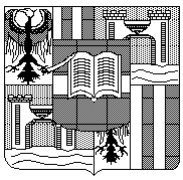

DEPARTMENT OF ECONOMICS
JOHANNES KEPLER UNIVERSITY OF LINZ

Reputation and Certification in Online Shops

by

Franz HACKL
Agnes KÜGLER
Rudolf WINTER-EBMER

Working Paper No. 1116
November 2011

Johannes Kepler University of Linz
Department of Economics
Altenberger Strasse 69
A-4040 Linz - Auhof, Austria
www.econ.jku.at

franz.hackl@jku.at
phone +43 (0)70 2468 -8333, -28333 (fax)

Reputation and Certification in Online Shops*

Franz Hackl†
Agnes Kügler‡
Rudolf Winter-Ebmer§

March 20, 2012

Abstract

We investigate the impact of self-organized reputation versus certification by an independent institution on demand for online shops. Using data from a large Austrian price comparison site, we show that quality seals issued by a credible and independent institution increase demand more than feedback-based reputation. This result is important for markets where the market-maker must deal with issues of asymmetric information concerning the quality of goods and services in the market.

Keywords: online markets; search engines; signaling; certification; reputation;
JEL Classification: C23, D21, D81, L15

*This research was supported by Grant 12444 of the Austrian National Bank's Jubilee Fund. Thanks to workshop participants in Valencia and Vienna.
†Johannes Kepler Universität, Linz, Austria; Email: franz.hackl@jku.at
‡Vienna University of Business and Economics, Austria; Email: akuegler@wu.ac.at
§Johannes Kepler Universität, Linz, Austria; Email: rudolf.winterebmer@jku.at and IHS, Vienna

1 Introduction

Buying online has specific asymmetric information problems: due to physical distance, potential buyers cannot properly assess the quality of the product or the handling of the supplier concerning delivery and complaints. The challenge for high-quality firms to communicate their quality is also present in an internet price-comparison (shopbot) setting: here, the shopbot intermediary facilitates the comparison of prices by constructing a website where all suppliers of a particular product are listed on one page. Such markets reduce search costs and increase price awareness enormously; therefore, online sellers have an urgent need to differentiate themselves by service quality, or they may use obfuscation strategies in order to avoid ruinous price wars (Clay et al. (2001) and Ellison and Ellison (2009)).

In order to solve the asymmetric information problem concerning the quality or reliability of an agent, online markets typically provide a system of reputation building that relies on customer feedback, which is structured and organized by the market maker. Examples of auctions (eBay) and shopbots (pricewatch.com or epinions.com) abound. A self-organized reputation mechanism is not without challenges, however, because of the potential for manipulation and the associated credibility problems. From a market design as well as from an economic policy point of view, it is very important to understand whether these self-organized forms of reputation building and presentation are sufficient to overcome the adverse selection problem or whether some form of quality certification from an outside institution is necessary. An official certification of a given minimum quality - often taking the form of a quality seal - may be desirable for a seller if the underlying procedure and issuing institution guarantee the credibility of the quality seal.

In this paper we compare the impact of a self-organized reputation mechanism to the impact of quality seals on demand for online sellers. To do so, we use longitudinal data from a large Austrian shopbot - www.geizhals.at - where we can observe the development of reputation as well as the granting and loss of two different quality seals over time. To our knowledge, ours is the first paper to quantitatively and systematically compare the importance of reputation to certification, which is an essential issue for the design of such markets. It turns out that quality seals are more important drivers of consumer demand than self-organized reputation; the impact of reputation vanishes once we introduce firm fixed effects. Interestingly, the costs to achieve certification have an influence on the credibility of the seal, which, in turn, is honored by the

consumers via higher demand: Quality seals that have higher costs for certification and are established and regularly checked by an independent institution attract higher demand. While our empirical results clearly provide a role for an official certification process to alleviate the adverse selection problem in online markets, the credibility and independence of the certification process are of crucial importance.

2 Reputation and Certification as Signaling Strategies

Dewally and Ederington (2006) discuss four possible strategies for retailers in asymmetric information situations to signal high quality: reputation, certification, warranties, and disclosure. In our current application of the Austrian internet shopbot, warranties and disclosure are not available. Warranties can in principle be issued by the individual firm or the market maker. The usefulness of warranties as a substitute for reputation is analyzed by Roberts (2011) for an online market for agricultural machinery. He finds that an institutionalized "money back guarantee" - even one issued by the market maker - did not determine prices or sales in this market, and therefore was no substitute for reputation, which might be due to credibility problems with the warranties.

Voluntary disclosure of quality information is another strategy that may be used predominantly by high-quality sellers. If disclosure is costless and if some other conditions apply, the so-called "unraveling result" will hold: starting with the highest-quality firm, all firms have an incentive to disclose in order to distinguish themselves from lower-quality firms (Grossman (1981) and Milgrom (1981)). In practice, however, disclosure is neither costless nor perfect: e.g., in eBay auctions, the seller can only transmit pictures of the offered product, which offers at least some limited opportunity to disclose the quality. Lewis (2011) shows for eBay used car auctions that low-cost sellers post more photos, which, in turn, increases the sales price of the car.[1]

Another strategy is to invest resources to build a reputation for high-quality products or a good price-quality ratio (Shapiro (1983), Klein and Leffler (1981)). Online markets provide an ideal setting for self-organized reputation building. Dellarocas (2003) analyzes the differences between Internet-based feedback mechanisms and traditional word-of-mouth networks and stresses problems of noisy data: costumer feedback-based reputation may be noisy

[1] In their survey, Dranove and Jin (2010) use a broader definition of disclosure that includes certification by third-party agencies.

because (i) different consumers may use different standards to measure quality, (ii) consumers who do report may be a selective sample of all customers, particularly those who are more picky, and (iii) as feedback is in general not easily verifiable, it may be prone to gaming.

