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Round, just-below, or precise prices? Cultural differences in the prevalence of price endings in E-commerce

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Introduction: The consumer literature distinguishes between three different price endings: round (e.g., $10.00), just-below (e.g., $9.99), and precise (e.g., $9.87) prices. Extant research suggests that these prices can differ markedly in their prevalence between countries. Despite some empirical indication, the link between cultural characteristics and price-ending prevalence has yet to be quantified systematically; we know surprisingly little about why sellers and retailers prefer certain price endings over others.

Method: In the present, pre-registered research (OSF project[1]), we build on Hofstede's cultural model (1984) to investigate how the three cultural dimensions individualism, uncertainty avoidance, and long-term orientation can explain whether certain price endings are more (vs. less) prevalent. Using a web scraping approach, we extracted 9,200 prices from 23 different countries from an international online marketplace.

Results: Our results indicate that in countries (1) with higher individualism scores round and precise prices are more prevalent while just-below prices are less prevalent. (2) Higher uncertainty avoidance scores predict a higher prevalence of just-below prices and a lower prevalence of precise prices. Finally, (3) a higher long-term orientation predicts a higher prevalence of round prices and lower prevalence of just-below prices.

Discussion: Altogether, our results suggest that Hofstede's cultural dimensions are useful in predicting the prevalence of price endings. The present research disentangles divergent empirical findings on price prevalence and furthers our knowledge on the link between cultural dimensions and price-ending practices. Taking a cultural perspective to understand price-ending prevalence is a fruitful avenue for future research and theorizing, as well as organizations, in particular online marketplaces.

KEYWORDS

cultural differences, just-below price, round price, precise price, web scraping, price endings

1 Introduction

Imagine Charlie, who grew up in a part of the world in which precise prices such as "$28.67", "$45.95", and "$79.99" are prevalent. Contrary, Kim grew up in another part of the world seeing round prices such as $30.00. Based on the respective culture, Charlie and Kim might expect retailers to set specific, heterogenous, prices.

1 URL to the corresponding OSF project: osf.io/zg4k2.

Now, consider a large retailer, that is operating worldwide. This retailer is deliberating on what prices to set around the world for its new handbags. Doing some research, the retailer concludes that setting one price that fits each part of the world is not the best approach. The retailer decides to allocate a research budget to investigate if consumers with different cultural backgrounds expect heterogeneous prices to find adequate prices.

In a globalized world, retailers wanting to sell their products in all parts of the world are faced with the challenge of heterogenous pricing expectations, making price settings extremely difficult. This vivid example illustrates that around the globe, retailers might have to use different prices to sell their products (Anderson, 2004): $50.00 for a pair of jeans, $49.99 for headphones, or $28.87 for a necklace. This diverse price setting has been demonstrated for a variety of goods and services over past decades (e.g., Jeong and Crompton, 2017). Inevitably, this leads to impressions that certain price endings are more prevalent than others. Whereas, Charlie thinks round prices are uncommon, Kim has the impression that precise prices are less common. Indeed, prior research indicates that e-commerce sites differ in their prevalence of certain price-endings, depending on the country (e.g., Suri et al., 2004; Nguyen et al., 2007). For instance, round prices (e.g., $30.00) are sometimes used with the aim of indicating high(er) quality (e.g., Schindler and Kibarian, 2001) and trustworthiness (e.g., Dillller and Brielmaier, 1995; Suri et al., 2004). In contrast, just-below prices are sometimes used to signal reduced or particularly low prices (e.g., Schindler and Kibarian, 2001; Levy et al., 2020). Research indicates that in some instances that precise prices on the other hand are interpreted as well-thought-out and fair prices (e.g., Mason et al., 2013; Loschelder et al., 2014; Frech et al., 2020). In sum, choosing particular price endings leads to the inference of much more information than just the exchange value of a product.

But why do retailers differ in their use of and preference for certain price endings? Are price endings solely a function of country or do cultural differences matter as well? Only a few studies suggest that the use of certain prices might indeed be affected by the respective culture. Some scholars (Nguyen et al., 2007; Jeong and Crompton, 2018) have tried to explain these cultural differences using Hall's (1976) cultural dimensions which assume that communications in the respective cultures can be high vs. low context. Research using these cultural dimensions, however, were not able to conclusively link price prevalence and culture. Consequently, surprisingly little is known to this day on whether and how cultural characteristics can explain the prevalence of different price endings. This is why the current study poses the following research question: how can cultural characteristics empirically explain whether certain price endings are more (vs. less) prevalent in different countries?

