

# **DETERMINANTS OF REVERSE AUCTION RESULTS: AN EMPIRICAL EXAMINATION OF FREELANCER.COM**

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## **Abstract**

*In recent years, auction mechanisms have been widely implemented in online platforms, leading to the advent of reverse auctions sites on which people can offer small- and medium-sized projects such as craft or information technology (IT) projects. These sites are especially interesting for freelancers who can bid for a particular project. The principal offering the project can make a decision based on the bid amount as well as on other information available about the freelancers. In this paper, we derive factors from transaction cost theory that explain the decision of a principal besides the bid amount. Based on an empirical analysis of bidding information extracted from Freelancer.com, we found that the bid amount has the highest effect on the decision of the principal followed by the number of reviews the freelancer has already received and the number of already conducted transactions between a freelancer and a principal. We also found that principals prefer freelancers who live in the same cultural area. Furthermore our results indicate that a gold membership has no effect on the decision of the principal which is of interest especially for those freelancers who believe they are considered to be more reliable as a gold member.*

*Keywords: reverse auction, transaction cost, reputation, freelancer.*

# 1 Introduction

Historically, auctions have had a long tradition and can be dated back to 500 B.C. However, not until the rise of the World Wide Web were auctions adopted as a broad market mechanism. In particular the decreased transaction costs for carrying out auctions can be seen as the reason for this development (Bakos 1997). In online auctions it is no longer necessary for all participants to physically participate in the auction at the same time. With the abolishment of these restrictions auctions are no longer limited to a certain kind of products, e.g. paintings, but can now encompass all kinds of products and services as can be observed in the various online auction platforms (e.g. eBay, Freelancer.com).

The decrease in transaction costs for carrying out auctions has led to an increased problem of information asymmetries which directly influence the probability of an adverse selection (Dewan and Hsu, 2004). In online auctions it is easier to operate with a false identity or to refuse the delivery of the goods after receipt of payment. Thus the selection of an appropriate transaction partner in online auctions depends intensely on trust in the transaction partner (Sun, 2010; Bierhoff and Vornefeld, 2004). Trust is hereby mostly established by the reputation of the potential transaction partner. Several studies have shown that if a seller has a good reputation, they can achieve higher auction profits. In particular this correlation was analysed on the basis of a Vickrey auction (Houser and Wooders, 2006; Stern and Stafford, 2006). However, a transfer of these results to other auction modes seems feasible.

In recent years reverse auctions have been increasingly used as an online auction mode. There the initiative emanates from the buyer (principal) and the seller (agent, freelancer) who places the bid. Thereby the decision for a certain agent can either be based solely on the bid (e.g. Dubli.com) or can be decided freely by the agent (e.g. my-hammer.com, eLance.com, Freelancer.com). Particularly in the latter it can be assumed that it is important for the agent to know, which factors the principal takes into consideration in awarding the bid. The principals want to reduce their costs as much as possible. A part of these costs are the transaction costs, so the principals have an intention to reduce transaction costs for searching for an appropriate transaction partner. Specifically in online auctions transaction partners are anonymous which provides an avenue for unfair behaviour especially of the agents (Carter and Stevens 2007). The possibility of unfair behaviour increases transaction costs of online reverse auctions. The reputation of agents helps to reduce transaction costs of a principal due to its ability to provide an insight into the agents' behaviour. Other variables influencing transactions costs of a principal especially in online reverse auctions have been sparsely researched. The theory of transactions costs has been applied in order to explain the bids of Dutch flower auctions (Koppius and van Heck, 2002) and the market efficiency in double auctions (Noussair et al., 1998) though.

The goal of this study is, based on a theoretical derivation, to confirm empirically influencing factors on the acceptance of a bid in online reverse auctions. In doing so transaction cost theory is applied as a basis for the definition of the influencing factors. The empirical verification of the deduced influencing factors results from data, collected from the online auction platform Freelancer.com.