Dewan and Hsu (2004) and Bajari and Hortaçsu (2003) find that positive feedback or a higher net score increases prices; in particular, the first negative feedback reduces sales considerably. Moreover, customer feedback seems to be endogeneous: after the first negative feedback, the probability of receiving further negative feedback increases (Cabral and Hortaçsu, 2010).[2]

While both voluntary disclosure and warranty and reputation mechanisms may be self-organized by either the market participants or the market maker, certification typically requires an outside body, which can either be a government institution or a private intermediary. Certification may be defined as a process whereby an unobservable quality level of some product or firm is made known to the consumer through some labeling system, which is usually issued by an independent third party (Auriol and Schilizzi, 2003). In order to be meaningful, certification must be costly to the firm, and the required quality standards must be regularly checked. Moreover, the reputation of the certification depends crucially on the reputation of the certifier. Theoretical analyses[3] focus on incentives for the certifier to give unbiased reports, the impact of certification on the market structure, and the effects on size and quality level of the market. While a certification process can, in principle, provide a cardinal measure of a firm's quality (e.g. hospital report cards), many certificates only provide information about a minimum quality level the firm must exceed (e.g., quality seals).[4]

For e-tailing, such quality seals have become increasingly common.[5] Whether the quality seal *WebTrust* strengthens purchasing intentions for both known and unknown companies was investigated by Kaplan and Nieschwietz (2003). Odom et al. (2002) find that the leading brands of web seals in the United States (*Verisign*, *TRUSTe*, *Good Housekeeping* and *CPA WebTrust*) addressed

[2]See Hoffman et al. (1999), Froomkin (1996), Friedman et al. (2000) and Grabner-Kraeuter (2002) for early discussions about the importance of trust for online shopping relative to brick-and-mortar stores.

[3]See Dranove and Jin (2010) for a survey.

[4]Licensing is another form of certification to set a minimum standard. If a license granted by a government agency is necessary to enter the industry, the lower-quality end of the market is automatically cut off.

[5]Other well-known examples of certification include the ISO 9000 quality management system (Corbet et al., 2005), food safety (Crespi and Marette, 2001), organic food (Lohr, 1998), teacher quality (Angrist and Guryan, 2008), and training standards (Acemoglu and Pischke, 2000).

only a few of online purchasers' fears and concerns, and there was a large gap between consumers' needs for assurance and what they felt was being offered by the web seals.[6] Lala et al. (2002) explored consumers' ability to differentiate between web seals of different qualities. They found a strong effect related to consumers' preference for a high information quality seal, but found that customers failed to demonstrate interest in a low information quality seal. These analyses are mostly of a descriptive nature, and are not able to directly compare certification with self-organized methods for reputation. An exception is the study by Baye and Morgan (2003), who find that firms achieve higher prices in a shopbot when they are certified by CNet; this price advantage disappeared, though, as more firms gained access to the certificate.

3 Data and Estimation Strategy

We use data from Austria's largest price search engine (www.geizhals.at), which compares product offers from different e-commerce retailers[7]. As geizhals.at is Austria's uncontested market leader, our data cover the whole Austrian online market, including suppliers from other countries (especially Germany) that are interested in Austrian e-commerce business. Together with the ranking of retailers' prices, the website indicates additional offer characteristics, as shown in Figure 1 for an arbitrarily chosen digital camera. The offers are ordered according to their prices in the first column. The second column informs the consumer about the company logo and whether the seller is endowed with a quality seal. Online feedback and the number of consumers that already have assessed that particular retailer are shown in the third column. Column four includes information on availability and shipping costs. A somewhat detailed description of the product offered by the retailer can be found in the last column.

The website classifies products into categories, subcategories, and subsubcategories.[8] For computational reasons, we restrict our data to the subcategory "digital cameras" in the category " photos" from May 1, 2006 through December 30, 2008. We use weekly data as observation units. Therefore, aggregates have been used for variables that refer to a certain time period (e.g., clicks),

[6]Edelman (2011) argues that there is adverse selection of companies acquiring trust certification for website safety from TRUSTe: the trustworthiness of certified sites was found to be lower than that of uncertified sites.

[7]The English translation of "geizhals" is "nickel nurser".

[8]As an example, the category "Video/Photo/TV" contains the subcategory "TV sets" and the subsubcategory "30-39 inch LCD TV sets."

and time-weighted averages have been calculated for variables that vary within these periods of time (e.g., prices). In total, we observe 4,365,711 price offers for 911 retailers j of 2,665 products i in 139 weeks t. From our 911 retailers in the sample, 297 shops are based in Austria, 612 in Germany, and two in the Netherlands.

Two kinds of information about retailers' service quality are presented on geizhals.at.

Self-Organized Firm Reputation: Customers can evaluate retailers' service characteristics[9] with grades between 1 (very satisfactory) and 5 (very unsatisfactory). Geizhals.at lists the average firm assessments of customer evaluations filed within the last 365 days on the website's main page, which summarizes all offers for a specific good (see Figure 1).[10] As quality of information is crucial for the business model of a price search engine, Geizhals.at tries to ensure a high quality level of customer evaluations: The filing of an evaluation requires registration at geizhals.at. Moreover, the price search engine makes a special effort to verify evaluation reliability and invalidates unreasonable customer evaluations.