With the present study, we sought to contribute to theory and practice by investigating the effects of cultural dimensions on the price prevalence in a specific target market. We used a novel approach to investigate the correlation between cultural dimensions and price-endings: web scraping. We used this approach to extract 9,200 prices from 23 different countries from an international online marketplace. Contrary to extant research, this approach allowed us to diverge from running surveys and local experiments and to collect data on real prices settings from an online retailer. Thus, extracted prices represent those prices that real retailers chose to sell their product in this specific target market. This provides us with the opportunity to elaborate on whether cultural dimensions of the target market shape the decision of retailers choosing one price-ending strategy over another (i.e., round vs. just-below vs. precise prices) in a real setting. Thus, the aim of this study is to investigate whether (and to what extent) cultural dimensions can explain the prevalence of price-endings.

By empirically answering this question, we seek to make at least four contributions. First, contrary to previous research, we build on the established and empirically validated model by Hofstede (1984) to investigate how the three cultural dimensions—individualism, uncertainty avoidance, and long-term orientation—can explain differences in the prevalence of prices. Second, the present research uses a web scraping approach (Glez-Peña et al., 2014) which enabled us to automatically investigate the most comprehensive set of countries thus far (including 23 different countries) and their respective prevalence of prices (including 9,200 prices) in the same global online marketplace. A web scraping approach has several benefits over manual country and price ending selection as it automatically collects large-scale data, which is accurate, structured, and less prone to (human) mistakes. This is why our approach expands prior studies that have focused on only a few, selected countries (with automatically limited variance in cultural differences). Third, we categorize the collected prices into the three most studied price categories (i.e., round, just-below, precise prices). Hence, we contribute to the pricing literature by furthering our understanding of how the prevalence of these price-ending categories is linked to cultural dimensions. Fourth, our research seeks to integrate a range of divergent empirical findings regarding countries' most prevalent price endings, thereby giving us a better, empirically sound understanding of price preferences between cultures. In sum, we hope to inspire a cultural perspective on pricing research and practice, particularly in e-commerce.

2 Theoretical background and hypotheses development

2.1 Psychological pricing—round, just-below, and precise prices

Extant research considered psychological pricing an important phenomenon. Psychological pricing is based on the assumption that prices have a distinct impact on consumers and is based on various previously identified mechanisms (Hillen, 2021). First, there is the underestimation effect (Lambert, 1975). In an effort to lower the information-processing effort, consumers might pay less attention to the last rightmost digits (Schindler and Wiman, 1989). Instead of rounding up to the next higher price, consumers just omit the rightmost digit, as this seems to require less cognitive effort (Brenner and Brenner, 1982). By ignoring the last digits of a price, consumers underestimate the price as a whole (Hillen, 2021). Second, another psychological effect is coined the level effect (Manning and Sprott, 2009). This effect postulates that because the typical way to read prices is from left to right, consumers attach more meaning to the first digit of a price. So for instance, if consumers compare $4.99 and $5.00, they compare both prices for as long as the spot a difference. In this case, consumers stop at

the leftmost digit as both numbers are different. Third, the image effect assumes that oftentimes prices are associated with a specific quality. For instance, prices ending with a nine with discount and sales prices (Schindler and Kibarian, 2001).

Against this background, the literature distinguishes three types of prices: round prices, just-below prices, and precise prices. Round prices (at times also referred to as "even prices", Wieseke et al., 2016) are prices that have been rounded to the nearest whole number (*integer*; e.g., $3.00) or whole power of ten (e.g., $850). In contrast, just-below prices (also known as "odd prices" or "nine-ending prices", e.g., Holdershaw et al., 1997; Macé, 2012) are prices that are "just below" these round figures (e.g., $2.99, $849). While these two categories of prices have a long tradition in the literature (see Troll et al., 2023, for a meta-analysis), precise prices (e.g., $2.64, $848.31) received relatively little attention and have been, historically, relatively seldom (Wieseke et al., 2016). Precise prices are prices that are neither just below a round figure nor are they round in terms of ending in trailing zeros; thus, they form a distinct category. Please note that this classification is not necessarily mutually exclusive. For instance, in some cases, a round price might be a just-below price or a round price.