Section 2 of the paper introduces transaction cost theory and the derived hypotheses. The empirical verification is carried out in section 3. In section 4 we discuss the implications of our results as well as the limitations of our study and give suggestions for further research.

## 2 Influencing factors on the bids of reverse auctions

Online reverse auctions constitute a special kind of transaction, which differs from other transactions in the information and, particularly, in the bargaining phase. Getting information about possible transactions or transaction partners is simplified and does not require the physical presence of the auction parties at a certain place and a certain time. On the other hand, the Web facilitates the use of false information or the hiding of certain information by the transaction partners, particularly the agent.

Based on the assumptions of transaction cost theory the principal especially has to deal with uncertainty. On the one hand there is parametric uncertainty, which describes the uncertainty about future environmental developments concerning the transaction. On the other hand there is behaviour-related uncertainty, based on the assumption of opportunistic behaviour of the market participants, which occurs on the basis of information asymmetries (Williamson, 1985). This results in higher information and control costs. To reduce the behaviour-related uncertainty in reverse auctions, it is of vital importance to build trust between the principal and the agent. Trust is hereby defined as the judgement of the reliability of the agent and the resulting willingness of the principal to conduct transactions, despite the possibility of opportunistic behaviour by the agent (Wang and Benbasat, 2008).

To reduce opportunistic behaviour and to build trust, nearly all big online auction platforms have introduced reputation mechanisms. Principals (and sometimes also agents) can rate the performed transactions and communicate their experiences with specific transaction partners. The reputation mechanisms of the various online auction platforms differ only slightly. Mostly a three-point assessment scale is used: negative, neutral and positive. Furthermore principals can publish comments, which can be seen on the agent's profile. Thus potential principals can judge the reliability of the agent and have a clue as to whether the agent is trustworthy (Ye et al., 2009; Dellarocas, 2005; Koppius et al., 2000). Kreps (1990) argues that on a one-time transaction with a specific principal, selfish and profit-maximizing agents have an incentive to scam. This incentive is reduced through an appropriate reputation mechanism, because the agent has to fear the resulting negative consequences when dealing with other principals.

Some empirical studies have analysed the influence of the agent's reputation on the achieved auction price. EBay which is one of the biggest auction platforms was mostly employed as data source (Zhao and Huang, 2008). Results showed that reputation has a significant and positive influence on the principal's willingness to conduct a transaction with the agent. Furthermore, agents with negative comments achieved lower prices for the products (Lucking-Reiley, Prasa and Reeves, 2007; Dewan and Hsu, 2004; Bolton et al., 2004; Melnik and Alm, 2002). Houser and Wooders (2006) showed that the agent's reputation represents a significant and economic determinant of the selling price. A 10% increase of positive ratings led to a 0.17% increase of achieved selling prices, whereas a 10% increase in neutral and negative comments led to a 0.24% decrease of achieved selling prices.

In contrast, there are also studies where reputation has no strong influence on the transactions of the agents (Gilkeson and Reynolds, 2003; Wan and Teo, 2001). In particular the negative effects of negative ratings on the agent's outcome was not always confirmed (Bajari and Hortacsu, 2003; Jin and Kato, 2008). Based on a meta-analysis Liu et al. (2007) concluded that reputation influences the agent's outcome, positive ratings lead to significantly higher selling prices, whereas negative ratings lead to lower selling prices and neutral ratings have no significant influence on the selling price.

In reverse auctions the bidders represent the agents and in the particular reverse auction online platform the principals can choose freely, with which agent they conduct the transaction. So the following hypothesis can be postulated:

*H1: The better the agent's reputation, the better the agent's possibility of winning the auction.*

Besides the implementation of reputation mechanisms other measures to reduce behaviour-related uncertainty are also possible. In particular this includes singular or regular paid fees to use certain functions of the online auction platform. Such fees represent costs for the agent and only pay off, if the profits from the auctions exceed the fee. As a result the agent has an incentive, to conform to the principal's expectations in order to achieve the profits. If every agent has to pay the same fee, the behaviour-related uncertainty is reduced equally. If fees apply only by choice or for certain functions, it can be argued, that the agent with the willingness to pay those fees, has a higher level of trust, based on the behavioural assumptions underlying the expenses of the fee. So this signalling measure (Kirmani and Rao, 2000) may lead to a higher willingness of the principal to conduct a transaction with the agent. Hence the following hypothesis can be formulated:

