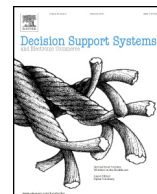




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The role of external and internal signals in E-commerce

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ABSTRACT

Online markets present a challenging environment to evaluate experience products, especially products sold by unknown online sellers. To alleviate this problem, unknown online sellers may choose to signal quality using website signals. However, signals are not useful unless buyers notice these signals and believe that these signals are true. In this study, we evaluate the effect of the believability of external and internal website signals on the buyer's evaluation of seller and product quality and purchase intentions when interacting with unknown online sellers. The results suggest that external and internal signals, if believable, have a significant effect on buyer perceptions. While both types of signals are important, buyers find external signals more salient than internal ones. These results enhance our understanding of signals in e-commerce because they help online sellers to refine their digital business strategies and inform online buyers about the importance of website signals.

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1. Introduction

With the increase in online sales and e-commerce adoption, a growing number of retailers launch online storefronts to capitalize on lower market entry costs. Given the high number of online sellers on the market and similar technology used in creating online storefronts, it is becoming more difficult to differentiate between high- and low-quality online sellers. The uncertainty caused by the online environment and lack of familiarity with online sellers makes buyers hesitant to engage in online purchasing [38]. To alleviate the uncertainty caused by the virtual representation of online stores and offerings and acquire new customers, sellers use signaling as a part of their digital business strategy to differentiate themselves from other sellers and convey information about the quality of their products. Signals that are well understood help online buyers recognize the actual quality of online sellers and products, and influence their perceptions of trust, deception and purchase intentions.

We propose that sellers may display internal and external signals to influence the buyer's perceptions of seller and product quality and to increase their purchasing intentions. Internal signals arise as a consequence of the seller's internal decisions to project a specific image, or communicate a specific company policy. These signals provide evidence of the seller's promises. Examples of these signals include the display of

the privacy policy or return policy. In contrast, external signals are those that imply an endorsement from a third party. In general, these external signals are seals that indicate verification by, or affiliation with, a well-recognized outside company. Examples include seals to verify the authenticity of a website (e.g. Verisign), or the affiliation with a specific payment mechanism (e.g. PayPal). Both internal and external signals are of the utmost importance to evaluate the quality of unknown sellers and to form perceptions of trust and mitigate deception concerns associated with an unfamiliar website.

To better understand the forces that can potentially mitigate the uncertainty triggered by information asymmetry when dealing with unknown sellers, this study draws upon signaling theory. This theory helps identify the types of signals that form buyer's perceptions of seller and product quality, and help alleviate trust and deception concerns. To this end, we evaluate the effect of internal and external signals on perceived seller and product quality, as well as perceived trust, deception and purchase intentions. However, for a signal to be useful, it should be seen and understood by a receiver. Thus, this study focuses not only on the presence of signals, but also on their believability. The study addresses observable website signals related to the online purchasing process that are provided by sellers pre-contractually (i.e. before an actual purchase takes place). In particular, the empirical portion of this research covers online pharmacies in which the failure to identify the quality of a seller or a product correctly may lead to potentially damaging outcomes. The quality of pharmaceutical products is difficult to evaluate and therefore, the role of signals is paramount in this context.

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This study provides both theoretical and practical contributions. At the theoretical level, an examination of website signals can contribute to our understanding of how the believability of signals influences the online shopping experience, as well as inform us about the potential of signals to uncover hidden qualities of sellers and products. At the practical level, our findings can help inform online users and online sellers about the effect of website signals on the buyer's perceptions.

We begin with the review of signaling theory, and then introduce website signals. We investigate the effect of website signals on seller and product quality as well as on the perceptions of deception and trust, and purchase intentions. Then, we describe the research design and analysis and conclude with the discussion of results and their implications for theory and practice.

2. Signaling theory

Signals are visible features of an object that can be altered according to a signaler's preference [44]. Signaling theory offers a framework that explains how extrinsic cues or signals are used by one party to convey hidden or limited quality information to another party to facilitate a purchase or exchange [47]. In seller–buyer relationships, signaling theory has been used to understand the types of signals that sellers provide to buyers to reduce information asymmetry and help buyers make more accurate assessments of quality when the information about products is limited [24].

In e-commerce, information asymmetries accompany a technology-mediated channel [47]. The information asymmetry problem between online buyers and sellers perseveres because of product-based and seller-based information uncertainty [15]. Two major sources of information asymmetry that buyers experience in online markets are seller quality and product quality [6]. The lower entry cost in online markets creates additional uncertainty as sellers of both high- and low-quality have an ability to create online storefronts, which display different types of signals. Signaling theory [44] is used in situations of uncertainty and explains how signals can be used to influence the buyers' attitude towards the signaling party. In dyadic seller–buyer relationships, sellers introduce particular signals to indicate their quality and quality of their products, and buyers evaluate the validity of the sellers' quality based on the signals provided [38].

Signals are differentiated by their cost [44]. *High-cost signals* require significant investment of money and other resources. For example, verification seals require an effort to be obtained, as an approval of a third-party company and monetary expenditures on membership fees are needed. In contrast, *low-cost signals* may be perceived as relatively inexpensive to produce. For example, the cost of copying a privacy policy from other credible online sellers is close to zero.

In addition, some online signals are linked to an external provider's page and can be verified as true signals. For example, verification seals are usually linked to the verification seal provider website or listed in the provider's directory. Other signals, such as a privacy policy, are difficult to verify upfront before the purchase is complete and buyer private information is submitted, as a seller may or may not choose to adhere to the policy after the purchase.

