Long-Term Orientation in Trade

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Gert Jan Hofstede, Catholijn M. Jonker, and Tim Verwaart

1 Introduction

Trade requires trust. A buyer has to trust the seller, or the virtues of the product, or if he trusts neither he could still trust the enforcement mechanisms that can be put into operation in case of cheating. For a seller it is the same, except that he usually knows about the product, so that he is on the knowing side of an information asymmetry.

Trust does not work in the same way across cultures [1]. For instance, in some societies the emphasis is on interpersonal trust based on kinship; in others it is on interpersonal trust based on other markers; yet in others it is in impersonal institutions such as certification or law. Gorobets and Nooteboom [2], demonstrated on the basis of a multi-agent simulation that economic systems based on trust as well as systems based on opportunism may be viable in different societies.

This paper investigates the micro-dynamics of trust in a trade relationship. It does so by specifying an agent model for trade in a product with a hidden quality attribute. The situation is based on a simulation game, the Trust and Tracing game [3, 4]. The focus of study of this game is on trust in a business partner when acquiring or selling commodities with invisible quality.

When playing the game with people from different parts of the world, different patterns of trade and trust emerge [3]. A multi-agent model of the interactions in the game may help to improve the understanding of effects of culture on trade, and may help to understand if different economic systems and institutions may have been differently efficient in different parts of the world.

Hofstede
Wageningen University, Hollandseweg 1, 6706 KN Wageningen, e-mail: gertjan.hofstede@wur.nl

Jonker
Delft University of Technology, Mekelweg 4, 2628 CD Delft, e-mail: C.M.Jonker@tudelft.nl

Verwaart
LEI Wageningen UR, Postbus 29703, 2502 LS Den Haag, e-mail: tim.verwaart@wur.nl

This paper focuses on one aspect of culture only. This is a deliberate simplification that is made in order to highlight the role of this particular dimension of culture. The 5-dimension model by Hofstede [5] allows for this approach. The paper first discusses the cultural dimension of long-term versus short-term orientation. It then specifies the decision rules for the trading agents. After this, results of test runs are presented. Some conclusions and caveats round off the paper.

2 Long- versus Short-Term Orientation

Behaving as a good, upstanding member of the group is at the core of the lives of all beings that live in social groups [6]. Human beings are intensely social and they exemplify the point very well. Ensuring the successful functioning of our social groups is a basic requirement for survival. We spend up to twenty years being taught how to act as virtuous members of society. But how to be virtuous? It turns out that different societies have found different answers to that question. In some, rationality is a prominent virtue; in others, common sense. In some, virtue consists primarily in honouring tradition; in others, it consists more of becoming prosperous. The issue of whether the sources of virtue are to be found in the past and present on the one hand, or in the future on the other hand, is one of the basic dimensions of culture found by Hofstede [5]. It is a dimension not easily recognized by Western minds. The other four dimensions (individualism / collectivism, power distance, masculinity / femininity, uncertainty avoidance) in Hofstedes model are more often mentioned in research. Yet this fifth dimension, called long-term versus short-term orientation (LTO) by Hofstede, is very important for trade. If nothing else, its strong correlation with economic growth across 39 countries in the period 1970-2000 testifies to this ([7], p. 223).

Hofstede ([5], p. 359) gives the following definition of the LTO-dimension:

> Long Term Orientation stands for the fostering of virtues oriented towards future rewards, in particular, perseverance and thrift. Its opposite pole, Short Term Orientation, stands for the fostering of virtues related to the past and the present, in particular, respect for tradition, preservation of face and fulfilling social obligations.

Both positively and negatively rated values of this dimension are found in the teachings of Confucius, but the dimension also applies to countries without a Confucian heritage, for instance Brazil. Long-term orientation needs not be correlated with collectivism, as it is in the very collectivist Southeast Asian countries. Within Europe, Finland and the Netherlands are fairly long-term oriented, whereas Sweden and Germany are more short-term oriented. Table 1 displays distinctions that are relevant to the work in this paper.

