685)	(1.774)
Risk	-0.029	-0.116
	(0.295)	(0.309)
IFE × Risk	-0.119	1.012***
	(0.365)	(0.365)
Female	-0.070	0.226
	(1.101)	(0.788)
Intercept	1.369	-0.119
	(1.332)	(1.161)
Observations	128	320

Table B.1: **Regression analysis of farmers' decision**

B.2.3 Traveling Merchants

It is important to note that the individualism/collectivism approach does not offer an interpretation of traveling merchants' behavior. Due to the role assignment protocol, there is no highly collectivist or individualist traveling merchant (i.e. the distribution of traveling merchants' I/C scores is away from the tails). Traveling merchants' I/C scores are especially skewed toward collectivism. Figure B.2 portrays these distributions per treatment.

In the PSM phase, I observe 15/50 (30%) cases of cheating in the EFE treatment and 21/51(41%) cases of cheating in the IFE treatment. The amount of cheating in the experience phase follows a

similar pattern, I observe 51/146 (35%) cases of cheating in the EFE treatment and 41/107 (38%) cases of cheating in the IFE treatment.

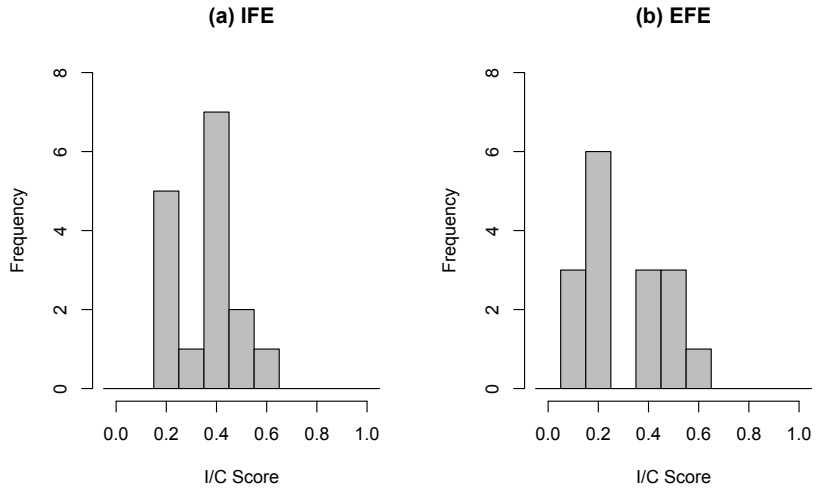

Figure B.2: **Histograms of the distribution of traveling merchants' I/C scores per treatment.**

To probe into the choice of cheating by traveling merchants, I, first, limit the sample to the cases that long-distance trade had happened and therefore traveling merchants had the choice between sharing and cheating. I use a panel regression model in which the dummy variable takes the value of 1 if traveling merchants cheat and 0 otherwise. I control for the repeated observations for the same individuals by including random effects. I also cluster the standard errors at the group level. Table B.2 reports the results.

	(1) Cheat PSM	(2) Cheat PSM	(3) Cheat Experience	(4) Cheat Experience
I/C Score	0.369	0.367	0.363	0.373
	(0.385)	(0.400)	(0.289)	(0.314)
IFE	0.459**	0.453*	0.331	0.345*
	(0.232)	(0.245)	(0.217)	(0.205)
IFE × I/C Score	-1.040	-1.018	-0.854*	-0.916*
	(0.657)	(0.670)	(0.483)	(0.513)
Female	-0.219**	-0.220**	-0.070	-0.070
	(0.109)	(0.111)	(0.138)	(0.140)
Risk		0.002		-0.005
		(0.025)		(0.032)
Intercept	0.284*	0.279*	0.264**	0.284***
	(0.171)	(0.157)	(0.111)	(0.109)
Observations	101	101	253	253

Clustered standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table B.2: **Regression analysis of cheating**

In the PSM phase, female subjects cheat significantly less often than male subjects. This difference, however, disappears in the experience phase. Similar to the previous studies [24, 23] a weak pun-

ishment mechanism (that is, an inefficient court system in this experiment) induces more cheating. That is perhaps due to that fact that the trust signal sent by the farmers is crowded out by the weak enforcement.