In this study, we introduce signal believability—the degree to which signal receivers believe that a signal is true. As we examine signals in a virtual environment, it is important to identify the difference between signal assessment process in a physical world and a virtual world. In the virtual world, if the signals are displayed, then the first step for a buyer is to notice a signal; the second is to judge the signal. Similar to cue utilization theory [41], a signal is believable if buyers think they have an ability to make a correct assessment about a signal that is authentic and not forged. The correct judgment of an online signal may be impaired by its virtual representation. If the buyer believes the signal is true and associates the signal with higher quality, then the signal is effective and no further signal verification is required.

Signaling theory can provide new insight for research in online commerce. In this study, we consider two types of signals: internal and external. Internal signals are the result of the seller's internal decision to project a certain image of the store. Website policies exemplify internal signals as it is up to the seller what information and promises to provide in these policies. Internal signals represent the *inside-out* projection of the seller through the website. Alternatively, external signals, although sometimes requested by the seller, are determined externally by a third party. For example, a verification seal represents an opinion of the external party about the seller and thus signifies the *outside-in* reflection presented in the website.

3. Website signals

To be effective, a signal should be costly enough to allow differentiation between high- and low-quality sellers [44]. A signal that is costly is beneficial for a high-quality seller and detrimental for a low-quality seller as costs involved in the production of such a signal should be recovered. While it is easier to recover high signal costs for a high-quality seller as the quality of products and services is likely to be constant, it is more difficult for a low-quality seller because the expenditure related to the signal will be lost if a seller defaults on the claim [24].

Low-cost signals are easy to produce as they do not require significant investment. Low-cost signals may be either reliable when they are truthful or unreliable when they are forged and can be used by both high- and low-quality sellers. Sellers use low-cost signals if they bring benefits. For low-quality sellers, impersonating high-quality sellers is beneficial as it conveys a certain level of quality that may help convince a hesitant buyer. Thus, if the cost of a signal is affordable for a low-quality seller and if a high-quality seller uses this signal, there is a possibility that a low-quality seller will imitate this signal.

Sellers can easily manipulate signals in an online environment. However some signals, if manipulated, can be easily identified by buyers as false [28]. Thus, the ease of verification of a signal is an important factor in reducing the information asymmetry between a seller and a buyer. Some website signals that are relatively easy to verify are third-party seals, store locator information, live chat and use of encryption. Examples of signals that are difficult to verify before the purchase are various policies, such as privacy, security and return policies and online reviews [28].

Signals have more value when they are easy to verify [31]. If a buyer does not experience any difficulty to verify the truthfulness of a signal before the purchase, it is possible that the online purchase uncertainty may be reduced. On the other hand, signals that are difficult to verify before the purchase do not alleviate uncertainty in the same way as easy-to-verify signals do. Usually, signals combine both signaling costs and the verifiability dimensions. Thus, some signals are costly, require upfront expenditures and are easy to verify (e.g. Verisign seal), while other signals (e.g. privacy policy) are less costly to produce, do not involve upfront expenditures and can only be verified if a seller defaults on the claim [28].

Website signals that have been studied in e-commerce research include technological characteristics of websites, website design features, social signals as well as content and product characteristics [5,6,10,18,21,37,47]. While the purpose of signaling is to influence the perceptions of a receiver in a positive way, some online signals deliver negative information. For example, the country of origin of an online seller plays a negative role in case there is a negative association with the country [42], and amateurish design of websites signals deceptiveness to online buyers [29].

In this study, we focus on signals that are deliberately displayed by sellers pre-contractually (before the purchase). Particularly, we focus on signals that if omitted, will not disrupt the necessary processes of online purchasing (e.g. seals and policies). Thus, certain signals such as website design, payment mechanisms or product descriptions are

excluded from this research, since they are necessary for well-functioning of any online storefront.

For the purpose of this study, we selected external and internal signals that are differentiated by their cost and ease of verification. External signals are provided by third parties and characterized by a higher cost for a seller and a relative ease of verification for a buyer. Internal signals are provided by an online seller and characterized by a lower cost to produce for a seller and more difficulty to verify for a buyer. Both groups of selected signals serve a similar purpose of reducing the information gap between a seller and buyer by conveying information about the safety and the security of a website as well as its ability to deliver high-quality products. However, external signals are characterized by external endorsements provided by third-party companies to ensure the quality of a website and its offerings, while internal signals include internal information provided independently by a seller. Together, external and internal signals contribute to form buyers' perceptions of trust and deception, impressions about seller and product quality and, ultimately, purchase intentions.

3.1. External signals

External signals require some effort to be produced and mainly serve the purpose of positive signaling, leading to increased positive perceptions such as trust. Trust can be categorized as perception-based trust that is formed via direct experience with a website or a seller, or a transference-based trust¹ that in contrast is transferred from a trusted source, such as an individual, word of mouth or review [20]. In the absence of word of mouth [49] and personal recommendations [20], web-based organizations may employ hyperlinks, or connections to other reputable websites to increase positive perceptions and trust towards their websites. Prior research has found that less reputable websites get more benefits from linking to more reputable websites [46]. This phenomenon is called a trust transference [46,20]. One of the manifestations of such trust transference is employing third-party verification seals. Such verification seals extend the notion of institution-based trust mechanisms studied in the field of e-commerce such as escrow services and credit card guarantees (e.g. [36]). Third-party seals are considered as determinants of transference-based trust because they come from a trusted source [7].

Third-party verification seals were developed by the e-commerce industry to reduce the informational gap between a seller and buyer and to inform the buyer that the website can be trusted [32]. Verification seals are provided by independent certifying bodies that guarantee that the seller's behavior is consistent with e-commerce standards [23].