*H2: Bidders, who invest by choice in special services, have a higher possibility of winning an auction.*

Besides uncertainty, specificity is another reason for increasing costs according to transaction cost theory. Based on the deliberation that during a transaction, transaction-specific investments by one transaction partner are done, one-sided dependences can occur. This can lead to opportunistic behaviour by the other transaction party (Hill, 1990). The specificity of online auction transactions is mostly low, because the goods already exist and only an exchange of goods and money takes place. In particular reverse auctions are used to auction off services, whereby the provision of a service can bear a high level of specificity. If transactions, based on a higher level of trust, are repeatedly carried out between the same transaction partners, a higher level of specificity can occur, even in auctions with a usual low level of specificity (Williamson, 1985). Specificity affects transaction costs depending on the frequency of the transactions. The more frequently the same transaction occurs, the lower the transaction costs are, based on learning processes regarding the execution of the transaction. Such learning processes can also appear if transactions proceed between the same transaction parties (Bea and Göbel, 2002). So the following hypothesis can be derived:

*H3: The more frequently one bidder was chosen by principal X, the higher their possibility of winning an auction of X.*

According to transaction cost theory there are further transaction influencing factors. These are summarized under the term transaction atmosphere and include, in particular, political, social and legal framework conditions (Williamson, 1975). Cultural and linguistic differences between the agent and principal are among the cultural factors (Chen et al. 2002). Linguistic and cultural resemblance eases the communication between both transaction parties and thus leads to reduced transaction costs. This coherence is specified in the following hypothesis:

*H4: The more similar, regarding linguistic and cultural aspects, agent and principal X are, the higher their possibility of winning an auction of X.*

In addition to the transaction costs, production costs also influence the choice of the transaction partner. The costs, which arise from the transformation of the service, form the production costs. At various auction forms, the choice of the bidders is only limited to the production costs, represented by the bid level. At the here observed reverse auctions with free choice of agent, production costs constitute a further influencing factor, besides the transaction costs. At reverse auctions the principal chooses the agent, so the selection will be done by minimizing the costs for the principal. With regard to the transaction costs, the following hypothesis can be derived:

*H5: The lower the production cost of a bidder, the higher their possibility of winning an auction.*

Some of the derived influencing factors have already been analysed in several studies, especially the influence of reputation, whereas the influence of the transaction atmosphere is unknown so far. Table 1 summarizes the studies and the investigated influencing factors.

<b>Dependent variable</b>	<b>Study</b>
Auction price	Dewan and Hsu, 2004; Melnik and Alm, 2002; Gilkeson and Reynolds, 2003; Lui et al., 2007; Zhang, 2006; Standifird, 2001; Wan and Teo, 2001; Haruvy and Popkowski Leszczyc, 2010; Easley et al. 2010
Price premium	Gregg and Walczak, 2008; Stern and Stafford, 2006; Hou 2007
Willingness to transact	Gregg and Walczak, 2008
Number of bidders	Haruvy and Popkowski Leszczyc, 2010
Relationship with principal	Jap, 2007
<b>Independent variable</b>	
Rise of ratings by one	Melnik and Alm, 2002; Standifird, 2001
Rise of positive ratings by one	Liu et al., 2007; Standifird, 2001; Hou, 2007
Rise of neutral ratings by one	Hou, 2007
Rise of negative ratings by one	Melnik and Alm, 2002; Liu et al. 2007; Standifird, 2001; Hou, 2007
Positive ratings	Dewan and Hsu, 2004; Gilkeson and Reynolds, 2003; Zhang, 2006; Wan