Quality Seals: Sellers are also allowed to present the seals of their external quality certification agencies. These seals are also listed below the firm's name at the website's main page with the firm's price offers (see Figure 1). Currently, there are two e-commerce quality seals used at geizhals.at. The first is a seal issued by the Austrian Chamber of Trade, Commerce and Industry (WKO)[11]. A retailer is allowed to carry the WKO seal if it signs a letter of commitment that requires, rather unspecifically, the offering of certain service features (e. g., an offer of counseling before and after purchase, delivery, and service). The WKO seal is only eligible for Austrian e-commerce shops. There is no certification process based on whether the retailer actually offers the required service features. Moreover, the seal is free of charge for the retailer. In contrast to this is the Euro-Label seal[12] issued in Germany by the EHI Retail Institute and in Austria by the Austrian Institute for Applied Telecommunications (OIAT).

[9]Geizhals applies the following list of service characteristics that can be individually assessed by the clients: navigation on the site, assortment, availability, service, price level, shipping cost, product information, payment methods, terms of business, website performance, and satisfaction with the handling of the offer (order transaction, validity of information, confirmation of order and tracking of shipment, delivery time, packing and content of consignment, service after shipment).

[10]Customers interested in perusing more detailed customer evaluations have access to average grades for the last three months, to the average ratings with respect to single service criteria, and to open comments that customers provide with their evaluations.

[11]http://portal.wko.at

[12]http://www.euro-label.com

The seal defines a code of conduct for e-commerce shops and includes intense audit procedures with yearly inspections. Retailers must pay for the seal and the certification process. Compared to the WKO seal, the Euro-Label seal requires much higher monetary and service investments by the retailer. The above two institutions have provided us with information about when a seal is granted to or revoked from any of the e-tailers.

Of the 911 e-commerce shops in our sample, 113 retailers had either the WKO seal or the Euro Label seal at some point during the study period. Of these, 54 retailers had a Euro-Label seal and 64 had a WKO seal. Over the entire observation period, however, more retailers were assigned a Euro-Label seal than a WKO seal. As shown in Figure 2, a maximum of 47 sellers with a Euro Label seal and 43 retailers with a WKO seal were listed at geizhals.at at any one point.

We want to measure the impact of different quality indicators on consumers' purchasing behavior. Unfortunately, we can not observe the actual purchase decision, since this act happens at the e-commerce retailers' own websites. We can, however, use a proxy variable for consumers' demand. Referral requests (clicks) from the geizhals.at website to a specific website are the total number of clicks of consumers at geizhals.at on a link for product i of retailer j. These referral requests measure the attention paid to a specific retailer. If attention correlates in a stable way with actual purchases across different retailers, we could use these referral requests as a proxy for actual consumers' demand. [13] A still better proxy for actual buying decisions is the concept of the last click through (LCT) (Smith and Brynjolfsson, 2000): during the purchasing decision of a specific good, a customer may visit several websites and compare the characteristics of the shops (e.g., terms of trade, service before and after sale). In the sequence of these referral requests, the last click in a shop has a higher purchase probability, as the consumer is apparently no longer interested in the shop characteristics of other e-commerce sites. In our data, an identification of the LCT is possible because the sequence of clicks by an individual customer can be identified by a unique web browser cookie.[14] Multiple product searches by an individual require the identification of different search periods. For the clustering of clicks into different search spells, a Grubbs' test for outlier detection of particularly long time periods

[13]Note that geizhals.at gets paid according to the number of clicks a firm receives through Geihals.at.

[14]In the identification of the LCT, we have omitted all clicks from customers with web browser settings that do not allow the transmission of cookies on the local PC. Customers who use the same web browser (cookie) cannot be separated from one another.

between the referral requests was applied. Since even a cluster of clicks within a search interval of one hour would have outliers, we must adopt some minimal requirements for a search interval: a self-contained search interval must contain at least 3 (5) clicks, and intervals must be separated by at least one week (month) without clicks. If there are too few clicks or if the "click-less" period is too short the adjacent search spells are connected (for further information on this definition of LCTs, see Dulleck et al. (2011)).

Table 1 shows the descriptive summary statistics of the variables used in our empirical analysis. The variable *Euro-Label* is 1 if the retailer at time point t has the Euro Label and 0 otherwise. The same holds for the *WKO seal*. The *Last-click-through (LCT)* per observation unit (week) has a maximum of 544 clicks, a minimum of 0, and a mean value of 1.008. The price of the product is covered by the variable *Relative Best Price (RBP)*, and is calculated by dividing the price of retailer j's product i by the lowest price offered for this product. Its minimum and maximum values are 1 and 4.991. Observations five times larger than the best price have been excluded from the analysis, as data input errors by retailers might be responsible for these unreasonably high prices[15].

Availability describes the availability of the product: If the seller had specified that the product is "available at short notice" or just "available," the dummy is 1: if the product is not available, it is 0. *Self-Organised Firm Reputation* describes the average score of firm evaluations made by consumers in the last month. Its mean value is 1.723 and the variable ranges between 1 and 5, where 1 is the best grade a consumer can give. The variable *Product Assessment* represents the ratio of the number of positive evaluations of the product to the total number of evaluations within the last month.

At geizhals.at, different forms of shipping costs are reported. Thus, there are differences in costs related to cash in advance, payment by credit card, and cash on delivery. We use cash in advance in our empirical analysis as we lose the fewest observations with this form of shipping cost.[16] The variables *Trend* and *Trend*^{2} measure the life-span and the squared life-time of each product, respectively. Additionally, missing flags are included for the variables *Product Assessment, Self-Organised Firm Reputation,* and *Shipping Costs*; the missing values were imputed with the mean of the available values for each variable.