Two types of seals can appear on websites. The first type is a general verification seal, such as the Verisign seal (www.verisign.com) which proves secure e-commerce transactions for any type of website, or the TRUSTe seal (www.truste.com), which ensures the privacy and safety of websites. The second type of seal is domain-specific, for example, VIPPS (Verified Internet Pharmacy Practice Sites) seals (www.nabp.net) are used in the pharmaceutical industry and confirm that a pharmacy is licensed and complies with federal regulations. Verification seals are signals of choice and are not required to be displayed, thus not all sellers use them. For example, at the time of writing, in 2016, VIPPS endorsed 46 websites, while the TRUSTe seal was present on 5000+ websites.

To obtain third-party verification seals, online sellers are generally required to adhere to the program principles [32] and agree to be inspected by third-party organizations. In addition, annual membership fees are usually involved. For example, to receive a TRUSTe seal, a seller can be charged anything from \$599 up to \$75,000 [32]. Such costs and paperwork can explain why obtaining a verification seal can be quite an expensive endeavor for any online seller.

In terms of verifiability, it is often possible to confirm the authenticity of a verification seal by examining the seal before placing an order. Generally, online sellers display a logo of a seal that is linked to a corresponding company page on a certifying organization's website. In addition, many certifying bodies keep a directory of all websites that are verified.

Endorsements and affiliations with other organizations enrich a seller's signal [39] and are associated with higher prices and transaction activity [6]. In addition, certifications serve as signals of unobservable quality in markets that are characterized by information asymmetry [24]. Furthermore, they increase overall satisfaction with a seller, increase trust and reduce concerns related to misuse of private information, fraud and other deceiving practices [34]. Such endorsements can also serve as an indication of trust transference from other reputable sources [46]. Thus, we expect the positive effect of external signals on the website and perceived seller quality.

However, for a signal to be useful, the receiver of a signal should be able to understand and believe in it [32]. If the external signal is present on the website, but buyers fail to notice it, or do not believe in the truthfulness of the signal, the purpose of signaling is impaired. Therefore, the believability of the external signal will reduce information asymmetry between a buyer and seller and will influence a buyer's positive perceptions of trust and seller quality, and will reduce the perception of deception. Consistent with our definitions, the perception of trust is the degree to which a buyer perceives the website to be reliable to conduct business, and the perception of deception is the degree to which a buyer perceives that the website may have misleading information or fraudulent motives, and perceived seller quality is the perceived ability of the seller to deliver products as promised. Thus, we propose:

H1a. *The believability of external signals will increase the buyers' perceived trust towards the website.*

H1b. *The believability of external signals will decrease the buyers' perceived deception of the website.*

H1c. *The believability of external signals will increase perceived seller quality.*

3.2. Internal signals

Internal signals are relatively easy to produce because little monetary or other investment is required. Website policies as an example of internal signals are provided by a seller. The cost of production of such signals is minimal as low-quality sellers may find existing policies online, modify them and publish on their own website within minutes. In contrast with external signals, internal signals do not require third-party endorsements or annual fees. However, the verifiability of such signals can be difficult for a buyer, as there is no pre-contractual certainty that these signals will be honored by the seller in case of default on the signal claim. In addition, unlike external signals, internal signals do not benefit from trust transference derived from linking to other reputable websites.

Various policies displayed on retail websites serve the purpose of minimizing the information gap between a seller and buyer. By providing these policies, sellers signal to buyers that certain regulations exist on the website that refer to issues related to customer service and include information regarding the security of transactions, rules of information sharing and rules concerning product delivery. Well-known policy signals include privacy policy, security policy and return policy. Since policy signals increase the perceptions of quality in the buyer's mind [18], it is advisable for high-quality sellers to use these signals. The cost of obtaining such signals can be high for high-quality sellers who choose to seek legal advice in crafting these policies. However, the cost of obtaining such signals for low-quality sellers is usually minimal because oftentimes basic copy and paste is the only action required. Thus, low-quality sellers that want to imitate high-quality

¹ We thank an anonymous reviewer for suggesting the integration of signaling and trust transference theory.

sellers may display similar policies, and buyers dealing with unknown sellers may not know in advance if these policies are true or not.

Signals that are produced internally are difficult to verify before the purchase because it is uncertain if a seller will adhere to these claims after the transaction has taken place. While high-quality sellers may acknowledge their claims because it is economically advantageous to keep customers satisfied in the long run and a certain cost of punishment exists in case of non-compliance, low-quality sellers may default on their claim if they do not plan to stay in business for a long term.

Policy signals serve as a guarantee provided by a seller not to misuse buyer information, deliver products in a certain manner and accept products back in case of buyer dissatisfaction. Spence [45] suggests that guarantees can be used as signals of quality in situations of quality uncertainty as they provide protection against product or service failure. Guarantees have been found instrumental in revealing seller quality in situations of information asymmetry [24]. The availability of guarantees may increase trust in the website and reduce perceived deceptiveness if a buyer believes that the guarantees are true. However, the mere presence of these signals does not assure that buyers are influenced by them. Thus, we propose that in order for such signals to be influential, buyers should notice them and believe in their content.

H2a. *The believability of internal signals will increase the buyers' perceived trust towards the website.*

H2b. *The believability of internal signals will decrease the buyers' perceived deception of the website.*

H2c. *The believability of internal signals will increase perceived seller quality.*

4. Perceived trust

Trust is a crucial aspect of any dyadic (buyer–seller) relationship in which a buyer cannot control the behavior of a seller that in turn can lead to negative consequences of one party not complying with contractual requirements [30]. Based on prior research, trust is a central factor in online transactions and a positive predictor of purchase decisions [4,9]. Moreover, trust reduces the level of perceived risk linked to transaction processes [35], and indicates the buyers' belief that online merchants will not engage in opportunistic behavior [13].