Prices are one of the most important instruments of the marketing mix, and price endings hold various meanings to retailers and consumers (see Schindler, 1991, for a review). Research indicates that the meaning attached to price endings goes far beyond the exchange value of a respective product or service and includes considerations such as price appeal and product quality (Schindler et al., 2011). Thus, two retailers might select different prices for the same product because they want to communicate different meanings to the respective target groups. Similarly, consumers interpret these prices differently and may come to different price and quality judgements (see Troll et al., 2023, for a meta-analysis). However, one must keep in mind that these studies, overall, did not consider cultural differences as a predictor for how these prices are perceived. Instead, most extant research collected data on how these prices are perceived without considering the cultural background.

Specifically, just-below prices are used by managers when they intend to signal a good value (Schindler et al., 2011) which is based on the image effect (Schindler and Kibarian, 2001). Consumers interpret just-below prices in a similar vein in that consumers think these prices are reduced or signal particularly low prices (e.g., Schindler and Kibarian, 2001)—just-below prices convey "a good deal". At the same time, however, some studies suggest that consumer might interpret just-below prices as signaling lower quality (e.g., Schindler and Kibarian, 2001), while this might not be intended by the retailer. Further, research suggests that when confronted with just-below prices consumers might think that retailers are dishonest about their true costs (e.g., Mason et al., 2013; Frech et al., 2020).

Round prices also oftentimes leverage on the image-effect and are used by managers when they want to explicitly signal quality and are oftentimes used for larger consumption situations such as cars and furniture (e.g., Schindler et al., 2011). This is why prices ending on nine are seldomly used (Macé, 2012) in that context. Further, research demonstrated that round prices tend to be used for higher quality products, while just-below prices are used for lower quality products (Stiving, 2000). With respect to consumers' perception of these prices, there exists marked heterogeneity: while some studies suggest that consumers perceive round prices as an indicator of high(er) quality (e.g., Schindler and Kibarian, 2001), a recent meta-analysis suggests that this so-called "quality image" effect might be non-existent and not different from zero (Troll et al., 2023). Regarding another factor, trustworthiness, there is evidence that round prices might lead to an increase in consumers trust in the retailer (e.g., Dillller and Brielmaier, 1995; Suri et al., 2004).

Contrary to just-below and round prices, precise prices have not been the focus of extant research—even though they account for nearly 25% of all prices (Troll et al., 2023). So far, researchers did not thoroughly investigate why retailers choose precise prices. There are studies indicating that precise prices might be used to signal that a retailer is fair and competent (e.g., Loschelder et al., 2014). Consumers interpret a precise price as a well-thought-out price (e.g., Mason et al., 2013; Frech et al., 2020). In line, when presented with precise prices consumers attribute a higher competence and expertise to the respective retailer (Mason et al., 2013; Loschelder et al., 2016). If a price is perceived as well-thought-out, it is reasonable to assume that retailers took more time to come up with this price instead of using a standard price. It is likely that retailers have deliberated more on precise than on round and just-below prices (as originally discussed by Schindler, 1991). Thus, while research is scarce, there seem to be some benefits in using precise prices.

Although there is a long-standing tradition of pricing research, we know surprisingly little about cultural differences for (a) retailers' use of certain price-endings or (b) consumers' perception of these price-endings. The present study focuses on the open research question (a): we seek to contribute to the understanding of cultural differences in retailers' use of price endings by extracting factually-used prices from an online marketplace and examining the empirical association of established cultural dimensions (e.g., individualism) with price-ending prevalence. Please note that there is only scarce empirical evidence on the retailers' perspective on round, just-below, and precise prices. Further, the present research is the first to systematically examine cultural differences in retailers' use of price endings. Thus, to complement this lacuna of previous research on the retailer perspective, we also draw on research that focuses on consumers' perceptions of price endings to derive hypotheses on the relations between cultural dimensions and price prevalence.

Using an online context as a background seems particularly interesting to study those three prices. One argument that can be made is that consumers have easy access to various retailers with almost no effort (Hillen, 2021). The availability of different retailers as well as the ability to compare various prices reduces consumers cognitive efforts and increases information processes (Lee et al., 2009). A counterargument can be made. Research shows that consumers experience an information overload in an online context (Gao et al., 2012). While the comparison of various prices makes sense for one or two prices, when consumers have to compare a whole basket, comparing prices becomes less easy (Hillen, 2021). In line, retailers include individual pricing models and shipping prices that make it harder to compare online prices than prices in an offline context (Brynjolfsson and Smith, 2000). Both arguments can

suggest that those mechanisms which were found in offline contexts transfer differently to an online context.