As each product can be offered by different retailers at different points in

[15]In total, 695, or 0.016% of our observations were deleted. Our results only change marginally if we include this group of price offers.

[16]Shipping cost is the only variable that we must parse from a text field. Therefore, 10% of the missing cases are coded with the mean shipping cost.

time, we have an unbalanced panel. For the estimation of the demand for retailer j's product i at time t, the following model is considered:

$$y_{ijt} = \alpha_i + \theta_j + \mu_t + \beta x_{ijt} + \gamma w_{jt} + \epsilon_{ijt}. \quad (1)$$

Here, α_i, θ_j, and μ_t represent the fixed effects for firms, products, and time, respectively. The covariates x_{ijt} include the price of product i of retailer j relative to the best price offered for this product, the product assessment, the availability of the product i of retailer j (which was valid for the longest time period within the week under observation), and shipping costs. y_{ijt} is a measure of consumer demand (LCTs). w_{jt} is a vector of observable covariates varying at the firm level over time only. In our regressions, w_{jt} includes the two indicator variables for the WKO seal and the Euro Label as well as the self-organized reputation of the retailers.

In the above model, we are confronted with the following econometric issues:

(i) As the dataset is three dimensional, we must deal with the computational complexity of a three-way fixed effects model (FE-model). We assume that the unobserved time component μ_t can be treated as fixed. Thus, μ_t can be estimated directly by introducing time dummies into the vector of covariates, and therefore, in what follows, time dummies are dropped. Product fixed effects are swept out by subtracting the group mean for all observations (see, for instance, Andrews et al. (2006)). Given our sample size, we are confronted with severe computational and prohibitively large memory capacity problems. Therefore, we follow Cornelissen (2006), who suggests a memory-saving decomposition in which the cross product matrix will be generated for the least squares equation without generating dummies for the group effects. As the cross-product matrices are of considerably lower dimension than the design matrix, the required computer memory can be reduced substantially. To cover within-group dependence in the estimation of the standard errors, we cluster them on a product-retailer pair index.[17]

(ii) Obviously, the price relative to the price leader (RBP) cannot realistically be assumed to be exogenous since retailers may change their prices in response to the quantity demanded. Pursuing an idea of Hausman (1996), we instrument the relative best price of a retailer j for a given product k with the average relative best price of all other products of the same retailer j in

[17]We also ran regressions where the standard errors were calculated by two-way clustering, as proposed by Miller et al. (2009). The results are robust in terms of significance and, thus, are not separately reported here.

the other online markets (categories) available (i.e., excluding the category "photos"):

$$ARBP_{jt} = \frac{\sum_{i=1}^{\widetilde{N_{jt}}} RBP_{ijt}}{\widetilde{N_{jt}}}$$

where $i \notin \{photos\}$ is the product a retailer j is listing in other categories and $\widetilde{N_{jt}}$ is the total number of products a retailer is offering at time t in all categories but "photos." In the first stage, the instrument $ARBP_{jt}$ has a strong and significant impact on the relative price.[18] The exclusion restriction is particularly convincing because the relative price a firm charges for unrelated products should have no impact on demand in one particular market. Moreover, customers cannot easily infer the price-setting policies of particular retailers because they cannot inspect the complete price list of a retailer. The organization of the website allows only price comparisons for one particular product across firms, so consumers cannot determine the overall pricing behavior of one particular firm.

4 Results

We start with a model including product and time fixed effects but with no fixed effects for individual firms (Table 2). Last-click-throughs are used as demand indicators. In Columns 1 and 3, we use ordinary least squares methods, while in Columns 2 and 4, a 2SLS procedure is used with the average relative best price from other markets as an instrument. Instrumenting the relative price does not change the results to a large extent; all coefficients remain very similar both in terms of size and statistical significance. Therefore, we concentrate the discussion on the IV results.

When we include only the Euro-Label certification in the model (Columns 1 and 2) we find demand enhancing properties for both self-organized reputation and the Euro-Label; all coefficients are highly significant. The quantitative effects are both sizable, but the impact of certification is stronger. Certification with a Euro-Label increases LCTs for a firm by 0.44 per week, which is almost half the mean value of LCTs (1.008) per week. On the other hand, if the firm were able to increase its reputation by one point (e.g., on the negative scale from 2 to 1), which is more than one standard deviation (0.75), demand would increase by 0.23 LCTs per week.

[18] The Cragg-Donald F statistic amounts to about 183,070, and the Anderson-Rubin F test is about 2,939.

Including the WKO seal in Columns 3 and 4 does not change these results at all. Interestingly, the WKO seal carries a negative coefficient, although it is very small. This remarkable difference in the effect of the certificates can be explained by the credibility of the issuing institutions. On the one hand, the *Verein zur Förderung der kundenfreundlichen Nutzung des Internet* is an independent association engaged in consumer protection. On the other hand, the *Wirtschaftskammer Österreich"* which is issuing the WKO seal is the official entrepreneurs' association in Austria. Moreover, the two seals differ in their certification procedures: While the WKO seal is easy to obtain, Euro-Label certification requires intensive audits with recurrent inspections later on. Unfortunately, our data do not allow us to discriminate between the two competing hypotheses of trust in the issuing certifier and cost of obtaining the certification.

We find the coefficients of the control variables to be according to expectations. The price of a firm relative to the best price in the market has a strong negative effect: if a firm charges a price 10% higher than the best price, its demand would go down by 0.36 LCTs per week. Shipping costs, however, have no significant effect on LCTs (they are even slightly positive in Table 3); previous research (Hossain and Morgan, 2006) has shown that customers treat regular prices and additional charges for shipping and handling quite differently. Obviously, price obfuscation strategies via shipping costs are effective in our data (see also Ellison and Ellison (2009)). Product assessment, which may vary over time, has a positive effect on demand, as does the expeditious availability of the product. Available products and products with a high number of consumer recommendations are demanded more often.