	and Teo, 2001; Easley et al. 2010
Negative ratings	Dewan and Hsu, 2004; Gilkeson and Reynolds, 2003; Zhang, 2006; Wan and Teo, 2001; Easley et al. 2010
E-Image	Gregg and Walczak, 2008
Auction duration	Haruvy and Popkowski Leszczyc, 2010
<b>Control variables</b>	
Number of bidders	Stern and Stafford, 2006; Standifird, 2001; Wan and Teo, 2001; Jap, 2007; Easley et al. 2010
Number of bids	Stern and Stafford, 2006; Dewan and Hsu, 2004; Chen et al., 2002; Liu et al., 2007
Insurance	Melnik and Alm, 2002; Hou, 2007
Auction length	Melnik and Alm, 2002; Liu et al., 2007; Zhang, 2006; Hou, 2007, Wan and Teo, 2001
Starting price	Stern and Stafford, 2006; Gilkeson and Reynolds, 2003; Liu et al., 2007; Zhang, 2006; Wan and Teo, 2001
Reserved price	Liu et al., 2007; Dewan and Hsu, 2004; Zhang, 2006
Price visibility	Jap, 2007
Picture	Stern and Stafford, 2006; Melnik and Alm, 2002; Liu et al., 2007; Easley et al. 2010
Product type (new/used)	Gregg and Walczak, 2008
Weekend	Wan and Teo, 2001
Shipping	Melnik and Alm, 2002; Gilkeson and Reynolds, 2003; Liu et al. 2007; Standifird, 2001

*Table 1. Variables in previous studies*

According to Table 1, the dependent variables in previous studies were mostly limited to the auction price and the realized price premium, which is also reflected in the auction price. As independent variables on the auction price, previous studies focused on ratings. Both the influence of positive or negative ratings and the influence of an increase of positive, negative or neutral ratings were analysed. The number of bidders respectively the number of bids, the presence of (transportation) insurance, the length of the auction, the starting respectively the reserve price, the presence of pictures, the product type and shipping factors (shipping costs, shipping provider) were used as control variables. However, not all of the used control variables can be applied to our study. So for example provided pictures and shipping costs are irrelevant in the considered reverse auctions, where services are sold by auction.

Regarding previous research, one can criticize that on the one hand, in most studies, only influences on the auction price were investigated and that on the other hand the analyses were mostly limited to eBay, whereby the results are restricted to Vickrey auctions and eBay. Only Jap (2007) has reported a study investigating factors influencing the result of online reverse auctions. Minimizing transaction costs was defined as core premise for principals, but the operationalization of transaction costs was mostly limited to the reduction of behaviour-related uncertainty through the use of reputation mechanisms, insurance offerings or provided information. Recent studies, however, indicate that the auction result depends on multiple factors and reputation is one of the most important factors.

### 3 Empirical Evaluation

#### 3.1 Data Collection

In order to prove the hypotheses derived in the former section we collected data from 2,662 closed auctions from Freelancer.com, which is a web portal for the global outsourcing of small- and medium-sized IT-projects (e.g. development of websites, administration of blogs and newsletters, development of software). More than 1.9 million users worldwide were registered in November 2010 and already more than 850,000 projects have been successfully auctioned and completed using Freelancer.com.

Potential agents can apply for a listed project with a bid consisting of an amount in costs and an estimated time to delivery. Both bid specifications influence the production costs either directly or indirectly and hence the decision of the principal (H5).

For selecting an agent, the principal has access to further information such as the reputation and gold membership of each agent. Reputation is expressed as the average current rating, number of posted ratings and the number of incomplete projects. These reputation values are appropriate for estimating the behaviour of an agent and to avoid moral hazard and shirking (H1). Another indicator allowing the pre-evaluation of the behaviour of an agent might be the gold membership. Each agent can become a gold member on Freelancer.com for a monthly fee of US\$ 20. The gold membership is intended to signal a high degree of loyalty, because an agent who regularly invests money is willing to seriously bid for and complete projects (H2).