The LTO-dimension can be predicted to have some effect on behaviour of participants in the Trust And Tracing game. The game has a limited time frame, so a long term oriented strategy may not be a successful one to win the game. The games reward system is about gains made during the game run, not about building a strong market position; the game is finite. One typical characteristic of long-term oriented

Table 1 A summary of relevant distinctions between norms in long term oriented and short term oriented societies (source: ([5], p. 367)

Short term oriented	Long term oriented
Immediate gratification of needs expected	Deferred gratification of needs accepted
Traditions are sacrosanct	Traditions adaptable to changed circumstances
Short-term virtues taught: social consumption	Long-term virtues taught: frugality, perseverance
Spending	Saving, investing
The bottom line	Building a strong market position
Analytical thinking	Synthetic thinking

thinking is that it is not limited to the time frame or to the logical puzzle set by any single event. Chinese, Japanese, Korean and Vietnamese culture are long-term oriented. Hampden-Turner and Trompenaars [8] were thinking about this when they entitled their book about Asian business values Mastering the infinite game. Asian logic is not atomistic.

Hofstede [5] performs an extensive literature review that confirms the importance of long-term orientation to trade. Long-term orientation opposes the disruption of harmonious relationships. This does not mean that conflict or competition are nonexistent. It means that they will not be framed as such. There are strong encouragements to self-discipline, and any emotion that might cause repercussions is repressed. Subordinates are very ready to comply, because it is in the interest of the social entity as a whole. Usefulness to the whole of society is an important criterion for behaviour, and it takes precedence over truth. Making statements that are not factual in order to achieve benefits for the group is not a sin, but a virtue.

Long-term orientation is correlated with self-effacement. This was found by Minkov [9] in a meta-analysis of data from the World Values Survey. The individual thinks of itself as a small element within the continuity of life. Hence, learning and developing ones capacities is more important than winning a particular game, or obtaining a particular result. In contrast, short-term orientation correlates with self-enhancing values in which being successful in a game is a desirable thing that will improve ones reputation.

It can thus be expected that the performance of long-term oriented traders is much dependent upon factors that are not within the scope of the experimental setting. They will be more aware of possible adverse real-world consequences of what they do during the game than will participants from short-term oriented cultures. Of course this problem needs not affect the performance of agents – but it will affect validation against the behaviour of human traders.

3 The effect of LTO on trade processes

Figure 1 presents a process model of a trading agent, inspired by the setting of the Trust and Tracing game. The focus of this game is on trust in a business partner

when acquiring or selling commodities with invisible quality. There are five roles: traders (producers, middlemen and retailers), consumers and a tracing agency. Typically there are 4 producers, 4 middlemen, 4 retailers and 8 consumers, to reflect the multiple steps and oligopoly character of most supply networks. The real quality of a commodity is known by producers only. Sellers may deceive buyers with respect to quality, to gain profits. Buyers have either to rely on information provided by sellers (Trust) or to request a formal quality assessment at the Tracing Agency (Trace). This costs a tracing fee for the buyer if the product is what the seller stated (honest). The agency will punish untruthful sellers by a fine. Results of tracing are reported to the requestor only or by public disgrace depending on the game configuration. A strategy to be a truthful seller is to ask for a trace before selling the product. In that case sellers use the tracing report as a quality certificate. Middleman and retailers have an added value for the network by their ability to trace a product cheaper than a consumer can.

For each of the processes represented in figure 1, the paper elaborates on the expected difference in behaviour between from long- and sort-term oriented cultures, based on Hofstedes work.
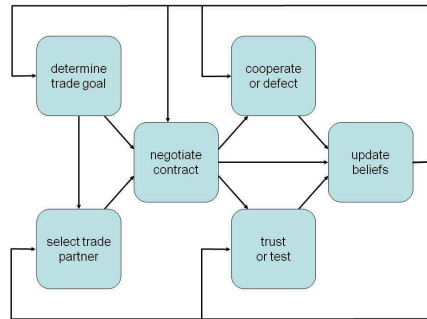
Fig. 1 Processes and internal information flow of a trading agent.

Partner selection. Long term oriented traders aim to develop lifetime relations. Not only a transaction's calculated pay-off counts; the resulting relation is of value by itself. Given the choice, a long term oriented trader would not neglect a proposal from a known relation in order to make a one more attractive one time deal with a stranger.

Short term oriented traders are not interested to develop long lasting relations. They want to make attractive deals as soon as possible. Their preferences in partner selection depend on other dimensions of culture, but they may be interested in doing business with high status partners to show off.

Trade strategy selection. Long term oriented traders will follow a thrifty strategy. They trade valuable high quality products if it serves their purpose, but they do not need them to show off. They avoid the risk of damaging their relations and do not

trade commodities that they are not certain about. Rather will they trade low quality, avoiding the risk of unintentionally selling low quality for high quality, or being forced to show distrust in suppliers by tracing their deliveries. Even if they like to gamble, they will not do it in business. They invest in relations and will not defect.