In the next step, we include the firm fixed effects in the regressions (Table 3). Introducing firm fixed effects should resolve any time-invariant firm characteristics and allow a strict pre-post comparison of the demand effects of firm certification. Moreover, it will capture only the time-varying effects of firm reputation. Our results show that in general, most estimated coefficients are lower than those that were estimated omitting firm fixed effects. Self-organized firm reputation drops numerically to zero and is totally insignificant. This might be due to less variation of firm reputation over time. In contrast to this, the impact of the Euro-Label remains strong and significant, although at a somewhat lower level. Comparing a firm before and after certification with the Euro-Label show an LCT increase of 0.16 per week, which is still one-sixth of the mean LCTs. Again, the WKO seal has no impact on demand.

The model with firm fixed effects thus corroborates the evidence that cer-

tification is more important than self-organized reputation in a costumer feedback mechanism. The effect of reputation might be less easily identifiable in the firm fixed effects model due to the slow change of this indicator over time; still, the impact of reputation in the model without firm fixed effects is considerably lower than the impact of Euro-Label seal certification.

In the next step, we want to account explicitly for the rank of the firm that is granted a seal (Table 4). Does the impact of certification vary with the rank of the firm in the geizhals.at listing (the cheapest offers are listed at the top)? Our classification of the dummies is based on the assumption that consumers cannot easily comprehend the whole list of offers, which can include as many as 200 firms. Consumers must scroll through the entire list in order to get the whole picture of supply. When searching for a product, customers can see five to ten offers on their screens at once, depending on the amount of product information provided by the firms and the size of the screen. Thus, we distinguish between three different field positions: a retailer with the Euro-Label seal is among the five cheapest offers *(EL & among Top-1:5)*; the quote is between the sixth and tenth *(EL & among Top-6:10)*; the offer ranks eleventh or higher *(EL & among Top-11:...)*. The same holds for the WKO seal.

We find evidence that the Euro-Label seal has its highest impact for firms listed between the sixth and tenth place. The firms with the Euro-Label seal have demand enhanced by more than 0.86 LCTs per week compared to firms with no seal. Interestingly, this positive effect on demand is smaller for firms at the top of the listing. Firms among the best five offers observe, on average, an increase in LCTs of 0.49 clicks per week. It seems that the top listed firms cannot exploit the seal to the same degree as firms between the fifth and tenth place, as they already have the signal with the low prices. In contrast, firms between the fifth and tenth place can compensate for their lower ranking with the seal. However, when ranked at 11 or below, we find no evidence that having the Euro-Label seal is related to an increase in LCTs. The bad ranking of these firms cannot be overcome by the seal at this point. Regarding the WKO seal, the position of retailers seems to be totally irrelevant; similar to the simple model shown above, the coefficients are quite small and not statistically significant.

5 Summary and Conclusions

In online markets, it is essential for retailers to establish mutual trust with customers. As consumers are not able to examine physical good itself and customer-retailer relationships typically occur only sporadically, it is important that retailers offer enough information to counteract obvious information asymmetries concerning their service characteristics and credibility. Thus, appropriate feedback mechanisms such as third-party certification and self-organized reputation mechanisms are needed. The literature so far has focused exclusively on self-organized reputation mechanisms brought about by consumer evaluations and formal certification processes resulting in awarded quality seals. This paper is the first to compare the different effectivenesses of reputation and certification in online markets.

From the point of view of market design, it is very important to determine whether a self-organized reputation mechanism is sufficient to overcome informational asymmetry or whether a formal certification of some sort - be it from an official or private institution - is also necessary. Using data from an Austrian price comparison site, we were able to show that customers react more strongly to an official certification as compared to a self-organized reputation mechanism. In a simple demand model without firm fixed effects, we find that the effect of having a certificate is quantitatively stronger than the effect of a better firm reputation. When we introduce firm fixed effects, the impact of reputation disappears completely. In such a model, identification comes from changes in reputation or certification over time within a firm.

Moreover, the type of certification is important as well. In our data, we can observe two quality seals: one established from the official employers' association, which is relatively easy to obtain, and another from an independent consumer club, which requires more extensive and repeated auditing and checking. While the former has practically no impact on consumers, being awarded the latter attracts considerably higher demand. Unfortunately, in our case, we cannot differentiate between the impact of independence and the credibility of the issuing institution on the one hand and the costs of the quality seal on the other which leaves room for further research in other markets.

Our results are important for the design of many newly-constructed markets, with a shopbot as an excellent example: in these markets, market-makers must specify the rules of the game. Relieving information asymmetries relating to the quality of goods and services is an important aspect thereof. We have shown that an investment into an independent and costly certification

procedure may be worthwhile over and above routinely setting up a costumer feedback mechanism.

References

Acemoglu, D. and Pischke, J.-S. (2000). Certification of training and training outcomes. *European Economic Review*, 44(4):917–927.

Andrews, M., Schank, T., and Upward, R. (2006). Practical fixed-effects estimation methods for the three-way error-components model. *Stata Journal*, 6(4):461–481.

Angrist, J. D. and Guryan, J. (2008). Does teacher testing raise teacher quality? Evidence from state certification requirements. *Economics of Education Review*, 27(5):483–503.

Auriol, E. and Schilizzi, S. (2003). Quality signaling through certification. Theory and an application to agricultural seed market. IDEI Working Papers 165, Institut d'Economie Industrielle (IDEI), Toulouse.