The rating profile of an agent indicates how often the agent has already conducted a transaction with a particular principal. We thus can prove whether agents having already completed projects for a principal are preferred (H3). The country of origin of the principal and the agents is also apparent on their user profile. We operationalized cultural similarity while assigning countries with cultural spaces (H4). If principal and agent are from the same cultural area, we define them as culturally similar. There is no common division of the world into cultural areas, though. However, most of the classifications are very close to each other, some define, for example, Europe as a cultural area (Newig, 1995) while others see no cultural difference between Europe and Northern America (Huntington, 2002). In this paper we use the classification of Huntington which is shown in Table 2.

Cultural Area	Number of Principals	Number of Agents
Western	2031	6209
Orthodox	53	1700
Islamic	239	5139
African	29	790
Latin American	68	829
Sinic	25	550
Hindu	174	13976
Japanese	6	19
Other	37	2037

Table 2. Cultural areas and the number of principals as well as agents originating in the areas

Taking Table 2 into account, it is striking that approximately 76% of the principals are from Western countries while 61% of the agents are from Islamic or Hindu countries. We can thus manifest that Freelancer.com is an IS supporting to outsource small- and medium-sized IT-projects.

All variables used in this study as well as their data-level and assignment to the hypotheses derived in the previous section are shown in Table 3. Cultural similarity is a dichotomous variable stating whether principal and agent are from the same cultural area.

Variable	Symbol	Level	Hypothesis
Bid Amount	X <sub>1</sub>	Metric	H5
Time to Delivery	X <sub>2</sub>	Metric	H5
Avg. Rating	X <sub>3</sub>	Metric in [0;10]	H1
Number of Reviews	X <sub>4</sub>	Metric	H1
Number of Incomplete Projects	X <sub>5</sub>	Metric	H1
Gold Member	X <sub>6</sub>	Dichotomous	H2
Number of Joint Projects	X <sub>7</sub>	Metric	H3
Cultural Similarity	X <sub>8</sub>	Dichotomous	H4

Table 3. Variables used in this study

All variables shown in Table 3 are independent variables. We used the dichotomous variable decision of the principal for agent  $a$  as the dependent variable. The number of agents that can apply for a listed project is not restricted. In order to analyse the effect of transaction costs on our dependent variable, only those projects for which the principal has made a decision were considered. Furthermore we disregarded all projects having only one bid. We collected data of about 20 days from Freelancer.com. This data consists of 2,662 projects and 31,249 bids, so that 11.74 bids were made on average for a project. The bid amount is US\$ 218.83 on average (SD=US\$ 3249.30) and a maximal US\$ 500,000. However, only 11.66% of the bids were higher than US\$ 250 while 29.26% were equal to the minimum of US\$ 30. We can therefore state that projects offered at Freelancer.com are typically small- and medium-sized. It is striking that the rating of those agents who have already been reviewed is 9.82 (of 10) in average and that the standard deviation of this variable is only 0.38. We hence expect only a marginal effect of average rating on the decision of a principal. A summary of descriptive statistics about the independent variables is given in Table 4.

Statistic	Value
Number of Auctions	2,662
Number of Bids	31,249
Average Number of Bids per Auction	11.74
Average Bid Amount	US\$ 218.83
Average Bid Range	US\$ 425.61
Average Number of Reviews	45.73
Average Rating	9.82
Percentage of Winners with Gold Membership	51.65%
Percentage of Losers with Gold Membership	34.88%
Percentage of Winners from the same Cultural Area as the Principal	24.15%
Percentage of Losers from the same Cultural Area as the Principal	20.18%
Average Number of Joint Projects (Winners)	1.77
Average Number of Joint Projects (Losers)	0.03

Table 4. Descriptive statistics about the independent variables

### 3.2 Data Analysis

Since we want to analyse data from several auctions, we must normalize them such that the minimal as well as the maximal value for each independent variable is comparable over all auctions. We set the maximal value of each independent variable to 1 and the minimal value to 0. If, for example, the bid amount of an auction 1 is between US\$ 30 and US\$ 60 and that of an auction 2 is between US\$ 100 and US\$ 250 it is not possible to analyse the effect of the bid amount when jointly analysing auction 1 and 2. Such a joint analysis of all project auctions is, however, necessary because we only have one agent per auction for which our decision variable is 1 (winner of the auction).

