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Examining Comparative Shopping Agents from Two Types of Search Results

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When searching for products and information using search engines, Web consumers often see comparative shopping agents (CSAs) in search results. CSAs list companies that sell desired products and the prices they offer on one page, greatly reducing search costs. Using 168 digital camera models from seven major camera makers, we examine CSAs between organic and paid search results in terms of the number of CSAs, number of vendors, lowest and average prices, and price dispersion.

Keywords comparative shopping agent; price comparison site; paid results; organic results; reliability; trust

Faced with the great number of vendors selling merchandise online, a Web consumer often starts his or her shopping process by issuing a query in a search engine, comparing the products or services listed in the search results in search engine result pages (SERPs), and identifying and buying the desired product or service from a particular Web site or vendor. Major search engines, such as Google and Yahoo!, display two types of search results: organic and paid. The selection and ranking of organic results depends on the search engine's proprietary algorithms, which consider many factors, such as content relevance and link structure (e.g., Brin & Page, 1998; Haveliwala, 2003). Paid or sponsored results instead appear on the top, right, and sometimes bottom of a SERP because the content providers or advertisers place bids on one or more terms in the search query (Jansen, 2006; Jansen, Brown, & Resnic, 2007). Paid searches have enormous economic impacts and become primary business models for Web search engines (Jansen, 2006), turning it into an $8 billion industry in 2004, and 99% of Google's and 84% of Yahoo's income came from advertising (McCarthy, 2005).

A comparative shopping agent (CSA), such as Nextag (www.nextag.com) or Pricegrabber (www.picegabber.com), conveniently provides online shoppers with a list of vendors and their price information. Because CSAs charge advertising fees and commissions from the participating companies (Smith, 2002), rather than individual companies bid on keywords (i.e., pay the search engine companies), it becomes relatively cost effective for the CSAs to bid on keywords, appear in the paid search results, and thus expose their participating vendors to potential customers. An emerging business model, CSAs enable companies to target precisely those consumers who have clear intentions to shop for a particular type or model of product. Vendors participating in CSAs can reach targeted customers with lower marketing costs, and customers benefit not only from greatly reduced search costs provided by CSAs but also from a possibly lower purchasing price due to the large number of available offers. Considering these important effects of paid results, the convenience of CSAs, and their promise for electronic commerce, we ask: Do CSAs and their vendors attain different results when they appear in paid versus organic results? What differences mark the pricing strategies of companies with different overall customer ratings?

With digital cameras as our sample product—a category that contains a wide range of models (i.e., 168 models from seven major camera makers) and a large number (i.e., 7,853) of price observations in the search results on Google (www.google.com)—we compare CSAs between paid and organic results in terms of the number of CSAs included, the number of vendors listed by those CSAs, the lowest price, average price, and price dispersion (i.e., price range/mean price; Ratchford, Pan, & Shankar, 2003). In addition, the search results do not disclose a company's reliability which represents an overall customer evaluation of

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the company and is critical to consumers (e.g., Qu, Zhang, & Li, 2008). A rating such as satisfactory or unsatisfactory can be found from sources such as the reliability report of the Better Business Bureau (BBB). We consider a vendor that earns a satisfactory rating from the BBB a *satisfactory company*, whereas we define an *unsatisfactory company* as a reseller (i.e., vendor that buys digital cameras from the manufacturers and sells them to consumers) with an unsatisfactory rating. According to the BBB, unsatisfactory companies engage in methods such as high-pressure sales tactics and false statements about products when dealing with customers. We compare satisfactory companies with unsatisfactory companies in terms of their lowest price and average price. We thereby provide empirical evidence that paid results are more relevant to digital camera search queries than are organic results in terms of the number of CSAs and number of vendors; CSAs in paid results tend to offer the lowest price, a lower average price, and greater price dispersion than do those in the organic results; and unsatisfactory companies listed by CSAs offer the lowest prices and lower average prices more often than do satisfactory resellers. This study therefore contributes to management information systems and electronic commerce literature by documenting the characteristics of CSAs between paid and organic results, as well as the different pricing strategies adopted by satisfactory and unsatisfactory companies. Our findings in turn have implications for search engine companies, CSAs, resellers, and search engine consumers.