Bajari, P. and Hortaçsu, A. (2003). The winner's curse, reserve prices, and endogenous entry: Empirical insights from eBay auctions. *RAND Journal of Economics*, 34(2):329–355.

Baye, M. R. and Morgan, J. (2003). Red queen pricing effects in e-retail markets. Working papers, University of California, Berkeley. Available at SSRN: http://ssrn.com/abstract=655448.

Cabral, L. and Hortaçsu, A. (2010). The dynamics of seller reputation: Evidence from eBay. *Journal of Industrial Economics*, 18(1):54–78.

Clay, K., Krishnan, R., and Wolff, E. (2001). Pricing strategies on the web: Evidence from the online book industry. *Journal of Industrial Economics*, 49:521–539.

Corbet, C. J., Montes-Sancho, M. J., and Kirsch, D. A. (2005). The financial impact of ISO 9000 certification in the United States: An empirical analysis. *Management Science*, 51(7):1046–1059.

Cornelissen, T. (2006). Using stata for a memory saving fixed effects estimation of the three-way error component model. Methodenreport 3–2006, FDZ.

Crespi, J. M. and Marette, S. (2001). How should food safety certification be financed? *American Journal of Agricultural Economics*, 83(4):852–861.

Dellarocas, C. (2003). The digitalization of word of mouth: Promise and challenges of online feedback mechanisms. *Management Science*, 49(10):1407–1424.

Dewally, M. and Ederington, L. (2006). Reputation, certification, warranties, and information as remedies for seller-buyer information asymmetries: Lessons from the online comic book market. *Journal of Business*, 79(2):693–729.

Dewan, S. and Hsu, V. (2004). Adverse selection in electronic markets: Evidence from online stamp auctions. *Journal of Industrial Economics*, 52(4):497–516.

Dranove, D. and Jin, G. Z. (2010). Quality disclosure and certification: Theory and practice. *Journal of Economic Literature*, 48(4):935–963.

Dulleck, U., Hackl, F., Weiss, B., and Winter-Ebmer, R. (2011). Buying online: An analysis of shopbot visitors. *German Economic Review*, 12(4).

Edelman, B. G. (2011). Adverse selection in online trust certification and search results. *Electronic Commerce Research and Applications*, 10:17–25.

Ellison, G. and Ellison, S. F. (2009). Search, obfuscation, and price elasticities on the internet. *Econometrica*, 77(2):427–452.

Friedman, B., Kahn, P., and Howe, D. (2000). Trust online. *Communications of the ACM*, 43(12):1–45.

Froomkin, M. (1996). The essential role of trusted third parties in electronic commerce. *Oregon Law Review*, 75(1):1–45.

Grabner-Kraeuter, S. (2002). The role of consumers' trust in online-shopping. *Journal of Business Ethics*, 39(1/2):43–50.

Grossman, S. J. (1981). The informational role of warranties and private disclosure about product quality. *Jounal of Law and Economics*, 24(3):461–483.

Hausman, J. (1996). Valuation of new goods under perfect and imperfect competition. In Bresnahan, T. and Gordon, R., editors, *The Economics of New Goods*, pages 207–248. University of Chicago Press.

Hoffman, D., Novak, T., and Peralta, M. (1999). Building consumer trust online. *Communications of the ACM*, 42(4):1–45.

Hossain, T. and Morgan, J. (2006). ...plus shipping and handling: Revenue (non) equivalence in field experiments on eBay. *Advances in Economic Analysis & Policy*, 6(2, 3):1–27.

Kaplan, S. and Nieschwietz, R. (2003). A web assurance services model of trust for B2C e-commerce. *Communications of the ACM*, 4:1–45.

Klein, B. and Leffler, K. (1981). The role of market forces in assuring contractual performance. *Journal of Political Economy*, 89(4):615–641.

Lala, V., Arnold, V., Sutton, S., and Guan, L. (2002). The impact of relative information quality of e-commerce assurance seals on Internet purchasing behavior. *International Journal of Accounting Information Systems*, 3:1–45.

Lewis, G. (2011). Asymmetric information, adverse selection and online disclosure: The case of eBay motors. *American Economic Review*, 101(3):1535–1546.

Lohr, L. (1998). Implications of organic oertification for market structure and trade. *American Journal of Agricultural Economics*, 80(5):1125–1129.

Milgrom, P. R. (1981). Good news and bad news: Representation theorems and applications. *Bell Journal of Economics*, 12(2):380–391.

Miller, D., Cameron, A. C., and Gelbach, J. (2009). Robust inference with multi-way clustering. Working Paper 09-9, University of California at Davis, Department of Economics.

Odom, M., Kumar, A., and Saunders, L. (2002). Web assurance seals: How and why they influence consumers' decisions. *Journal of Information Systems*, 16(2):1–45.

Roberts, J. W. (2011). Can warranties substitute for reputations? *American Economic Journal: Microeconomics*, 3(3):69–85.

Shapiro, C. (1983). Premium for high quality products as returns to reputation. *Quarterly Journal of Economics*, 98(4):659–680.

Smith, M. and Brynjolfsson, E. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, pages 563–585.