We defined datasets consisting of the winner and another agent randomly selected from all non-winning bidders. These dataset were defined to compensate for the effect of a varying number of bids per auction. We generated a sample of 50,000 datasets using bootstrapping. Using only auctions with two bidders would be an alternative to our approach. However, this alternative is biased, since auctions with more than two bidders are not in the sample. With our sampling approach we can assure that the influence of our independent variable is not moderated by the number of bidding agents.

We conducted the following logistic regression analysis, since our dependent variable is dichotomous:

$$Prob(Decision) = e^Z / (1 + e^Z)$$

where  $Z$  represents the linear combination:

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8$$

We further computed the variance inflation factors in order to quantify the severity of multicollinearity of the logistic regression. The results of these analyses are presented in the next session.

### 3.3 Results

The results of the logistic regression are shown in Table 5. A first surprising result is that gold membership and the number of aborted projects have no significant influence on the decision of a principal. All other variables are appropriate for explaining the decision. Table 6 presents the quality of the overall model. Based on several criteria we can state that our model has an acceptable quality.

Variable	$\beta$	$e^{\beta}$	95 % Interval		Std. Err.	VIF	Wald-z	Sig.
			2.5 %	97.5 %				
Intercept	-0.1715	0.8424	0.8123	0.8737	0.0186	-	-9.23	< 0.001
Bid Amount	-1.0802	0.3395	0.3240	0.3558	0.0239	1.2203	-45.13	< 0.001
Time to Delivery	-0.4279	0.6519	0.6262	0.6786	0.0205	1.1642	-20.87	< 0.001
Avg. Rating	0.0791	1.0823	1.0782	1.0865	0.0019	1.6775	40.70	< 0.001
Number of Reviews	0.9483	2.5812	2.4715	2.6957	0.0222	1.5912	42.81	< 0.001
Number of Incomplete Projects	-0.0010	0.9990	0.9963	1.0017	0.0014	1.2330	-0.74	0.462
Gold Member	-0.0315	0.9690	0.9363	1.0029	0.0175	1.5576	-1.80	0.073
Number of Joint Projects	0.6747	1.9634	1.8887	2.0410	0.0198	1.0262	34.12	< 0.001
Cultural Similarity	0.4516	1.5709	1.5196	1.6238	0.0169	1.0288	26.71	< 0.001

Table 5. Results of the logistic regression analysis

Criterion	Value	Acceptance Level
Likelihood Ratio	19227.89	-
Degrees of Freedom	8	-
Sig. Likelihood-Ratio-Test	< 0.001	$\leq 0.05$
Nagelkerke's $R^2$	0.233	$\geq 0.20$
Kendall's $\tau$ - $\alpha$	0.243	$\geq 0.15$
Goodman-Kruskal $\gamma$	0.488	$\geq 0.10$
Brier Score	0.205	lower is better
Akaike's Information Criterion	119600	lower is better

Table 6. Quality criteria of the logistic regression analysis

All variables except gold membership and number of incomplete projects either have a positive or a negative effect, because there is no 95% interval starting on a level lower than 1 and ending up on a level greater than 1. The direction of the effect of the variables gold member and number of incomplete projects is thus not clear. Since these variables have been already identified as not significant, we have to declare them as inappropriate to explain the principals' decisions. A negative influence of the bid amount and project duration, and a positive influence of the average ranking, the number of reviews, the number of joint projects and the cultural similarity are detected with a confidence interval of 95%. There is no evidence for multicollinearity in our model due to very low variance inflation factors ( $VIF \leq 5$ ) and moderate low correlations between the variables as shown in Table 7. Table 8 summarizes the results with respect to the derived hypotheses.