Short term oriented traders are more opportunistic. They analyze a deal in terms of pay-off (which may include future prospects), rather than a relational network. More than the long term oriented, and depending on other dimensions of culture, they like to show off and are prepared to take risks if this is necessary to save face and meet social demands.

Negotiation behavior. Long term oriented traders show patience. They do not break off negotiations. They do not overcharge. A first proposal may be modest, but they do not rapidly give in.

Extremely short term traders are impatient. They want rapid deals. If they give in they do it quickly and with substantial concessions. If partners do not make concessions too, they break off easily and try their luck elsewhere.

Truthful or untruthful delivery. After an agreement has been reached, it comes to delivery. If the quality of the commodity is invisible at first sight, the supplier can be opportunistic and try to deliver a lower quality product than agreed upon, thus making an extra profit. Given the opportunity (and depending on other preferences), a short term oriented supplier may be tempted do so, after calculating the possible gain. A long term oriented supplier will not put a relation with a customer at stake by deceiving.

Trust or distrust. Long term oriented traders cannot take the risk of unintentionally reselling low quality products for high quality products. They do not easily trust new relations. Trust has to be earned. They deliver truthfully and demand equal seriousness from their suppliers. Once relations have developed, they may signal their valuation of the relation by showing trust. When they find out that their trust has been abused, they lose all respect and banish the supplier from business.

The short term oriented traders trust or distrust on the basis of calculated risk and preferences, but the scope of their calculations is no more than the bottom line of the current transaction.

Maintenance of beliefs about partners. People from long term oriented cultures value their relations. They value a deal not only by the financial pay off, but also by the relational gains. They invest in relations by behaving truthfully and by trusting their partners. They have no respect for others that put their relations at stake for some short term profit. If they turn out to be deceived by a business partner they will not easily forgive the deceiver.

People from short term oriented cultures find it hard to understand the sacrifice of the long term oriented. The short term oriented tend to grab a chance for an easy profit and are willing to put their relations at stake for it (the other dimensions of culture, personality and circumstances determine the extent to which they will actually defect). They can understand that a business partner may be tempted to

defect if a profitable opportunity occurs, and they have trouble understanding that people from long term oriented cultures cannot.

4 Representation in Agents

This section formalizes the knowledge about the influence of power distance on trade processes, formulated in section 2. The relevant attributes of transactions from this viewpoint are the economic value of the transaction, the quality of the traded goods as a status attribute in its own, and a perceived risk that the trade partner will not fulfill its contractual obligations or will not trust the delivery.

The negotiation model uses a utility function to compare bids.

$$U_{bid} = w_1 f_1(value) + w_2 f_2(quality) + w_3 f_3(risk) \qquad (1)$$

with $w_1 + w_2 + w_3 = 1$, and w_i in $[0,1]$, for all i. $f_1 \ldots f_3$ normalize value, quality, and perceived risk of the transaction in the interval $[0,1]$. Agents are modeled to have personal traits that determine their decisions and behavior. The traits are implemented as real values in $[0,1]$. Some traits are related to negotiation behavior; the most important are the weight factors in the utility function, impatience, concession factor and other parameters in the negotiation architecture of Jonker and Treur [10]. Some traits are related to the delivery decision and trust (honesty, confidence), some to the update functions that maintain beliefs about partners trustworthiness, benevolence, and acceptability as a trade partner. In addition to the traits, each agent has a long term orientation indicator - a real number in $[0,1]$. Traits and LTO-indicator are not visible to other agents. Furthermore, each agent has a label, that represents it societal status. The status label is visible for other agents. In the partner selection process, agents select the most acceptable partner. They try and open new negotiations by replying if a proposal has been received recently or by taking the initiative to propose to a partner. Agents may ignore a proposal if the partner is not sufficiently acceptable. The paper formulates rules for the decisions of the agents, based on the values of personal traits, LTO, and beliefs about the partner. An example of such a rule is given below. It uses a uniform random variable and increased probability (up to 0.5) to stop for the reason gap to the extent the agent is impatient, but impatience is tempered if the agent stems from LT-oriented culture or deals with a high-status agent.