Figure 1 depicts a screenshot of search results from the Google search engine for the query "Canon Powershot G10." The paid results appear on the top and right side of the page, while the organic results occupy the main body of the page. This SERP contains four results from different CSAs (i.e., four price comparison sites: www.everyprice.com, www.shopcartusa.com, www.nextag.com, and www.pricegrabber.com), three of which appear in the paid results and one in the organic results.

LITERATURE REVIEW

Prior literature pays significant attention to the effects of CSAs on e-commerce customers and the strategies employed by participating vendors. Smith (2002) discusses the influences of CSAs on consumer and retailer behavior, noting that CSA consumers tend to be price sensitive, and CSAs increase the

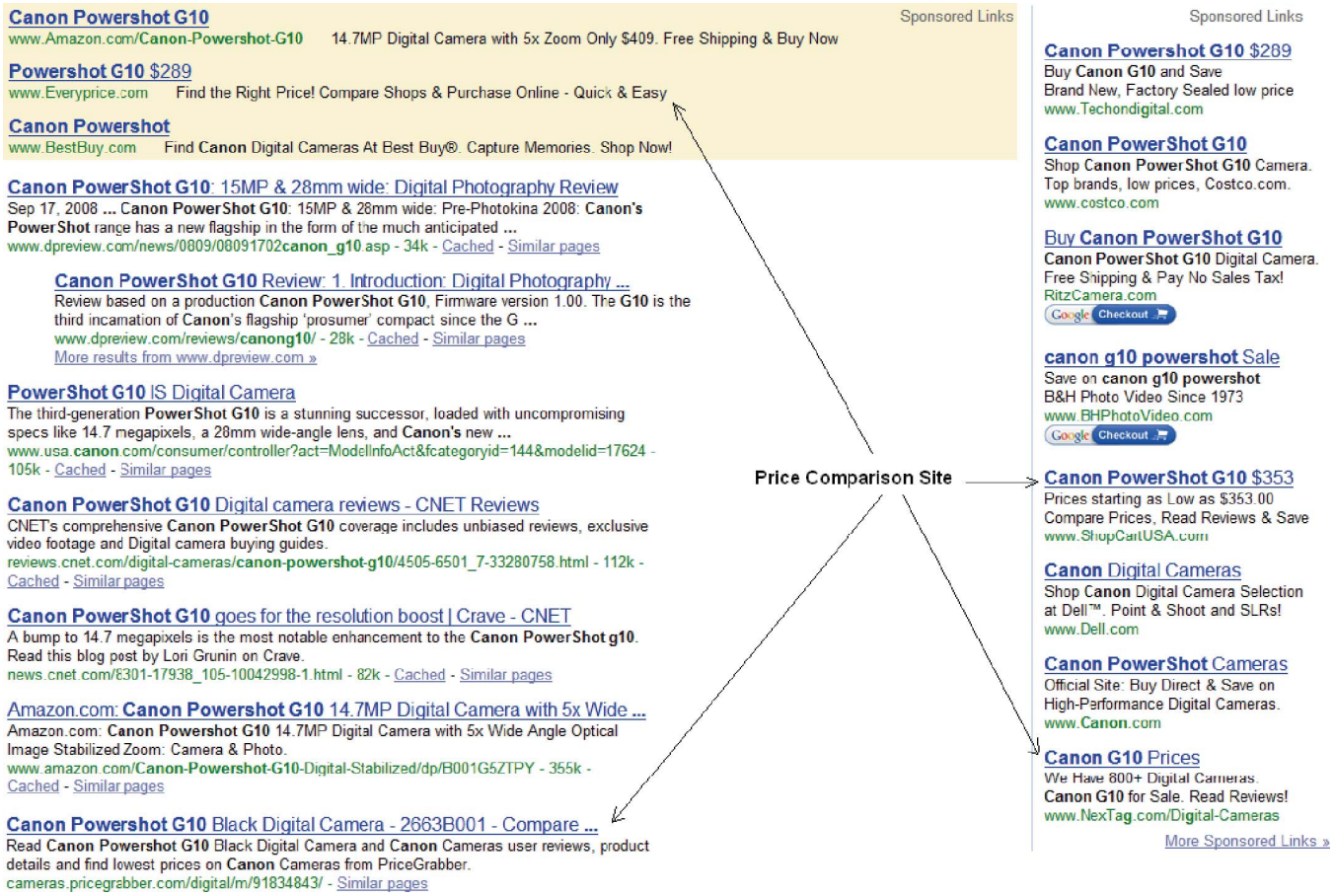

FIG. 1. Screenshot showing CSAs in both organic and paid search results.