Bid amount is the most discriminating variable followed by the number of reviews, the number of joint projects, cultural similarity, and the project duration. Average rating significantly explains the decision of a principal but with a little explanation power only. We also estimated the same regression for those 311 projects having only bids higher than US\$ 249 and found that the number of reviews is most discriminating for this type of projects, followed by bid amount and cultural similarity.



Variable	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>
Bid Amount (X <sub>1</sub> )	-	0.3871	-0.0337	0.1477	-0.0131	0.0448	0.0392	0.0158
Time to Delivery (X <sub>2</sub> )	0.3871	-	-0.0933	0.0344	-0.0417	-0.0438	-0.0197	-0.0114
Avg. Rating (X <sub>3</sub> )	-0.0337	-0.0933	-	0.5517	0.2811	0.5641	0.1140	-0.0748
Number of Reviews (X <sub>4</sub> )	0.1477	0.0344	0.5517	-	0.3620	0.4528	0.2183	-0.0706
Number of Incomplete Projects (X <sub>5</sub> )	-0.0131	-0.0417	0.2811	0.3620	-	0.3689	0.0806	-0.1166
Gold Member (X <sub>6</sub> )	0.0448	-0.0438	0.5641	0.4528	0.3689	-	0.1592	-0.0993
Number of Joint Projects (X <sub>7</sub> )	0.0392	-0.0197	0.1140	0.2183	0.0806	0.1592	-	-0.0292
Cultural Similarity (X <sub>8</sub> )	0.0158	-0.0144	-0.0748	-0.0706	-0.1166	-0.0993	-0.0292	-

Table 7. Correlation matrix of the independent variables

Hypothesis	Variable	Decision
H1	Average Rating	supported
	Number of Reviews	
	Number of Incomplete Projects	not supported
H2	Gold Member	not supported
H3	Number of Joint Projects	supported
H4	Cultural Similarity	supported
H5	Bid Amount	supported
	Time to Deliver	

Table 8. Summary of the results

When removing the variables gold member and number of incomplete projects from our model, we got the same results for Nagelkerkes  $R^2$ , Kendall's  $\tau$ - $\alpha$ , Goodman-Kruskal's  $\gamma$  and Brier Score and only a marginal lower likelihood ratio (19223.01).

## 4 Discussion

### 4.1 Implications for Research

In this paper we developed and empirically tested a model for explaining why an agent has won a reverse auction in which the principal is free to make a decision independent from the bid amount. The model was developed upon the assumption that principals act as cost minimisers and want to minimize both production and transaction costs. This assumption also determines other studies. But in contrast to other studies, we first examined other factors than uncertainty influencing the decision of a principal. The model developed here thus represents an extension of existing work, but it also requires further investigations to hedge our findings.

The findings of this study have also shown that, if available, a principal considers many factors when making a decision about a transaction partner. Since other platforms like Elance.com or peopleper-hour.com also provide information facilitating the evaluation of the loyalty of potential agents, it becomes possible to further examine the decision behaviour of principals. We thus hope our findings will not only be hedged, but also extended based on future studies.

From a statistical point of view we made a suggestion in this paper on how to analyse models with a dichotomous dependent variable which is in most cases 0 and only in one case 1. The proposed normalization and the bootstrapping approach allows many auctions to be subsumed and to avoid a bias based on different numbers of bids per auction and different maximal and minimal levels of our independent variables.

## 4.2 Implications for Practice

Our findings allow implications to be deduced for both bidders and providers of similar auction platforms. The most impressive implication for Freelancer.com and similar websites is that the revenue model they have implemented is not sustainable from a transaction cost perspective. Users of such a platform must pay a monthly fee in order to become a gold member. For Freelancer.com the most important benefit of the gold membership for a bidder is that “Gold members are often regarded as more reliable ...” (<http://www.freelancer.com/faq/view.php>). However, project creators do not honour such a membership in terms of a higher probability to be selected as auction winner. There is thus no need to become a gold member when the purpose for a bidder is to increase the bidder’s probability of winning an auction. Although some other advantages are associated with a gold membership, our findings indicate that a very important advantage has no evidence.