A Appendix

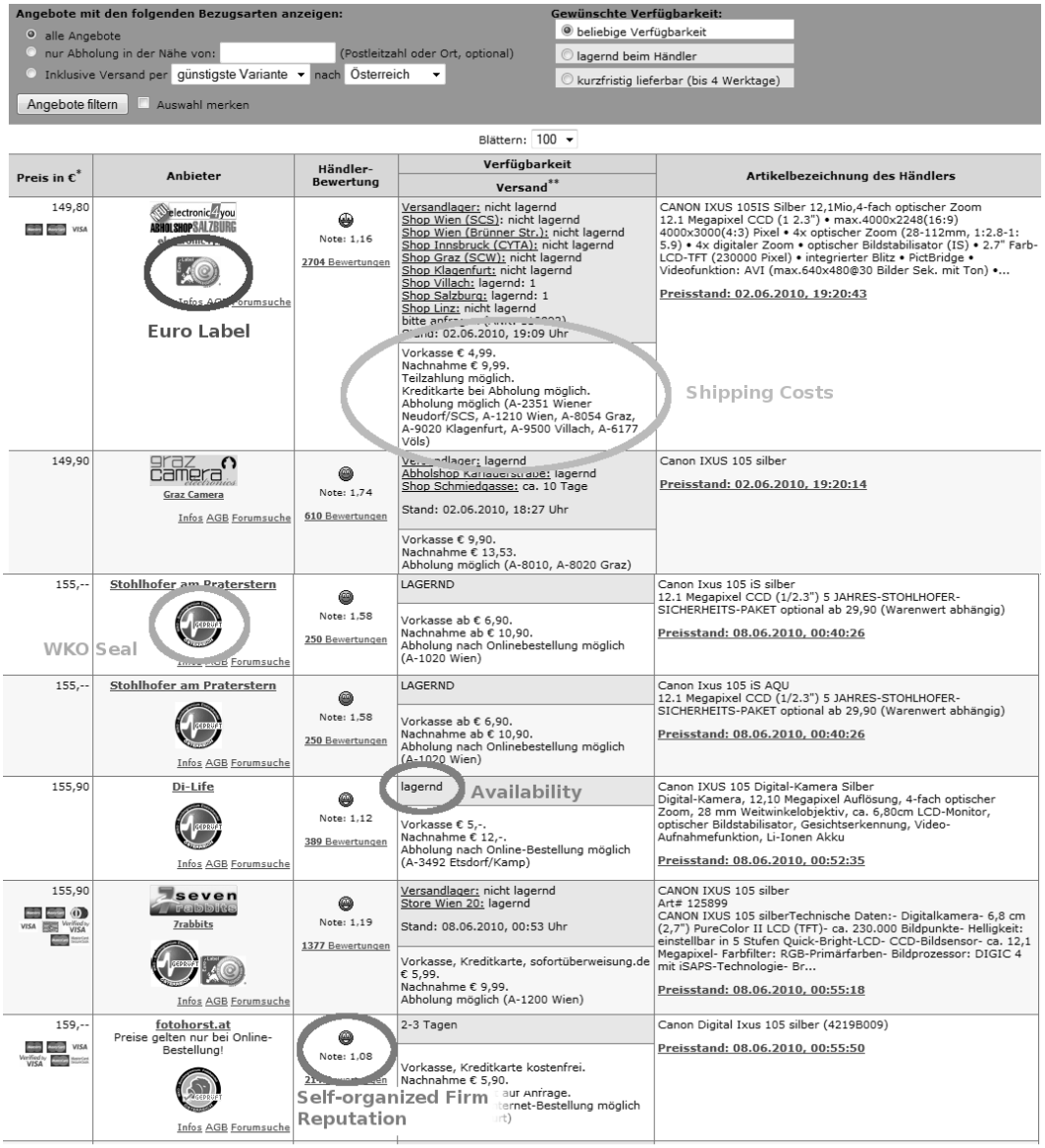

Figure 1: Outcome of an arbitrary product search at http://geizhals.at.

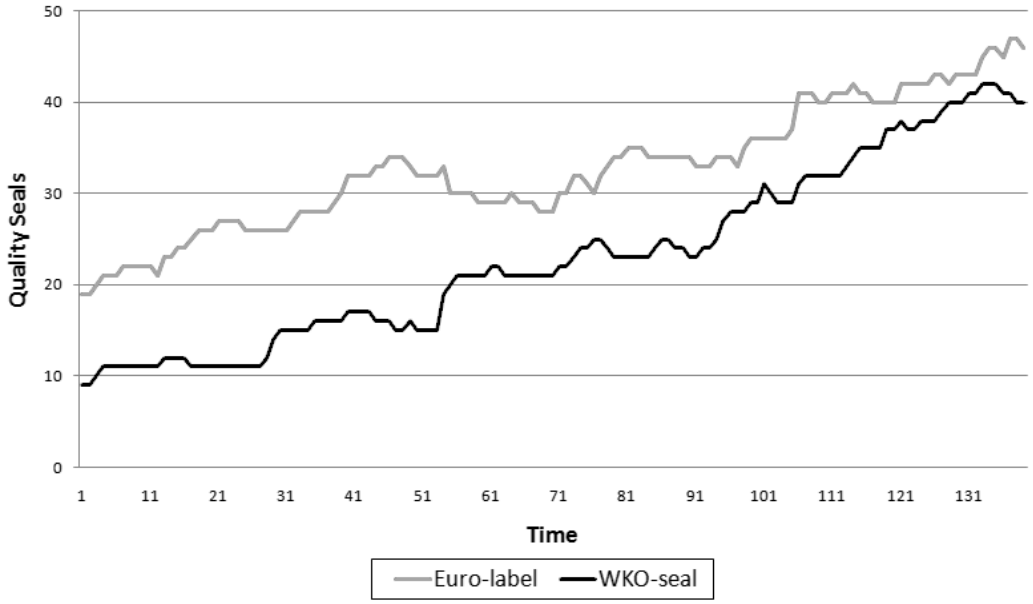

Figure 2: WKO seal and Euro-Label (Digital Cameras)