pressure on margins for vendors. Iyer and Pazgal (2003) examine the impact of CSAs on market competition and argue that stores inside CSAs engage in mixed-strategy pricing. Garfinkel, Gopal, & Pathak (2008) suggest a method for enhancing CSAs by integrating retail promotions and recommender systems, and Su (2007) shows that consumers choose three strategies (i.e., expected value, brand seeking, and price aversion) when they use CSAs to facilitate their online shopping.

Bailey, Faraj, & Yao (2007) empirically document that vendors that participate more in CSAs tend to offer lower prices because of the increased competition among participating vendors. The CSAs that pay a search engine company to gain a listing in the sponsored results likely draw more traffic than do those CSAs that do not appear in the paid results. Vendors participating in one of the former CSAs therefore may attract more traffic to their Web sites, which enables them to offer a lower price in anticipation of higher sales volume. Thus those vendors can have a higher profit because the increase in volume can make up for the loss in margin if the demand for a good is relatively price elastic (Case & Fair, 1999). Vendors that participate in CSAs that do not appear in the sponsored links instead might draw less traffic to their Web sites and thus may charge higher prices. Several studies compare price levels between online-only retailers and multichannel retailers (e.g., Xing, Yang, & Tang, 2006) or investigate price dispersion among vendors on the Internet, noting that a significant amount of price dispersion still exists (e.g., Baye, Morgan, & Scholten, 2007). Causes for this dispersion include search costs (Salop, 1979); market imperfections and retailer positioning (Bailey et al., 2007); product, e-tailer, and market characteristics (Pan, Ratchford, & Shankar, 2004); and the quality of the Web site and the product delivery process (Baylis & Perloff, 2002). However, the price strategies adopted by CSAs in the two types of search results have not been explored.

Jansen et al. (2007) find that in terms of relevance to search query, Web searchers have a bias against paid results because of their lack of trust on paid results. Consumers' trust is critical to the success of online retailers (Qu, Zhang, & Li, 2008). Hoffman, Novak, & Peralta (1999) report consumer perceptions (e.g., trust, privacy, security) of Web merchants. From two large biannual surveys, Lee and Turban (2001) identify merchant integrity as a significant positive influence on consumer trust in an Internet shopping context. Finally, Kim, Ferrin, & Rao (2008) find that consumers' trust and perceived risk greatly affect purchasing decisions. In this study, we also compare average and minimum prices between those companies with overall satisfactory customer ratings (i.e., trusted vendors) and those with unsatisfactory ratings (i.e., untrusted vendors).

HYPOTHESES

Because a CSA provides consumers with easy access to multiple companies and charges those companies an advertising fee and commission (Smith, 2002), CSAs gain economics of scale in bidding on keywords in a search engine to gain a listing in the paid results and expose multiple participating vendors to consumers. Because of the different mechanisms for generating and ranking organic results described earlier, we expect that more CSAs will appear in paid results than in organic results. For any query, the same CSA may appear multiple times in different SERPs. For example, if for a query the CSA Everyprice (www.everyprice.com) appears in the paid results in both the first and second SERP, to make our comparison of the number of CSAs in paid versus organic results more general, we consider *distinct* (non-duplicated) CSAs and *non-distinct* (i.e., including duplicated) CSAs in SERPs separately. Therefore, the frequency for Everyprice in the top two SERPs of paid results is 1 if we consider distinct CSAs, and 2 if we include the duplicated result. Thus, we hypothesize

H1a: The number of distinct CSAs in paid results is greater than that in organic results.

H1b: The number of CSAs in paid results is greater than that in organic results.

If a CSA gains the advantage in economics of scale for the paid results, it is more likely to bid on keywords if it has more participating vendors. In other words, a limited number of participating vendors could make it costly for the CSA to bid and to be shown in the paid results. Therefore, more vendors should be listed under CSAs in paid results than in organic results.