Rule 1 An STO agent tends to follows a *quality-minded* strategy, represented by relatively high values of w_2 and w_3 in equation (1); an LTO agent tends follow a *thrifty* strategy: relatively low value of w_2. The denominator N guarantees that the sum of the weight factors equals 1.

```
if cultural_script_contains(long-term-orientation (L: Real))
    and agent_trait_value(value_preference, P: Real)
    and agent_trait_value(quality_preference, Q: Real)
```

```
    and agent_trait_value(risk_aversion, R: Real)
    and N: Real = P + Q*(1 - L)*2 + R*min(1, (1 - L)*2)
then weight_for_value (P / N)
    and weight_for_quality (Q*(1-L)*2 / N)
    and weight_for_risk (R*min(1, (1-L)*2) / N);
```

Rule 2 In negotiations, an STO agent shows impatience if partner makes unrealistic bids or makes little progress, unless the partners societal status is high. The following rules express how the probability that a negotiation will be terminated if $U < M$ or $N < M$, depends on impatience, LTO, and status difference. Furthermore the rules record the reason for termination: there is either a gap between the partners proposal and what the agent finds reasonable, or the partner shows too little intention to accommodate the agent.

```
if cultural_script_contains (long-term-orientation(L: Real))
and current_round(X: Integer)
and current_negotiation (T: Trader, X, C: Commodity_list)
and others_bid_utility_in_round(U: Real, X)
and agent_trait_value(cut_off_value, M: Real)
and U < M
and agent_trait_value(impatience, I: Real)
and agent_label(status, S: Real)
and partner_model_contains_belief (T, status, Y: Real)
and random(0, 1, Z: Real)
and I * (1 - max(L, (1 - L)*(Y - S)))*0.5 > Z
then stop_negotiation(T, X, C, gap);

if cultural_script_contains (long-term-orientation(L: Real))
and current_round(X: Integer)
and current_negotiation (T: Trader, X, C: Commodity_list)
and progress_in_bids(X-3, X, N: Real)
and agent_trait_value(minimal_progress, M: Real)
and N < M
and agent_trait_value(impatience, I: Real)
and agent_label(status, S: Real)
and partner_model_contains_belief (T, status, Y: Real)
and random(0, 1, Z: Real)
and I * (1 - max(L, (1 - L)*(Y - S)))*0.5 > Z
then stop_negotiation(T, X, C, no_accom);
```

Rule 3 An STO agent delivers opportunistically; an LTO agent has a high threshold to defect deliberately. The threshold is used in the decision to cooperate or defect. The probability that an agent will cooperate is a monotonous function of the threshold, but also depends on other factors, like beliefs about the other agent and the relation.

```
if cultural_script_contains(long-term-orientation (L: Real))
and agent_trait_value(honesty, H: Real)
then deceit_treshold(H + (1 - H)*L);
```

Rule 4 An LTO agent exercises restraint to trace, cautious to preserve the relation; an STO agent only exercises restraint if partners status is high.

```
if cultural_script_contains(long-term-orientation (L: Real))
and current_round (X: Integer)
and deal_in_round (T: Trader, B: Bid, X)
and partner_model_contains_belief(T , trustworthiness, W: Real)
and agent_label(status, S: Real)
and partner_model_contains_belief(T , status, Y: Real)
and random(0, 1, Z: Real)
and W + (1-W)*max(L, (1 - L)*(Y - S)) < Z
then to-be-traced(B);
```

Rule 5 An LTO agents trust is more deeply affected than an STO agents if a partner defected. Beliefs about another agents traits and attitudes are updated on the basis of an experience value E, for a positive experience as $B_{t+1} = (1 - d^+)B_t + d^+E$, and for a negative experience as $B_{t+1} = (1 - d^-)B_t + d^-E$, with $d^- \geq d^+$ and the endowment factor $e = d^+/d^-$.

```
if cultural_script_contains(long-term-orientation (L: Real))
and agent_trait_value(base_neg_update_factor, N: Real)
and agent_trait_value(base_endowment_factor, E: Real)
and lto_endowment_factor (F: Real)
then neg_update_factor(N*(1 - L) + L)
and endowment_factor(E*(1 - L) + F*L);
```

Rule 6 An STO agent has stronger preference to select high-status partners than an LTO agent. The acceptability of a partner depends primarily on its believed fairness, but an STO agent also takes the partners societal status into account. It likes to show off, while an LTO agent is interested to have long-standing business relationships, independent of partners status.

```
if cultural_script_contains(long-term-orientation (L: Real))
and partner_model_contains_belief(T: Trader, fairness, F: Real)
and agent_label(status, S: Real)
and partner_model_contains_belief(T , status, Y: Real)
then acceptability (T, F + (1 - F)*(1 - L)*max(0, Y - S));
```