Furthermore the results allow a bidding strategy to be extracted that increases the probability of winning an auction. New members have the problem that they have not been reviewed yet and that they have not conducted a transaction with any principal. They hence must compensate these drawbacks with a decreased bid amount and an earlier delivery date. In order to increase their probability of winning the first project they should preferably bid for projects where the principal lives in the same cultural space. Agents might be enticed to generate a shallow identity which is used to offer projects that the agent wins with her true identity. This strategy helps to increase the number of reviews and has to be prevented by the auction platform provider.

Mature bidders can charge higher prices especially when they have already cooperated with the same principal and/or they have been reviewed by plenty of principals. We thus compared the bid amounts between those agents with the most reviews and those with the least reviews (per project) and found that there is a significant difference ( $p < 0.001$ ). Agents with a high number of reviews demand on average 17.0% more for the same project than those agents with a low number of reviews. Furthermore, agents with a high number of reviews have an estimated project duration which is 7.8% higher than the project duration of agents with a low number of reviews ( $p < 0.001$ ). Significant differences have been also identified when comparing the agent with the highest number of reviews to the average agent of a particular project. Agents with the highest number of reviews have a 3.1% higher bid amount ( $p < 0.001$ ) and 1.6% higher expected project duration ( $p = 0.0366$ ) than the average agents. These results are in line with those presented in section 2 of this paper.

However, it is worth noting that the average rating of a bidder has only a marginal effect on the decision of the principals. It is therefore not possible to prevent unfair behaviour such as rest-on-the-laurels. Although some information is available in order to make a satisfying agent selection none of this information can reliably assure that any agent is loyal and reliable. The problem of an adverse selection could be, however, alleviated if the principal would also use the number of aborted projects in order to make a selection.

## 4.3 Limitations and Further Research

As indicated in section 3, all but one hypothesis could be supported. However, there is just space for improvements of the proposed model since the quality criteria are acceptable but not outstanding. This suggests that other factors may exist which also influence the decision of a principal. Since the bids are not binding, renegotiation and private communication might have a strong distorting effect on the auction result. We were not able to observe this data though.

The investigation carried out in this paper assumes, at least implicitly, that principals are acting as rational deciders. From various source we know, however, that such decisions are sometimes neither rational nor rationally intended (Arkes and Ayton, 1999). Against this background, it seems conceivable that the selection of an agent is not rational or rationally intended in all cases.

As mentioned above cultural similarity is considered to be an influencing factor for transaction costs, but an operationalization of this construct is lacking. In this study we measured cultural similarity based on an assignment of the countries to cultural spaces. Although we believe that such a classification of cultural spaces is superficial, the proposed operationalization can be viewed as a first idea. However, further work is required in order to better measure assumptions and prejudices a principal may have about a bidder based on the country the bidder is living in.

Although the normalization of data was necessary to make independent variables comparable over all auctions, it prevented the effect of absolute variable levels to be measured. For example, assume a project for which two bids exist. Bidder 1 has been reviewed only once while bidder 2 has never been reviewed. Furthermore assume a second project which also has two bidders, bidder 3 has 100 reviews while bidder 4 has 20 reviews. After normalizing this data, bidder 1 and 3 have the same review value (1) while bidder 2 and 4 have a review value of 0. This allows the relative effect to be extracted that a bidder with more reviews has a higher probability of winning an auction but it does not allow the effect of the absolute number of reviews to be analysed. In this example a principal might make no difference between 0 and only 1 review. Investigating the effect of the absolute number of reviews might provide an avenue for further research.

Since our findings are based on an examination of only one auction platform, we plan to analyse another online reverse auction platform in order to retest the proposed hypotheses. With the explosive growth of projects auctioned online, research on reverse auctions will have a far-reaching impact.

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