Neither the I/C score nor the summation of I/C score and IFE $\times$ I/C score were significant in any of the specifications. This indicates that there is no significant correlation between the cultural disposition and the behavior of traveling merchants in the context of this experiment.

Appendix C

Testamentary Power and Welfare: Islamic Inheritance Law versus Primogeniture

C.1 Existence of a solution to the FOCs

Rearranging equation 4.4, I have:

$$w = (1-\tau)\beta k^{\alpha} l^{\beta-1} z^{1-\alpha-\beta} \tag{C.1}$$

$$w = (1-\tau)\beta (\frac{K}{L})^{\alpha} L^{\alpha+\beta-1} \tag{C.2}$$

Substituting from equation 4.12 and moving L to the left hand side, I have:

$$L = \left((1-\tau)\frac{\beta}{w} (\frac{\alpha}{\beta\gamma})^{\alpha} \right)^{\frac{1}{1-\alpha-\beta}} \tag{C.3}$$

Rearranging equation 4.7, I have $E+1 = \frac{1}{\tau}$. Substituting from equation 4.11, I have:

$$\tau = \left(\frac{k^{\alpha} l^{\beta} z^{1-\alpha-\beta}}{c} \right)^{-\frac{1}{2}} \tag{C.4}$$

$$\tau = \left(\frac{(\frac{K}{L})^{\alpha} L^{\alpha+\beta}}{Nc} \right)^{-\frac{1}{2}} \tag{C.5}$$

Moving L to the left hand side I have:

$$L = \tau^{-\frac{2}{\alpha+\beta}} (Nc)^{\frac{1}{\alpha+\beta}} (\frac{\alpha}{\beta\gamma})^{-\frac{\alpha}{\alpha+\beta}} \tag{C.6}$$

Setting equations C.3 and C.6 equal to each other, I have:

$$\tau = (1-\tau)^{-\frac{\alpha+\beta}{2(1-\alpha-\beta)}} \left(\frac{\beta}{w}\right)^{-\frac{\alpha+\beta}{2(1-\alpha-\beta)}} (Nc)^{\frac{1}{2}} \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2(1-\alpha-\beta)}} \tag{C.7}$$

I use the following reduced forms; $\rho = \left(\frac{\beta}{w}\right)^{-\frac{\alpha+\beta}{2(1-\alpha-\beta)}} (Nc)^{\frac{1}{2}} \left(\frac{\alpha}{\beta\gamma}\right)^{-\frac{\alpha}{2(1-\alpha-\beta)}}$ and $\mu = \frac{\alpha+\beta}{2(1-\alpha-\beta)}$. These, in turn, change equation C.7 to the following;

$$\tau = (1-\tau)^{-\mu}\rho \tag{C.8}$$

For equation C.8 to have a solution, the following maximization should have a solution:

$$\max_{\tau} \ \tau - (1-\tau)^{-\mu}\rho \tag{C.9}$$

FOC and SOC are as follows:

$$FOC: \qquad 1-(-\mu)(-1)(1-\tau)^{-\mu-1}\rho = 0 \tag{C.10}$$

$$SOC: \qquad (-\mu)(-\mu-1)(-1)(1-\tau)^{-\mu-2}\rho < 0 \tag{C.11}$$

Notice that the second derivative is always negative. Therefore, the solution to the FOC is always a maximum. The solution to the FOC is as follows:

$$\tau^* = 1 - \left(\frac{1}{\mu\rho}\right)^{\frac{1}{-\mu-1}} \tag{C.12}$$

I plug back the optimal tax rate in the maximization problem to ensure that $\tau^* > 0$.