2.2 Previous research on cultural differences in prices

Due to globalized markets, intercultural communication is becoming more and more important for economic behavior and decision-making. Research on cultural differences in consumer behavior is manifold (e.g., Belk et al., 1989; Belk, 1988; Belk et al., 1988). The reason being that consumption is intertwined with a respective culture (Ackerman and Tellis, 2001). In a given culture, children learn how to buy and sell through various actors in their upbringings such as schools and parents (Carlson and Grossbart, 1988) as well as by adhering to social norms (Cialdini et al., 1990). Not surprisingly, research on cultural differences has also found its way into the pricing literature (Nguyen et al., 2007). This research largely focused on investigating the prevalence of the very last digit(s) of a price in different countries. We review a number of relevant studies below.

The most frequently studied countries are the U.S. and Asian countries. For the U.S., it is almost uniformly reported that nine is the preferred last digit, followed by the digits five and zero (e.g., Suri et al., 2004; Schindler, 2009). In contrast, for Asian countries, mixed findings have emerged. For South Korea, Taiwan and India research indicates a high prevalence of zero-ending prices, followed by fives (Parsa and Hu, 2003; Jeong and Crompton, 2017). Inconclusive results are reported for both China (Nguyen et al., 2007; Jeong and Crompton, 2017) and Japan (Schindler, 2009). Switching continents, extant studies find a high prevalence of zero followed by nine for South American countries such as Brazil and Argentina, and the European country Italy (Nguyen et al., 2007). Similarly, research indicates that Norway and Australia have a high prevalence of nine, followed by zero-ending prices (Nguyen et al., 2007). These descriptive results are interesting in their own right and seem to suggest that there are cultural differences, leading to preferences for specific price-endings over others. However, the extant literature leaves the following question unanswered: can cultural differences, such as the degree to which consumers seek to avoid uncertainty or how individualistic they are, systematically explain differences in a country's price-ending prevalence?

Altogether, there is currently limited research adopting a cultural perspective on price-endings. One exception to the prior statement relied on Hall's (1976) context model to examine and empirically explain cultural differences in price prevalence and effectiveness. Based on this conceptualization, the authors argued that consumers in high-context cultures would be less prone to the illusion of the sale-price image of just-below prices, as they are culturally more likely to "read between the lines". Consumers would more likely be offended by management's attempt to "fool" them (Nguyen et al., 2007). Accordingly, researchers proposed that just-below prices should be particularly effective and more common in low-context cultures which extract information from the explicit message—the price-ending itself (Nguyen et al., 2007; Jeong and Crompton, 2017, 2018). This empirical research supports a higher prevalence of 9-ending prices in low-context cultures and a higher prevalence of 0-ending prices in high-context cultures (Nguyen et al., 2007). Regarding the effectiveness of these prices, research has produced inconclusive findings (Jeong and Crompton, 2018) and a recent meta-analysis even found a reversed effect (Troll et al., 2023). These findings combined with the lack of empirical evidence for Hall's model (Cardon, 2008; Kittler et al., 2011) call for future research using an empirically validated model to investigate whether cultural characteristics can explain differences in price prevalence.

2.3 Hypotheses development—Hofstede's cultural model and prices

An empirically validated model of cultural differences is Hofstede's model (Hofstede, 1984; Hofstede et al., 2010), which is one of the most prominent and widely cited works in intercultural research (Søndergaard, 1994; for a critical examination of the model, see McSweeney, 2002; Jones and Alony, 2007; Kirkman et al., 2017). Hofstede defines culture as "*the collective programming of the mind that distinguishes the members of one group or category of people from others*" (Hofstede et al., 2010, p. 6). While the model originally differentiated between four dimensions almost forty years ago, the more recent revised model distinguishes between six dimensions: power distance, individualism, masculinity, uncertainty avoidance, and the newer additions long-term orientation and indulgence (Hofstede et al., 2010).