Table 1: Summary Statistics

Variable	**Mean**	**(Std. Dev.)**	**Min.**	**Max.**	**Number of Obs.**
Euro-Label	0.108		0	1	4,365,711
WKO Seal	0.048		0	1	4,365,711
Last-Click-Through (LCT)	1.008	(4.946)	0	544	4,365,711
Relative Price	1.214	(0.183)	1	4.991	4,365,711
Average Relative Price	1.284	(0.115)	1	4.441	4,365,711
Availability	0.31		0	1	4,365,711
Self-Organized Firm Reputation	1.723	(0.756)	1	5	3,164,189
Product Assessment	0.713	(0.307)	0	1	2,605,706
Shipping Costs	10.685	(10.064)	0	49	27901
Trend	29.56	(19.67)	1	139	4,365,711
Trend^2	1260.268	(1730.21)	1	19321	4,365,711

Table 2: Demand Effects of Reputation and Certification I

	LCT	LCT, IV	LCT	LCT, IV
	(1)	(2)	(3)	(4)
Relative Price	-3.148	-3.636	-3.137	-3.585
	(.080)***	(.431)***	(.079)***	(.528)***
Shipping Costs	.0006	.001	.0005	.001
	(.002)	(.002)	(.002)	(.003)
Product Assessment	.192	.194	.192	.194
	(.034)***	(.038)***	(.045)***	(.029)***
Availability	.435	.412	.434	.414
	(.035)***	(.022)***	(.023)***	(.043)***
Trend	.083	.088	.083	.088
	(.009)***	(.012)***	(.010)***	(.013)***
Trend^2	-.0001	-.0002	-.0001	-.0002
	(.00002)***	(.00002)***	(.00003)***	(.00004)***
Self-Organized Firm Reputation	-.227	-.230	-.229	-.231
	(.014)***	(.010)***	(.011)***	(.015)***
Euro-Label	.450	.443	.455	.448
	(.069)***	(.059)***	(.068)***	(.064)***
WKO Seal			-.096	-.068
			(.064)	(.037)*
N	4365711	4365711	4365711	4365711

Remarks: Last Click Throughs (LCT) are used as a dependent variable. Estimation method: OLS with 139 time dummies and product fixed effects; no firm fixed effects are used. Columns (2) and (4) represent 2SLS estimations. Cluster-robust VCV is used.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 3: Demand Effects of Reputation and Certification II

	LCT	LCT, IV	LCT	LCT, IV
	(1)	(2)	(3)	(4)
Relative Price	-2.180	-1.523	-2.180	-1.530
	(.061)***	(.566)***	(.069)***	(.559)***
Shipping Costs	.025	.024	.025	.025
	(.003)***	(.003)***	(.003)***	(.002)***
Product Assessment	.193	.190	.192	.190
	(.043)***	(.040)***	(.044)***	(.039)***
Availability	.215	.232	.215	.232
	(.019)***	(.026)***	(.014)***	(.023)***
Trend	.090	.084	.090	.084
	(.015)***	(.015)***	(.014)***	(.010)***
Trend^2	-.0002	-.0002	-.0002	-.0002
	(.00003)***	(.00003)***	(.00002)***	(.00003)***
Self-Organized Firm Reputation	.007	.006	.007	.006
	(.004)	(.006)	(.005)	(.005)
Euro-Label	.167	.166	.161	.162
	(.084)**	(.063)***	(.083)*	(.063)**
WKO Seal			.046	.034
			(.060)	(.046)
N	4365711	4365711	4365711	4365711

Remarks: Last Click Throughs (LCT) are used as a dependent variable. Estimation method: OLS with 139 time dummies, product, and firm fixed effects. Columns (2) and (4) represent 2SLS estimations. Cluster-robust VCV is used. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4: Demand Effects of Reputation and Certification III

	LCT	LCT, IV	LCT	LCT, IV
	(1)	(2)	(3)	(4)
Relative Price	-2.142	-1.485	-2.141	-1.487
	(.070)***	(.564)***	(.049)***	(.326)***
Shipping Costs	.025	.026	.025	.026
	(.003)***	(.002)***	(.003)***	(.003)***
Product Assessment	.192	.189	.191	.189
	(.028)***	(.045)***	(.036)***	(.042)***
Availability	.214	.231	.214	.231
	(.029)***	(.018)***	(.021)***	(.019)***
Trend	.090	.083	.090	.083
	(.012)***	(.018)***	(.011)***	(.014)***
Trend^2	-.0002	-.0002	-.0002	-.0002
	(.00002)***	(.00004)***	(.00003)***	(.00002)***
Self-Organized Firm Reputation	.007	.006	.007	.006
	(.006)	(.004)	(.005)*	(.005)
EL & among Top-1:5	.421	.486	.414	.480
	(.109)***	(.166)***	(.156)***	(.189)**
EL & among Top-6:10	.833	.865	.826	.859
	(.110)***	(.118)***	(.132)***	(.123)***
EL & among Top-11:...	.058	.043	.051	.039
	(.090)	(.078)	(.086)	(.088)
WKO & among Top-1:5			.093	.197
			(.186)	(.105)
WKO & among Top-5:10			.090	.115
			(.185)	(.142)
WKO & among Top-11:...			.058	.039
			(.044)	(.060)
N	4365711	4365711	4365711	4365711

Remarks: Last Click Throughs (LCT) are used as a dependent variable. Estimation method: OLS with 139 time dummies, product, and firm fixed effects. Columns (2) and (4) represent 2SLS estimations. Cluster-robust VCV is used. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.