$$1 - \left(\frac{1}{\mu\rho}\right)^{\frac{1}{-\mu-1}} - \rho\left(\frac{1}{\mu\rho}\right)^{\frac{-\mu}{-\mu-1}} > 0 \tag{C.13}$$

With further manipulation of the above equation, I have:

$$\left(\frac{1}{\mu\rho}\right)^{\frac{1}{-\mu-1}} \left[1+\frac{1}{\mu}\right] < 1 \tag{C.14}$$

For inequality C.14 to hold, I should have:

$$(\mu\rho)^{\frac{1}{\mu+1}} \left[1+\frac{1}{\mu}\right] < 1 \tag{C.15}$$

ρ is a direct function of the number of nobles N and marginal cost of effort c. Therefore, the above condition could potentially be translated as having a small number of nobles in the economy, small effort cost, or both.

The above maximization has two solutions. To discuss the economically relevant solution, I employ figure C.1. Let us assume that initially the number of nobles in the economy is equal to N_1. In such a case, there are two intersections with the 45° line namely τ_1 and τ_4. Furthermore, assume that the

number of nobles has increases to N_2 (that is, $N_2 > N_1$). The graphical interpretation of this change is an upward shift of the curve. New equilibria are τ_2 and τ_3.

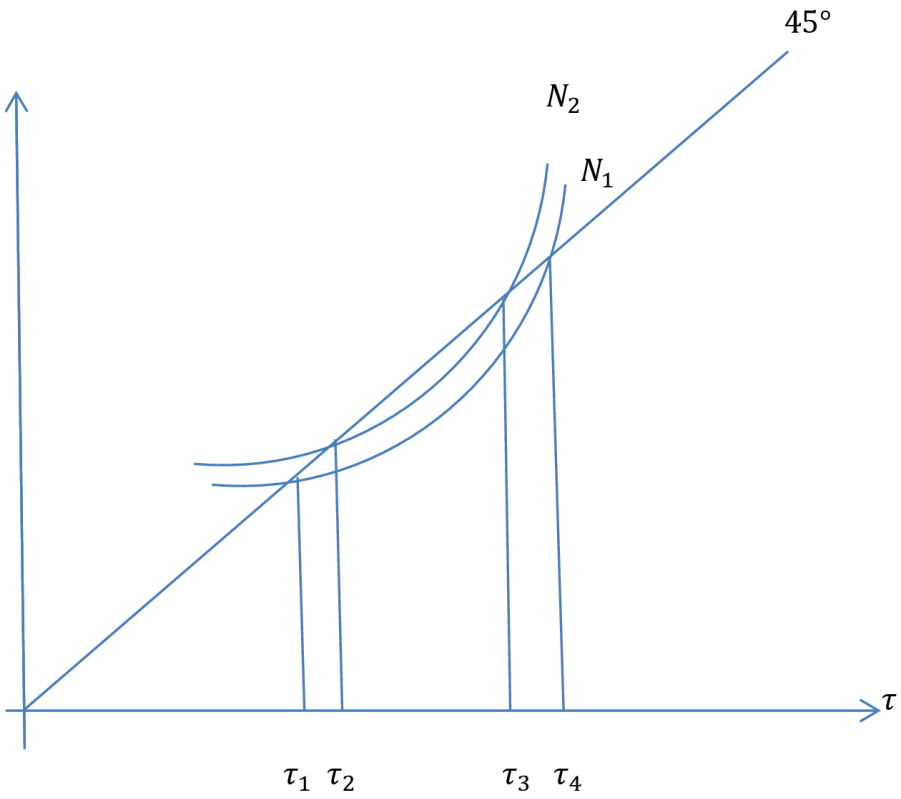

Figure C.1: **Graphical interpretation of the equation C.8.**

From section 4.1.4 we know that as the number of nobles increases, the total effort of nobles decreases and therefore the equilibrium tax rate increases. Considering that $\tau_4 > \tau_3$ and $\tau_2 > \tau_1$, economically admissible solutions are τ_1 and τ_2.