Not all of these identified dimensions can be expected to relate to the study of price-ending prevalence. While the dimensions power distance, masculinity, and indulgence represent distinguishing factors between cultures, we struggled to find sufficient relations or a convincing rationale to link these to the prevalence of price endings (directly relevant for present purposes) or to central constructs which are discussed in the pricing literature (indirectly relevant; e.g., value and quality perception, trust, fairness). For instance, indulgence is an unlikely predictive factor as it focuses on self-actualization, leaving little relation to price-ending prevalence or signals (and perceptions) of certain meanings related to price-endings. For the present research, we thus focused on (and pre-registered) the dimensions individualism, uncertainty avoidance, and long-term orientation of the Hofstede model as these dimensions were the ones for which we could derive hypotheses from the current literature (detailed below). However, for reasons of completeness, non-pre-registered analyses including the left-out dimensions power distance, masculinity, and indulgence can be found in the supplemental online material [OSF project (see text footnote [1])].

Figure 1 shows our conceptual model. Based on the cultural typology by Hofstede et al. (2010), we assume that the cultural dimensions individualism, uncertainty avoidance, and long-term orientation are associated with the prevalence of the three different price-endings. Research on the retailer's perspective on choosing one pricing strategy over another, as well as research on cultural differences in price prevalence is scarce. Thus, when deriving

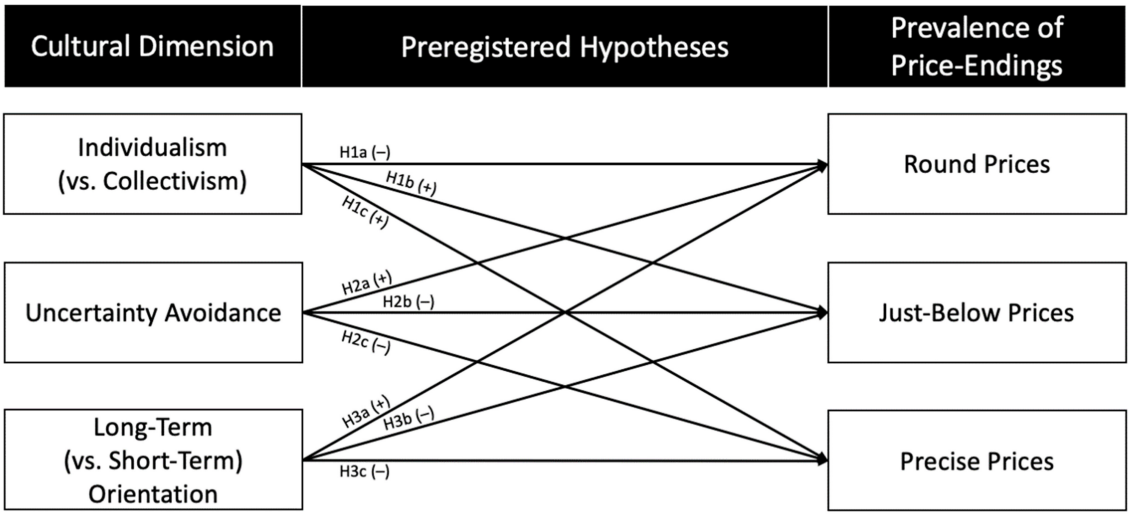

FIGURE 1
Conceptual model. On the basis of the cultural typology by Hofstede et al. (2010) we propose that the cultural dimensions individualism, uncertainty avoidance, and long-term orientation have an effect on the prevalence of the three price-endings.

our hypotheses, we broadened our scope and took research into account that focuses on consumers' perception of prices and price endings, worldwide.

Subsequently, we use the following approach to motivate the association of specific cultural dimensions with specific price endings. First, we introduce each cultural dimension. Second, we try to connect each cultural dimension with consumers' price perceptions. We draw on research on price perceptions to motivate how specific prices can be used in cultures to signal meaning. Lastly, we formulate hypotheses regarding the dimension's association with price-ending prevalence. We acknowledge that the price perceptions are likely learned due to observation. First, consumers do not regularly engage in such higher-order thinking when buying products. In line, while some retailers might set price-endings with an intent, others might also abide by what they are used to making price-settings an approach in which the price perceptions are unconsciously elicited.