H2a: The total number of vendors in distinct CSAs in paid results is greater than that in organic results.

H2b: The total number of vendors in CSAs in paid results is greater than that in organic results.

Cao, Gruca, & Klemz (2003) find that price satisfaction is negatively associated with satisfaction with the fulfillment process, which indicates that increasing price satisfaction by lowering the price may also entail a sacrifice of service quality in shipping and customer support. Some companies offering lower prices thus may fail to provide quality postpurchase service, which can lead to bad overall customer ratings, such as an unsatisfactory rating by the BBB. We expect the average price offered by (unique) unsatisfactory companies in CSAs will be lower than that from (unique) satisfactory companies in CSAs. Furthermore, because CSAs pay a search engine company to gain a listing in the sponsored results, which implies their participating vendors attract more traffic to their Web sites than do companies in CSAs that do not pay, the vendors in the former CSA likely offer a lower price, because they anticipate greater sales volume from the greater Web traffic. Therefore, we predict CSAs in paid results offer lower average prices than those in organic results.

H3a: The average price offered by unsatisfactory companies in CSAs is lower than that offered by satisfactory ones in CSAs.

H3b: The average price offered by all distinct vendors in CSAs that appear in paid results is lower than that offered by CSAs listed in organic results.

Bakos (1997) argues that the lower transaction costs of the Internet may lead to Bertrand competition. That is, when customers cannot differentiate products from various suppliers, they always choose the low-price supplier. Because a lower price is negatively associated with the fulfillment process (Cao et al., 2003) and may lead to a bad overall customer rating, we investigate whether the lowest price tends to be provided by an unsatisfactory company rather than by a satisfactory company in a CSA. In other words, do unsatisfactory companies try to attract customers by providing the lowest price? Moreover, we suppose CSAs listed in paid results include more vendors than do CSAs in organic results, so it seems more likely that the lowest price will appear in a CSA in paid results rather than in organic results.

H4a: The lowest price in CSAs is offered more often by an unsatisfactory company than by a satisfactory one.

H4b: The CSAs that appear in paid results offer the lowest prices more often than do the CSAs in organic results.

In H2b, we have predicted that in the paid results, CSAs contain more companies than they do in organic results, and thus, we also predict that the highest price is more likely to appear in CSAs in paid results. Moreover, in H4b, we have assumed the lowest price more often appears in CSAs in paid results than in CSAs in organic results. Therefore, we also anticipate that the price range (highest – lowest) for vendors in all CSAs in the paid results will be greater than that in the organic results. Price dispersion, or the price range divided by the mean price (Ratchford et al. 2003), also should be greater among the vendors in the CSAs in paid results than among vendors in all CSAs in the organic results.

H5: The price dispersion in CSAs in paid results is greater than that in CSAs in organic results.

DATA

Search Queries

Using a keyword research tool from Google Adwords, with the initial seed keyword of "digital camera," we ranked the Google-suggested keywords (e.g., "canon digital camera") by search volume (relative number of users searching for that keyword on Google) to identify seven major camera manufacturers: Canon, Nikon, Panasonic, Sony, Kodak, Olympus, and Fujifilm. From each camera maker's (U.S.) Web site, we manually identified all digital camera models listed as of December 2008. Using the combination of a maker and a camera model, we created search queries, such as "Canon PowerShot G10," in which the model (PowerShot G10) specifies which camera we are looking for and the camera maker (Canon) provides a context to improve the relevance of the search results. Following this procedure, we identified 168 queries representing all 168 models from the seven major digital camera makers.

CSAs and Vendors

We submitted each of the 168 search queries to the Google search engine, looked for CSAs from the top three SERPs, and identified vendors and their offered prices from those CSAs. For example, for the query "Canon PowerShot G10," the CSA ShopCartUSA compared prices from five vendors. We recorded the query, the CSA, the page number, the index of the CSA in the top three SERPs, the five vendors' names, and their offered prices. For this particular query and CSA, we obtained five price observations (from the five vendors selling this model). Across the 168 queries, we obtained 7,853 price observations from 27 unique CSAs and 158 vendors. Each vendor or CSA has its own unique Web domain name, such as www.vanns.com or shopping.msn.com, so we use their second- (and sometimes both second- and third-) level domain names, such as vanns and shopping.msn, to represent them. We completed this manual search and data gathering process in one week in the middle of December 2008 (the data gathering for any individual query took less than 20 minutes). To make fair comparisons, such as that on price, we ignored CSAs corresponding to non-U.S. domains; considered only brand new products, which can be a camera, camera body only, or camera kit (e.g., with lens); for the same query, we made sure that the camera, model, and color were the same for all identified vendors in a CSA.