There are several lines of research explaining the antecedents of trust. Zucker [50] proposes that trust-building can be process-based (centered on reputation and experience), characteristic-based (centered on disposition), or institutional-based (such as third-party certification). Bhattacharjee [1] suggests three key dimensions of trust—the trustee's ability, benevolence and integrity. Research on trust in e-commerce suggests four categories of trust antecedents—cognition-based, affect-based, experience-based and personality-oriented [22]. Another line of research proposes that trust can be transferred via the hyperlinks from one reputable organization to another or from a physical store to an online store [46].

As mentioned earlier, trust is either built by self-perceptions based on the direct experience with a trustee, or transferred from one trusted entity to another entity with which a trustor has no direct experience or interactions [20]. While dealing with unfamiliar websites, trust can be formed either by internal signals while interacting with the website and its content, or by external signals that in effect transfer trust from other entities to the website. Taken together, these sources contribute to form trust towards the website, and this, in turn will affect the buyers' perceptions of the seller (i.e. the entity behind the website) and the quality of products offered by the seller. Thus, we propose:

H3a. *Higher perceived trust in the website will positively affect perceived seller quality.*

H3b. *Higher perceived trust in the website will positively affect perceived product quality.*

5. Perceived deception

Based on the presence or absence of website signals, buyers may form perceptions of deceptiveness of a website. Deception is the form of information manipulation that is created by a deceiver in order to influence the behavior of a potential victim [19]. Deception is always intentional, the deceiver does not provide a prior notification of deceptive purposes, and deception is not requested by a victim [8]. Online deception is generally associated with conflicts of interest and financial stakes [16]. While some sellers are honest and reliable businesses, other sellers can use deceptively manipulated signals to positively influence buyer behavior. Deception in e-commerce can result in delivering inferior products, financial fraud, unauthorized collecting and selling of buyer private information, failure to acknowledge refund, delayed delivery of products and services or no delivery at all [12,38]. If buyers suspect deception on a website, it may affect the buyer's attitudes towards the seller and the quality of products sold on the website.

H4a. *Higher perceived deceptiveness of a website will negatively affect perceived seller quality.*

H4b. *Higher perceived deceptiveness of a website will negatively affect perceived product quality.*

6. Perceived seller and product quality

In online interactions, buyers face a problem of not only seller quality uncertainty but also product quality uncertainty [38]. Although related, uncertainty regarding the seller quality and product quality are distinct constructs because a certain quality of a seller is not always linked with a certain quality of a product as a seller may or may not have enough knowledge about the product or may behave opportunistically [6]. As e-commerce is mediated by information technology, a product's physical informational cues are not available for inspection [47]. In addition, online markets are more appropriate for search and digital goods and less appropriate for experience goods [11]. Buyers seeking medicines on the Internet may look for additional assurances to make sure that a product is of high quality. Ozpolat and Jank [33] report that smaller online retailers transacting with new customers benefit from external assurances the most. We argue that there is a carry-over effect from a seller to a product. When buyers deal with unknown sellers, they cannot judge the quality of a product (e.g. fake product vs. authentic product). However, if they believe in the higher quality of a seller, they may believe that it is more beneficial for a high-quality seller to sell high-quality products.

Online merchants have to promote themselves as a reliable distribution channel. If sellers manage to leverage signals that facilitate a buyer's ability to make accurate product quality evaluations, they may influence the buyers' perceptions of product quality. It is particularly important when products have more experiential attributes and are offered by unknown retailers. Thus, when buyers perceive the seller's quality positively, this view may increase their perception of product quality.

H5. *Higher perceived seller quality will positively affect perceived product quality.*

When buyers perceive a product to be of a high quality, they may be more willing to transact with the seller. In contrast, when products are perceived as of low quality, buyers are less likely to engage in transactions. Product quality thus serves as a last step in making a purchase decision. First, buyers establish trust in the seller, evaluate the seller's quality and look for signals to reduce their perception of deception. If

these requirements are fulfilled, buyers will proceed to observing products on the website. If the products seem to be of an adequate quality, buyers will transact. Therefore, we expect when buyers perceive the quality of a product as high, they are more willing to engage in online transactions with the seller.

H6. Higher perceived product quality will positively affect purchase intentions.

7. The difference between external and internal signals

External signals are obtained from outside entities, while internal signals are produced in-house. The difference in investment between external and internal signals is based on the amount of money and effort the seller spends on signals in advance. External signals are default independent [24]. The investment on these signals occurs independently of the seller's actions. Internal signals are default contingent [24]. The monetary loss can occur only if the seller defaults on the claim. For example, if a seller invests in expensive external endorsements such as verification seals, it will involve expenditures independently of whether the seller is able to make a sale. At the same time, internally produced signals such as policies do not require investment in advance, and may incur penalties only if the seller defaults on the claim. In a virtual environment it may be difficult to locate and prosecute the seller who defaults on the claim. Therefore, internal signals, especially when buyers deal with unfamiliar sellers, may be less effective in forming the buyers' positive opinions about the seller. In addition, external signals may benefit from trust transference if linked to other reputable websites [46,20]. Thus, we propose that external signals have more value for buyers when forming decisions regarding the seller quality.

H7. The effect of external signals on perceived seller quality will be stronger than that of internal signals.

8. Research model

Fig. 1 summarizes hypotheses and presents our research model. The basic premise of the model is threefold: (1) believability of website signals, both external and internal, positively affects trust towards the website and reduces deception towards the website; (2) if buyers have higher trust and lower deception towards the website, they may form more positive perceptions towards seller quality, that in turn may influence their perceptions of product quality; (3) if buyers determine the good quality of a product, they may be willing to transact with the seller (see Fig. 1).