Rule 7 An STO agent has aversion against partners that did not respect it (rule 2) or simply did not reply to a bid in an ongoing negotiation. It drastically reduces its fairness belief about the partner if a partner did not show respect by making acceptable proposals.

```
if cultural_script_contains(long-term-orientation (L: Real))
and current_round(X: integer)
and stop_negotiation(T: Trader, X, C: Commodity_list, gap)
and partner_model_contains_belief(T: Trader, fairness, F: Real)
and neg_update_factor(N: Real)
then new_fairness(T, (1 - max(N, 1  L))*F);
```

```
if cultural_script_contains(long-term-orientation (L: Real))
and current_round(X: integer)
and stop_negotiation(T: Trader, X, C: Commodity_list, no_accom)
and partner_model_contains_belief(T: Trader, fairness, F: Real)
and neg_update_factor(N: Real)
then new_fairness(T, (1 - max(N, 1 - L))*F);
```

```
if cultural_script_contains(long-term-orientation (L: Real))
and current_round(X: integer)
and stop_negotiation(T: Trader, X, C: Commodity_list, no_reply)
and partner_model_contains_belief(T: Trader, fairness, F: Real)
and neg_update_factor(N: Real)
then new_fairness(T, (1 - max(N, 1 - L))*F);
```

5 Experimental Verification

The implementation of the rules developed in the previous section was verified at two levels. First the rules were verified at the level of individual decisions in scenarios of one-to-one agent interactions. Secondly the rules were verified in multi-agent simulations. In the multi-agent simulations, eight supplier agents and eight customer agents were trading commodities with a varying quality, visible to the supplier but invisible to the customer.

To assess the sentisitivity of the model for parameter settings, a thousand runs of 100 time steps were performed to test the sensitivity for a set of 10 parameters. For each parameter a random value was independently drawn from the uniform distribution for each run. 8 supplier agents and 8 customer agents were all configured homogeneously with the parameters drawn for the run. The number of successful transactions was observed per run. The observed output appeared to be particularly sensitive for three parameters: the LTO-index, the weight factor w_2 for quality in the utility function, and the initial fairness belief about other agents. A linear model of the number of successful transaction was fitted for the ten parameters. The adjusted R^2 value was 69.0%.

Table 2 presents estimated values of the bottom marginal variance and the top marginal variance associated with the parameters for this model. The bottom marginal variance is the percentage of total variance of the output that is no longer explained if the parameter is removed from the model; the top marginal value is the percentage of variance explained by a simple regression model of the parameter, as explained in [11].

The percentage of variance explained is rather low. Adding an interaction term for the three dominant parameters resulted in an R^2 value of 74.3%. A better fit could not be found. The remaining variance may be attributed to random effects in the simulation. In order to assess the variance introduced by random effects, 30 random parameters sets were generated. With each of these sets, 33 runs of 100 time steps were performed. For each set of 33 run with equal parameters, the standard deviation of the number of successful transactions was computed. The results for the standard deviation as percentage of the mean value are: minimum value 6.5, 25-percentile 8.2, median 9.6, mean 10.6, 75-percentile 12.9, maximum 17.9.

Scenarios were run to test the effect of the LTO index in different homogeneous and heterogeneous configurations, in 6 sets of 100 runs. 100 independent parameter sets were generated at random, except for LTO and for status. The random parameter sets were reused for each set of 100 runs, in order to enable pairwise comparison

Table 2 Interval used for generation of ramdom values, and bottom marginal variance (BMV) and top marginal variance (TMV) of 10 parameters used for sensitivity anlysis.

parameter	interval	BMV	TMV
LTO	[0.01, 0.99]	27.1	25.6
status_difference	[0.01, 0.99]	0.4	0.3
honesty	[0.01, 0.99]	4.3	4.2
initial_fairness	[0.01, 0.99]	6.5	7.8
impatience	[0.01, 0.99]	2.6	4.0
endowment_coefficient	[0.50, 0.99]	0.4	0.3
lto_endowment_coefficient	[0.20, 0.50]	0.0	0.0
weight_Q	[0.01, 0.99]	26.3	27.1
weight_R	[0.01, 0.99]	0.2	0.2
negative_update_factor	[0.01, 0.99]	0.8	0.0

of individual runs. Values of LTO were fixed to LTO=0.2 for all agents in the first 100 runs, LTO=0.8 for all agents in the second 100 runs, LTO=0.2 for suppliers and LTO=0.8 for customers in the third 100 runs, vice versa in the fourth 100 runs. In the fith 100 runs, 4 suppliers and 4 customers were given a value of LTO=0.2, the other agents were given LTO=0.8. Status was equal for all agents in the first 500 runs. In the last set of 100 runs, status was assigned at random at each individual agent. Table 3 presents average results of multi-agent simulations.