Table 1 lists the seven camera makers, number of models by each maker, average number of CSAs per model, and average number of observations per model. As we explained previously, the column "Distinct" refers to considering unique CSAs for each query, whereas the "Non-distinct" column refers to the situation in which we count repetitive CSAs in SERPs for a query. Therefore, the number for the non-distinct column will always be greater than or equal to its distinct counterpart. According to Table 1, in terms of the average number of CSAs and average number of observations per model, Sony and Canon are the most popular camera makers, and Kodak is the least popular maker.

BBB Ratings

The BBB deals with consumers and businesses, handles complaints from consumers, and provides a reliability rating for a company on the basis of a proprietary formula, which considers the type of business, number of transactions, number and type of complaints, and how the company has handled complaints. We resort to a reliability report from the BBB for a company's reliability rating instead of using a reputation system, such as those from BizRate (www.bizrate.com) or Amazon (www.amazon. com), which is based on direct user input, because (1) comments collected from users directly can be misleading and incorrect as they lack verification; (2) reputation systems try to

TABLE 1
Camera makers and average numbers of CSAs and price observations per model

		Non-Distinct		Distinct	
Maker	# of Models	Avg # of CSAs/model	Avg # of Observations/Model	Avg # of CSAs/model	Avg # of Observations/Model
Canon	29	5.97	65.1	4.38	46.1
Panasonic	20	7.05	44.8	4.10	24.6
Sony	17	8.65	72.1	5.88	48.4
Fujifilm	21	5.52	37.4	3.95	25.2
Kodak	26	4.58	23.7	2.92	15.1
Nikon	26	6.35	58.1	4.31	36.0
Olympus	29	4.48	32.1	3.21	21.5
Total # of models	168				
	Average	5.90	46.7	4.01	30.5

TABLE 2
Distribution of vendors' reliability ratings by the BBB

BBB rating	Number of Web sites/Vendors	Percentage of Web sites/ Vendors	Percentage of Web sites/ Vendors with BBB rating
Satisfactory	82	51.9%	64.6%
Unsatisfactory	45	28.5%	35.4%
Not found	18	11.4%	
No rating	13	8.2%	
Total	158	100%	100%

provide unbiased evaluations of the sellers but rarely are neutral because they receive commissions from successful transactions and/or advertising services; and (3) "the Better Business Bureau does not endorse any product, service, or company," as its Web site notes.

We manually identified the reliability record for each of the 158 vendors. Most of the time, the BBB provides a company with an overall rating in its reliability report, either satisfactory (S) or unsatisfactory (US), though occasionally, it issues a reliability score according to a fine-grained scheme, ranging from A+ to F. We convert these finer ratings, such that those equal to or above C- (i.e., BBB acceptable rating) are satisfactory and those under C- are unsatisfactory. In Table 2, we show the distribution of reliability ratings for the 158 vendors. "Not found" means a vendor does not appear in the BBB database; no rating means the BBB is not prepared to issue a reliability score for a company. Thus, in both cases, we have no reliability score. When we consider only satisfactory and unsatisfactory companies, we find that 35.4% (45) of the remaining 127 vendors earn an overall unsatisfactory rating.

HYPOTHESIS TEST

We test our hypotheses across all products, though the basic unit of analysis is a single product model. In Table 3, we list each of our hypotheses and the statistical test results. If the statement corresponding to a given hypothesis is true for a specific model/query, we mark the result as 1; otherwise, it is a 0. We report the observed numbers of 0s and 1s across all queries and calculate the significance values using a two-tailed binomial test. The total number of 0s and 1s in the table may not equal 168, because for some queries, we find no data to support or negate the hypothesized statement in the top three SERPs.