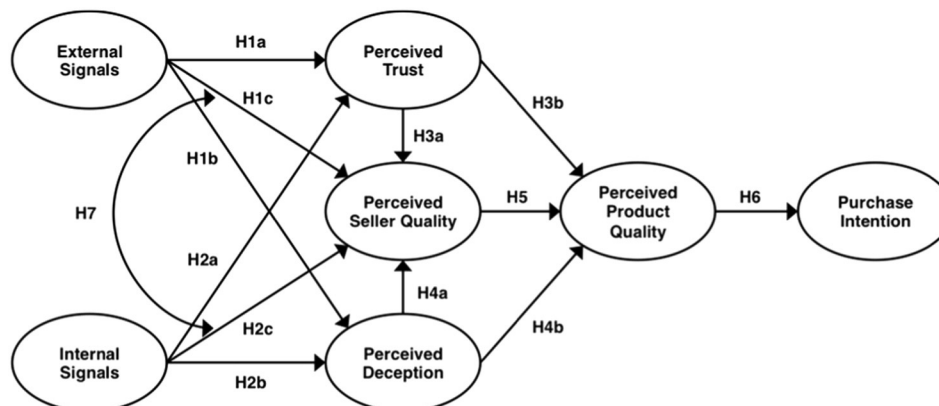


Fig. 1. Research model.

9. Methodology

To test the research model, an experimental methodology was employed. First, a website that resembles an actual online pharmacy website was created. The website contained external and internal signals. External signals consisted of verification seals (Verisign, TRUSTE and VIPPS). Internal signals consisted of policies (privacy, security and return policies). The design and overall look of the website were informed by an initial content analysis of pharmaceutical websites selected from those approved by the National Association of Boards of Pharmacy (<http://www.nabp.net>). This prior content analysis also confirmed that signals selected for the experiment are the most widely used verification seals and policies in online pharmacies. To avoid seller familiarity effects, the experimental website was created with a generic domain name and web address. It was important to establish a lack of familiarity with the website and a seller because the familiarity of the website could heavily influence a user's trust in the website [31].

9.1. Procedures

In order to establish a common task context, all participants were given a scenario according to which they had to examine website content and design and make a purchase decision on behalf of a fictional character. Participants were asked to locate a specific medicine for an elderly person who had neither a physical ability to go to an actual pharmacy nor the Internet skills to make an online purchase. The medicine was an over-the-counter brand.

To complete the task, participants were asked to (1) to evaluate the website by examining the store's design and content; (2) to locate a specific product; (3) to make their purchase decision; (4) to complete a post-test questionnaire. Measures used in the post-test questionnaire were adapted from existing and validated scales for signal believability [17], seller quality [9], product quality [47]; perceived trust towards the website [25]; perceived deception [17] and purchase intentions [14]. To reduce the concern for common method variance [40], several items were measured with reverse scales.

The experimental treatment was entirely administered online (including instructions on how to proceed) to avoid experimenter effects and to ensure that all participants received exactly the same information. No verbal questions or interactions were allowed while the experiment was in progress.

9.2. Sample

The sample consisted of students enrolled in the required introductory IS undergraduate course at a large urban U.S. university in the Northeast. Each study participant was assigned to evaluate the experimental website and answer a questionnaire after the evaluation. In

total, 274 subjects were recruited, and compensated with course credit for their participation. Similar studies in this area have used student samples [48]. In spite of the fact that students do not represent the whole Internet population, they are considered the present and the future of the online consumption [32]. The responses of participants confirm this suggestion with 94% of respondents stating that they have previously completed online purchases.

Out of 274 responses, 220 were retained for the analysis. Some responses were discarded either because participants abandoned the questionnaire before completing it, or because they did not notice the signals displayed on the website. Specifically, responses of participants who did not notice at least one external signal and at least one internal signal were discarded. Awareness of at least one signal in each category was fundamental to ensure that the responses regarding signal believability were reliable.

As signals only have value when a receiver understands and believes the signal, signal believability was established by asking the participants if the specific signals on the website were believable and/or convincing. Each signal was measured with a continuous scale item to capture the extent to which the potential buyer believed in the signal as displayed on the website. For this reason, participants who failed to notice the signals had to be excluded from the sample.

10. Results

The data were analyzed using partial least squares regression in R (plspm package version 0.4.2). A two-stage approach was used to analyze the data. During the first stage, the reliability and validity of the constructs were established. The reverse items that did not load in the intended construct were dropped. During the second stage, the path coefficients of the model were evaluated. Convergent validity was determined by confirming that all items loaded significantly on their respective constructs. Moreover, the composite reliabilities of all constructs were above the recommended value of 0.70 and average variance extracted (AVE) values were above the recommended value of 0.50 [43]. Cronbach's alpha values were above 0.8 for all constructs. Detailed results supporting the convergent validity of the constructs are reported in Table 1.

Table 1
Item loadings, AVE, composite reliability and Cronbach's alpha values.

Item	Construct	Item loading	AVE	Composite reliability	Cronbach's alpha	R2
TRUSTe1	External signals	0.825	0.696	0.932	0.913	
TRUSTe2		0.829				
VIPPS1		0.848				
VIPPS2		0.850				
Verisign1		0.823				
Verisign2	0.831					
PrivacyPolicy1	Internal signals	0.808	0.636	0.913	0.886	
PrivacyPolicy2		0.798				
ReturnPolicy1		0.721				
ReturnPolicy2		0.727				
SecurityPolicy1		0.858				
SecurityPolicy2	0.860					
PerceivedDeception1	Perceived deception	0.886	0.781	0.915	0.860	0.233
PerceivedDeception2		0.846				
PerceivedDeception3		0.917				
PerceivedTrust1	Perceived trust	0.940	0.909	0.968	0.950	0.481
PerceivedTrust2		0.964				
PerceivedTrust3		0.957				
ProductQuality1	Perceived product quality	0.906	0.827	0.935	0.895	0.783
ProductQuality2		0.926				
ProductQuality3		0.897				
SellerQuality1	Perceived seller quality	0.962	0.930	0.976	0.963	0.722
SellerQuality2		0.969				
SellerQuality3		0.962				
Purchase Intention1	Purchase intention	0.961	0.927	0.962	0.921	0.644
Purchase Intention2		0.965				

Note: R2 measures the relationship of a latent variable's explained variance to its total variance. Chin [3] considers values of approximately 0.670 substantial, values around 0.333 average, and values of 0.190 and lower to be weak.