Table 3 Average statistics of sample runs with long-term oriented (LTO=0.8) and short-term oriented (LTO=0.2) agents; the presented figures are mean values of 100 runs, each having a duration of 100 time steps; eight suppliers and eight customers can select each other for negotiation, exchange bids, deliver truthfully or defect, and request a trace.

Supplier culture	STO	LTO	STO	LTO	mixed	status
Customer culture	STO	LTO	LTO	STO	mixed	status
Number of succesful transactions	91	43	92	42	69	57
Number of traces requested	11.8	2.2	3.3	9.1	6.9	6.0
Number of defections revealed by tracing	0.7	0.0	0.2	0.1	0.3	0.4
Number of unrevealed defections	2.4	0.5	3.3	0.3	1.8	1.8
Average quality agreed in transactions	0.9	0.7	0.9	0.8	0.9	0.9

The high frequency of tracing and defection and the high level of average quality where STO-agents are involved is as expected and corresponds to the rules. The differences in number of transactions are more puzzling. All differences are significant at the two-sided 99% level, except the difference between run sets 1 and 3 and run sets 2 and 4. The high volumes of transactions occur in particular in individual runs with STO-agents where the w_2 parameter is very high. This makes the agents careless about money. For realistic simulations this parameter should not be set greater than 0.5. Another option might be to replace the additive utility function by a Cobb-Douglas type function. However, the latter requires a recalibration of the applied negotiation architecture, for which realistic parameter values were assessed for use with the additive utility function in human experiments.

A second factor that strongly influences the results is the initial setting of the fairness belief that agents maintain about other agents. It plays an important role in the partner selection process. If its value is low, the experience of a single successful transaction may improve the mutual beliefs to such extent that the agents stick together forever. So the initial setting of this parameter should be a realistic value, e.g., equal to the minimum-utility that agents apply in negotiations.

The results verify the implementation of the rules in the agents, in the sense that they behave and interact as expected. However, these tests do not validate the model to represent real trade processes. They only verify the correct implementation of the rules.

6 Conclusion

Hofstede and numerous other authors (e.g. [8]) describe cultural differences and their effect on trade at the individual level. The present paper contributes to bridging the gap between those approaches with agent-based modelling. In agent-based economics, individual traders are modeled as intelligent agents cooperating in an artificial trade environment. The agents are modeled as closely as possible to authentic human behavior. In recent papers the differences between such agents is no longer solely attributed to differences in their individual economic situations. Aspects such as personality and attitude are considered as well, see for example [12]. Without considering such aspects, the simulations will not correspond to reality. With respect to formalizing the important influence of cultural background on trade, we only found a few papers. The papers study trade at the macro-level. For instance, [13] presents an equilibrium analysis on the amount countries invest in learning another language and culture and the size and well fare of those countries. Bala and Long [14] present a formal model of the influence of trade on culture, i.e., the reverse direction of influence as studied in the current paper. Other literature also uses macro-level models, such as the gravity model to study the correlation between culture and trade, e.g., [15].

The contribution of the present paper is the formalization and simulation of culture with respect to the influence of Hofstedes cultural dimension of long-term versus short-term orientation. This dimension is relevant for trade between East Asia and the Western world. The formalization and simulation have been carried out on the micro-level, i.e., on the level of the individuals participating in trade. The trader behavior is formalized in the form of rules that take long-term versus short-term orientation of the parties involved into account. The agents reason with a perceived model of the parties they consider for trading. These perceived models do not contain estimates of the culture of the other parties.

The implementation of the model has been verified to qualitatively represent the effects expected on the basis of Hofstedes theory, if agents were configured either extremely long-term oriented or extremely short-term oriented. However, validation against empiric data from experiments are required to calibrate parameters to actual

behavior and to scale Hofstedes LTO index realistically to the simulation parameter setting. Validation and refining and tuning the model to real-life situations remains for future work.

The model has been developed as a research tool to experiment with intercultural trade processes in different institutional settings. Other potential application areas are training programs for business schools and international companies.

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