2.3.1 Individualism (vs. Collectivism)

The dimension individualism (vs. collectivism; IND) defines an individualistic culture as one "*in which the ties between individuals are loose: everyone is expected to look after him- or herself and his or her immediate family*" (Hofstede et al., 2010, p. 92). In contrast, collectivistic cultures refer to those "*in which people from birth onward are integrated into strong cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty*" (Hofstede et al., 2010, p. 92).

Intercultural studies report that individualistic cultures generally have a high(er) level of trust in distant other people. This underlying reason might be that individualistic cultures have more trust in distant others whereas collectivistic cultures tend to have an in-group bias, trusting members of their own cultural group more (Huff and Kelley, 2003). This is backed by the global preferences survey showing that the highest trust levels are in neo-Europe (United States, Canada and Australia; Falk et al., 2018). This also applies to consumer behavior in that higher levels of individualism are, for instance, associated with higher trust in e-commerce which can be considered distant others (Ganguly et al., 2010; Park et al., 2012; Hallikainen and Laukkanen, 2018).

Corroborating this reasoning, previous research showed that a higher individualistic and more trustful culture (e.g., U.S. sample) is more likely to interpret just-below prices as fair and just "a good deal" (e.g., Schindler and Kibarian, 2001; Guido and Peluso, 2004; Levy et al., 2020). This elevated trust in individualistic cultures makes it more likely that retailers can use just-below prices in order to signal a good deal to consumers. Those trustful consumers might be less likely to perceive just-below prices as signaling lower quality or as a deceptive marketing strategy. Contrarily, this might not be the case in more collectivistic cultures, as these cultures more likely think of just-below prices as signaling lower quality and deception because the trust in retailers is not as high (i.e., Polish sample; Suri et al., 2004), making just-below prices less prevalent.

This is in line with findings stating that, in collectivistic cultures, there is a strong bond of trust with the in-group (e.g., family and the own society, among consumers), while there is little trust with the out-group (e.g., less important relationships and other societies; Hofstede et al., 2010). Retailers determining specific prices are likely perceived as part of the out-group and might therefore be met with a certain skepticism. If this is the case, retailers must counteract this perception with using price endings that consumers interpret as more trustworthy and as signaling higher quality.

As mentioned above, round prices are oftentimes interpreted as more trustworthy and signaling higher quality compared to just-below prices (Dillller and Brielmaier, 1995; Schindler et al., 2011). Hence, it can be argued that in collectivistic (vs. individualistic) cultures round prices are used as a mean to foster consumers' trust and increase quality perceptions to counteract the skepticism consumers have toward retailers. Thus, round prices

should be less prevalent in individualistic and more prevalent in collectivistic cultures.

Further, intercultural studies show that consumers in individualistic cultures are more motivated to exhibit non-conformist behavior and to innovate, while in collectivistic cultures normative behavior is rewarded as pursuing individual and not the collectivistic interest is seen as more important in individualistic cultures (Burns and Brady, 1992; Tian et al., 2001; Gorodnichenko and Roland, 2012; for a meta-analysis, see Bond and Smith, 1996). To establish and maintain the needed sense of uniqueness (Lynn and Snyder, 2001) in individualistic cultures, retailers and consumers might more often use and expect precise prices that are markedly less common compared to other prices (Lee et al., 2009) and, hence, more unique compared to the prevailing norm of just-below and round prices. As mentioned above, research finds that those precise prices are more likely to be interpreted as well-thought out and as signaling higher competence as well as expertise of the retailer (Mason et al., 2013; Loschelder et al., 2016). Additionally, research indicates that precise prices are much less prevalent compared to round and just-below prices (Troll et al., 2023), making precise prices stick out more.

Taken together, precise prices should be used more often in more individualistic cultures as precise prices are rarer (i.e., individualistic). On the contrary, collectivistic cultures value conformity with standards and norms—potentially making precise prices less prevalent. The literature reviewed above leads to the following hypotheses regarding individualism (vs. collectivism; IND):

Hypothesis 1: The more individualistic countries are, (a) the lower the prevalence of round prices, (b) the higher the prevalence of just-below prices, and (c) the higher the prevalence of precise prices.