Discriminant validity was established by evaluating the cross-loadings of all measurement items [43]. All measurement items loaded higher on their designated factor than on any other factor. In addition, discriminant validity was confirmed by calculating the square root of AVE and ensuring that for each construct the square root of AVE was larger than the correlations of that factor and any other construct [43]. Detailed results of the discriminant validity analysis are provided in Table 2. Finally, we evaluated common method variance (CMV) using a single-factor factor test [26]. We conducted a confirmatory factor analysis by specifying a hypothesized method factor as an underlying driver of all the indicators. The results revealed that the fit of the single-factor model was unsatisfactory, indicating that CMV is not the major source of variations in the observed items ($\chi^2(377) = 4579.010$, CFI = 0.484, NNFI = 0.444, RMSEA = 0.225).

A bootstrapping method with 100 replicates was employed to test the path coefficients of the model. The results lend support to most of the hypotheses. Fig. 2 presents the results of the path coefficients and their significance. The hypothesis that believability of external signals increases perceived trust (H1a) was confirmed ($\beta = 0.511$, $p < 0.001$), along with the hypothesis that believability of external signals decreases perceived deception (H1b) ($\beta = -0.272$, $p < 0.001$). Also, believability of external signals was found to increase perceived seller quality (H1c) ($\beta = 0.117$, $p < 0.001$). Believability of internal signals was found to increase perceived trust (H2a) ($\beta = 0.263$, $p < 0.01$) and decrease perceived deception (H2b) ($\beta = -0.259$, $p < 0.001$). However, believability of internal signals was found not to affect perceived seller quality (H2c) ($\beta = -0.02$, $p > 0.05$). Moreover, the results suggest that perceived trust increases both perceived seller quality (H3a) ($\beta = 0.616$, $p < 0.001$) and perceived product quality (H3b) ($\beta = 0.511$, $p < 0.001$). Likewise, perceived deception significantly decreases both perceived seller quality (H4a) ($\beta = -0.226$, $p < 0.001$) and perceived product quality (H4b) ($\beta = -0.239$, $p < 0.001$). As expected, perceived seller quality increases perceived product quality (H5) ($\beta = 0.230$, $p < 0.001$). In addition, perceived product quality increases purchase intention (H6) ($\beta = 0.802$, $p < 0.001$).

Lastly, we were interested in testing whether the impact of external signals on seller quality was greater than the impact of internal signals. To this end, we conducted a modified *t*-test [27]. The impact of external

Table 2
Correlations among construct scores and square roots of AVEs.

	Perceived deception	External signals	Internal signals	Perceived product quality	Purchase intention	Perceived seller quality	Perceived trust
Perceived deception	0.884						
External signals	-0.427	0.834					
Internal signals	-0.427	0.561	0.797				
Perceived product quality	-0.708	0.533	0.491	0.909			
Purchase intention	-0.656	0.640	0.525	0.802	0.963		
Perceived seller quality	-0.676	0.604	0.475	0.805	0.817	0.964	
Perceived trust	-0.634	0.658	0.550	0.849	0.865	0.821	0.953

signals on seller quality was found to be significantly greater than the impact of internal signals ($\beta_{ext} = 0.117, SE_{ext} = 0.051, \beta_{int} = 0.207, SE_{int} = 0.018, t = 2.01, p < 0.05$).

11. Discussion

The main contributions of this study are to enhance our understanding of internal and external signals, to underscore the importance of signal believability and to empirically test believability in a high-uncertainty context. First, this study provides a comparison of the effect of external and internal signals on buyer behavior and can be helpful to provide constructive advice to online sellers. Second, the research completes the models of signaling in online commerce by introducing a new dimension—signal believability. Finally, the study tests the believability of signals in situations of high uncertainty when experience products and unknown sellers are involved.

11.1. Discussion of results

This study evaluates the role of signaling as a part of digital business strategy in situations when an online seller is unknown and experience products are involved. The premise of this research is based on the decision making of buyers when dealing with unfamiliar sellers. Buyers access the website and evaluate the signals, if they feel that the website is trustworthy, not deceptive and the seller is of high quality, they will evaluate products on the website. If products are perceived as of good quality, buyers may transact.

The results confirm that both external and internal signals, when believable, significantly increase perceived trust and decrease perceived deception towards the website. However, while the effect of external signals on perceived seller quality is significant, the effect of internal signals is not significant. One of the possible explanations of this finding is that external signals require more investment and effort to produce thus differentiating them from internal signals. In addition, external signals may benefit from trust transference when linked to reputable websites. At the same time, due to the low production costs, internal

signals may be a case of a possible pooling equilibrium [2] when buyers do not differentiate the quality by the signal provided as they do not value the signal.