For example, for H1a, 157 of the 168 queries produced search results that contain at least one CSA for a corresponding camera model. In 153 of these queries, the paid results contain more distinct CSAs than do organic results, whereas for only 4 queries, the paid results do not contain a greater number of distinct CSAs. Therefore, the numbers of 1s and 0s overwhelmingly suggest that for our digital camera queries, the paid results contains significantly more CSAs than do the organic results, which also supports H1b, H2a, and H2b. Using H4b, we further illustrate our analysis method. For each query, we identify and compare the lowest price offered by vendors in CSAs in the paid results (P_{min_paid}) with the minimum price from the organic results (P_{min_org}). The comparison result equals 1 if both P_{min_paid} and P_{min_org} exist and $P_{min\_paid} < P_{min\_org}$; the result is 0 if both P_{min_paid} and P_{min_org} exist but $P_{min\_paid} \geq P_{min\_org}$. If either P_{min_paid} or P_{min_org} does not exist, there is no CSA for this model in either the paid or organic results, and we ignore the query because we cannot make a comparison. For H4b, 73 queries generate CSAs in both paid and organic results, and vendors from CSAs in the paid results offer the lowest prices in 54 of them. We test the other hypotheses using a similar method. Overall, we reject H3b (the average price in the paid results is lower than that in the organic results, $p = 0.101$) but find support for all the other hypotheses ($p \leq 0.001$).

TABLE 3
Hypotheses and their significance values

Hypothesis	# of 1s	# of 0s	Sig. (2-Tailed)
H1a: The number of distinct CSAs in paid results is greater than that in organic results.	153	4	0.000
H1b: The number of CSAs in paid results is greater than that in organic results.	153	4	0.000
H2a: The total number of vendors in distinct CSAs in paid results is greater than that in organic results.	150	7	0.000
H2b: The total number of vendors in CSAs in paid results is greater than that in organic results.	154	3	0.000
H3a: The average price offered by unsatisfactory companies in CSAs is lower than that offered by satisfactory ones in CSAs.	112	29	0.000
H3b: The average price offered by all distinct vendors in CSAs that appear in paid results is lower than that offered by CSAs listed in organic results.	44	29	0.101
H4a: The lowest price in CSAs is offered more often by an unsatisfactory company than by a satisfactory one.	92	49	0.000
H4b: The CSAs that appear in paid results offer the lowest prices more often than do the CSAs in organic results.	54	19	0.000
H5: The price dispersion in CSAs in paid results is greater than that in CSAs in organic results.	62	11	0.000

In summary, from our comparison of paid with organic results, we find that paid results contain significantly more CSAs and vendors; vendors in CSAs listed in the paid results offer the lowest price more often than vendors in CSAs listed in organic results; and the price dispersion for vendors in CSAs in the paid results is greater than that in organic results. However, we find no significant difference in the average product price from vendors in CSAs between the two types of search results. Finally, unsatisfactory companies offer both the lowest price and a lower average price more often than do satisfactory resellers.

CONCLUSIONS

Web search engines have become a necessity for consumers to find information and shop online. A CSA enables these online consumers to easily compare prices from multiple vendors that carry the same products, which saves their time and efforts in search. We manually identify 168 digital camera models from seven major digital camera makers, search each of the models using the Google search engine, and examine the resulting CSAs in top three SERPs. In total, we attain 7,853 price observations from 27 different CSAs and 158 vendors. We compare the characteristics of the CSAs that appear in paid versus organic results, and we investigate the pricing strategy between satisfactory and unsatisfactory companies.

We test our hypotheses on the basis of the differences between paid and organic results. Paid results contain more CSAs and vendors than do organic results; the CSAs in paid results also offer the lowest price and exhibit a wider price dispersion more often than do those in organic results. However, our empirical results suggest that there is no significant difference in the average prices offered by vendors inside CSAs between paid and organic results. This price difference appears to pertain more to company reliability, because unsatisfactory companies offer both a lower average price and the lowest price more often than do satisfactory vendors.

Further research might extend our work by studying a different type of product, crossing multiple time points, or using company ratings from different sources. Also, we are interested in examining how a vendor's reliability may be associated with visible cues (e.g., type of result, product price, number of sites selling the same product) that consumers or software programs can identify or derive from the search results. We further believe it may be possible to predict a vendor's reliability rating using such cues.

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