To investigate the effects of internal and external signals further, we conducted several post hoc group comparisons. First, we investigated differences based on overall perceived believability of internal and external signals. We divided our sample into two groups—believers (respondents with higher reported perceived believability of signals) and non-believers (respondents with lower reported perceived believability). To separate believers from non-believers, we used a median split. We averaged the responses of all 12 believability items for each participant. Then, we calculated the median for this new variable. Finally, we categorized participants as either above or below the median of the new variable. The mean believability score was 4.694, median was 4.917 (measured on 1–7 scale). The two-group comparison of path coefficients revealed several interesting insights (see Table 3 for details). First, the effect of external signals on trust is stronger for believers than for non-believers ($\beta_{believers} = 0.252, \beta_{non-believers} = 0.449, \text{delta} = 0.197, t = 1.687, p < 0.05$). Second, the effect of internal signals on trust is weaker for believers than for non-believers ($\beta_{believers} = 0.447, \beta_{non-believers} = 0.158, \text{delta} = 0.289, t = 2.115, p < 0.05$). Third, the effect of internal signals on perceived seller quality is positive for believers, but negative for non-believers ($\beta_{believers} = 0.151, \beta_{non-believers} = -0.113, \text{delta} = 0.263, t = 2.445, p < 0.01$). Lastly, the effect of perceived trust on perceived product quality is stronger for believers than for non-believers ($\beta_{believers} = 0.626, \beta_{non-believers} = 0.399, \text{delta} = 0.227, t = 1.754, p < 0.05$).

Next, we investigated differences based on whether or not respondents had been deceived in the past. We divided our sample into 2 groups—respondents who had been deceived in the past and respondents who had not been deceived in the past. The two-group comparison of path coefficients found only one significant difference: the effect of external signals on perceived seller quality was weaker for respondents who had been deceived than for respondents who had not been deceived ($\beta_{deceived} = 0.016, \beta_{not\ deceived} = 0.193, \text{delta} = 0.176, t = 1.691, p < 0.05$).

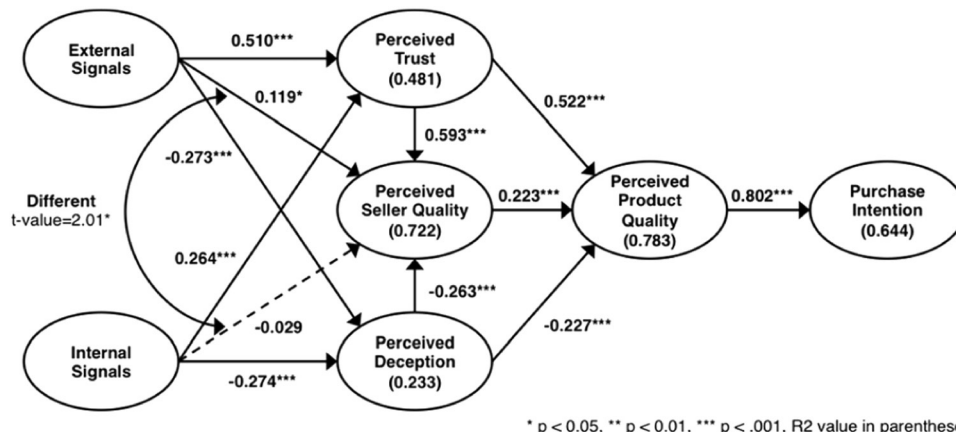


Fig. 2. Results of the analysis.

Table 3
Group comparison of path coefficients for believers versus non-believers.

	$\beta_{\text{believers}}$	$\beta_{\text{non-believers}}$	t-statistic
External signals → perceived trust	0.254	0.448	1.853*
External signals → perceived deception	−0.209	−0.160	0.503
External signals → perceived seller quality	0.061	0.169	1.001
Internal signals → perceived trust	0.446	0.162	2.259*
Internal signals → perceived deception	−0.311	−0.233	0.719
Internal signals → perceived seller quality	0.159	−0.117	2.218**
Perceived trust → perceived seller quality	0.423	0.589	1.597
Perceived trust → perceived product quality	0.646	0.402	1.796*
Perceived deception → perceived seller quality	−0.362	−0.267	0.898
Perceived deception → perceived product quality	−0.179	−0.259	0.789
Perceived seller quality → perceived product quality	0.151	0.278	0.916
Perceived product quality → purchase intention	0.701	0.739	0.314

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. 218 degrees of freedom.

Lastly, we evaluated the relative effect of each internal policy (i.e. privacy policy, return policy, and security policy) on perceived believability of internal signals. We compared the factor loadings across policies using bootstrap resampling and a modified t -test [27]. Results indicate that the effect of security policy is significantly stronger than the effect of return policy ($\lambda_{\text{security}} = 0.243$, $SE_{\text{security}} = 0.020$, $\lambda_{\text{return}} = 0.160$, $SE_{\text{return}} = 0.021$, $t = 2.863$, $p < 0.01$), whereas the effect of privacy policy is not significantly different from the effects of the other two policies.

These results provide additional value by demonstrating that users who show a higher level of perceived believability of signals tend to believe both internal and external signals, while users with a lower level of believability believe in external signals more than they do in internal signals. Therefore, in order to capture both audiences of believers and non-believers, unknown sellers are advised to provide external signals. The absence of external signals may negatively influence perceptions of non-believers and reduce their desire to transact.

11.2. Theoretical contributions

From the theoretical perspective, this study integrates economic theories of signaling with trust and deception theories in the context of e-commerce. With this integrated and multi-disciplinary theoretical background, the study introduces external and internal signals that differ in terms of cost to produce for a seller and ease of verification for a buyer. The conceptual separation between internal and external signals, at the core of this study, adds an important distinction to the mechanisms whereby signals influence the overall perception of seller quality. Furthermore, instead of modeling the role of signals as dichotomous through their presence or absence, our theoretical perspective emphasizes the dimension of signal believability. In so doing, we achieve the integration between economic theory of signaling and perception-based theories of trust and deception. While the use of signals can be assessed objectively, their believability is subjective.

Our theorization of the role of signaling as a part of digital business strategy takes place in situations of high uncertainty when an online seller is unknown and experience products are involved. By removing the powerful influence of brand name and seller recognition, this study sheds light on the importance of other signals typically overlooked in the current literature. When signals are present on a website, buyers may or may not pay attention to these signals. It is only when buyers notice these signals, and believe in them, that their effects on the buyer's decision making process can be truly understood. Signal believability captures the confidence that buyers' have in that the signals have not been altered or used without a third-party's explicit permission. Therefore, the articulation of signal believability synthesizes

the potential competing effects of trust and deception in the overall perception of seller quality.

11.3. Practical contributions

One of the major fears of consumers to shop online is the lack of trust [33]. The higher possibility of online deception creates fears for consumers to shop online and, in particular, dealing with unknown sellers. Thus, it is critical to understand what factors may increase purchasing behavior of online buyers. This study fills the gap in this line of research by introducing a concept of signal believability.

The results of this study are useful for practitioners and can inform online retailers to focus their attention on signals that influence the buyers' perceptions of deceptiveness and trust. Having demonstrated the role of signals in e-commerce, we recommend that sellers provide both external and internal signals on their websites. While high-cost external signals are found to be more significant in forming perceptions of seller and product quality, internal promises and guaranties of a seller are also helpful in solving the problem of limited information in online information asymmetries.

These findings are consistent with tenets of signaling theory that state the importance of signaling costs. When signals are costlier, buyers are more convinced that a seller and its offerings are of higher quality [24]. External signals are characterized by higher costs and ease of verification, thus they are more salient for buyers. In addition, external signals serve as explicit endorsements of third-party companies confirming the quality of a seller. The findings show that external validations provided by third-parties are more salient for buyers than low-cost internal policies. Thus, it is important for sellers that are trying to differentiate themselves from low-quality retailers, to consider not only internal signals as a part of their digital business strategy but also invest into costlier external signals. The presence of external signals is particularly important to convince buyers with low levels of believability to transact with unknown sellers.

Overall, website designers may find these findings regarding signals and their effects valuable in their ongoing attempts to make websites more informative. Our results show that, in addition to the presence of signals, it is important to find ways to improve signal awareness and help online consumers understand signals for them to be helpful in the buyers' decision making.

11.4. Limitations and future research

As in any study, there are limitations that must be acknowledged in the interpretation of these findings. One limitation is that participants took part in the study without a real stake in the outcome. Should that be the case, the participants could be more concerned about the task as high-involvement products were used in the experiment. In spite of this caveat, purchase intentions have been found to be good predictors of actual purchasing behavior [38], thus we consider the results to be informative and useful to predict the actual behavior.

The results of this study refer to situations with unfamiliar sellers. While signaling is highly effective in markets about which consumers are uninformed [24] future research may consider a comparison of familiar and unfamiliar sellers.²

Another important observation in the study is that some participants ($\approx 20\%$ in our sample) reported a failure to notice the signals. It would be interesting to examine how many people in actual purchasing situations pay attention to website signals, and if there are any differences between these two types on online buyers (those who pay attention to website signals and those who do not).

² We thank an anonymous reviewer for this suggestion.

In addition, this study focuses only on pre-contractual issues and examines the effect of signals on purchase intentions before an actual transaction takes place. A logical extension for future research is to investigate post-purchase signals. Another potential avenue for future studies is to enhance the research model with additional constructs. Future studies may incorporate more signals to completely identify antecedents of perceived uncertainty. In addition, website signals can be studied in different contexts. With the proliferation of online auctions, social networking sites and group purchasing sites, the studies of signals can be extended.

12. Conclusion

This study advances the theoretical and empirical understanding of the role of website signals in e-commerce. In this context, the characterization of signals as internal and external sheds light on the determinants of buyer purchase intentions when dealing with unknown online sellers. At the theoretical level, we develop a model that integrates trust and deception theories with economic theory of signaling. The core concept underlying this model is the role of signals as mitigators of information asymmetry in online transactions. In order to play a significant role in the reduction of this asymmetry, signals have to be believable by consumers. From the seller's perspective, signals differ in terms of their production: signals can either be created internally or obtained externally. The resulting model, combining external and internal signals, was tested empirically with respect to perceived seller and product quality, and the perceptions of deception, trust and purchase intentions. The results suggest that both external and internal signals have a significant effect on buyer perceptions of seller and product quality. While both types of signals are important, buyers find external signals more salient than internal ones. These results have implications for digital business strategies of online sellers who use signaling mechanisms to convey their quality.

Appendix A. Questionnaire Items

All items are answered on a 1–7 scale where 1 = 'definitely not' and 7 = 'definitely yes'.

Purchase intentions (adapted from [13])

1. I am very likely to buy a product from this website
2. I would purchase a product from this website

Perceived deception (adapted from [17])

Please evaluate the quality of website information. To what extent do you believe that the information provided by the website is:

1. Accurate
2. Misleading (R)
3. Truthful
4. Deceptive (R)
5. Factual
6. Distorted (R)

Perceived trust towards the website [25].

1. I feel safe in my transactions with the website
2. I trust the website to keep my personal information safe
3. I trust the website administrators will not misuse my personal information

Perceived seller quality (adapted from [9])

1. This online seller is of high quality
2. The likely quality of this online seller is extremely high
3. This online seller must be of very good quality

Perceived product quality (adapted from [47])

What do you think about products sold on this website?

1. I believe the products offered by this website are in good condition (i.e. not expired or altered)
2. The products appear to me to be properly manufactured
3. I perceive the products offered by the website to be of high quality

Please answer these questions without going back to the website: While you were using the website, did you notice "a signal"?

If the answer is Yes: How convincing is the signal? How believable is the signal? (adapted from Grazioli and Jarvenpaa 2000).

Familiarity with the product

The following item is answered on a 1–7 scale where 1 = 'not familiar' and 7 = 'very familiar'.

Were you previously familiar with the product?

Previous deception online

Have you ever been deceived in online transactions? Yes/No.

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³ The name of a signal in the actual questionnaire changes according to the names of signals selected for the study. Six signals were used overall.

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