2.3.2 Uncertainty avoidance

Uncertainty avoidance (UA) is defined as "*the extent to which the members of a culture feel threatened by ambiguous or unknown situations*" (Hofstede et al., 2010, p. 191). Uncertainty plays a major role in the evaluation of prices and products, especially in e-commerce, where the product usually cannot be directly inspected and every purchase involves a transaction risk (Al Kailani and Kumar, 2011; Rosillo-Díaz et al., 2019). Research found that cultures that are low in uncertainty avoidance (e.g., China, Hofstede, 1984) are also those cultural that rank high in patience and vice versa. This is likely connected to these cultures being close to Confucianism (Falk et al., 2018).

Prices serve as a means of communication between retailers and consumers and can be used to reduce uncertainty (Hofstede et al., 2010, p. 211). Grice (1975) postulates four maxims that shape communication which, in turn, can reduce uncertainty: (1) There should only be given as much information as needed (maxim of quantity), (2) information should be relevant to the situation at hand (maxim of relation), (3) only information that is considered correct should be provided (maxim of quality), and (4) the parties involved should try to keep the information clear and understandable (maxim of manner). Even though all maxims cannot always be met, it is expected that individuals generally seek to do so for ideal communication (Grice, 1975). If the maxims are not met, feelings of uncertainty can arise (Kahneman and Tversky, 1982).

In line with these maxims of communication, we know that prices are often used as a cue for product quality, in line with the image effect (Völckner and Hofmann, 2007; Boyle and Lathrop, 2009). Research found that round prices tend to be, overall, used for higher quality products, while just-below prices are used for lower quality products (Stiving, 2000). Additionally, research finds that most retailers, worldwide, preferring round prices over just-below prices believe in this association between round prices and higher quality perception (Schindler et al., 2011). Hence, retailers might rely on using round prices to reduce uncertainty in cultures with high uncertainty avoidance while they might be less likely to use just-below prices in those cultures.

Corroborating this assumption, intercultural studies show that consumers from cultures with high uncertainty avoidance prefer products and brands that are associated with higher quality (Anne Lee et al., 2007) making round prices that signal higher quality more appropriate and just-below prices less appropriate to consumer's needs. In line, although precise prices might be associated with a higher perceived competence and expertise (Mason et al., 2013; Loschelder et al., 2016), they might also be more likely to overcomplicate communication—thereby violating the common maxims of communication. This, in turn, might lead to a lower prevalence of precise prices in cultures with a high uncertainty avoidance. Taken together, we derived the following hypotheses regarding uncertainty avoidance (UA):

Hypothesis 2: The more uncertainty avoidant countries are, (a) the higher the prevalence of round prices, (b) the lower the prevalence of just-below prices, and (c) the lower the prevalence of precise prices.

2.3.3 Long-term orientation

Long-term orientation (LTO) "*stands for the fostering of virtues oriented toward future rewards—in particular, perseverance and thrift. Its opposite pole, short-term orientation, stands for the fostering of virtues related to the past and present—in particular, respect for tradition, preservation of "face", and fulfilling social obligations*" (Hofstede et al., 2010, p. 239).

Empirical research suggests that countries with a higher LTO foster more long-lasting business relationships (Hallikainen and Laukkanen, 2018), which can go beyond purely economic interests (Harris and Dibben, 1999). These relationships are more strongly characterized by mutual support, a shared understanding of a possible future, and identification with the other party—thus enabling closer cooperation than short-term business relationships (Harris and Dibben, 1999; Hofstede and Minkov, 2010). Additionally, there is empirical evidence suggesting that cultures with higher LTO have higher quality expectations (at least regarding the quality of websites). Indeed, countries with higher LTO prefer a reliable, aesthetically appealing, and easily navigable website (Tsikriktsis, 2002), while those with lower LTO have a stronger price focus and prefer the presentation of good deals via just-below prices (e.g., through discounts; Radziszewska, 2019).

As mentioned above, round-prices are associated with higher quality and as an indicator of honesty (Dilller and Brielmaier, 1995) and quality (Schindler and Kibarian, 2001), these prices should be more prevalent in higher LTO cultures. The underlying logic is that, as round prices convey quality and trustworthiness, they might be one cue retailers use to easily foster long-term relationships. On the contrary, in cultures with a short(er)-term orientation, where short-term business relationships are more the norm, just-below prices should be more prevalent as they signal a good deal and put less focus on maintaining long-lasting relationships (Schindler, 2006; Levy et al., 2020). In short-term cultures, retailers and consumers might be more interested in increasing the benefit right now instead of fostering long-term relationships.

Compared to round and just-below prices, precise prices cannot be directly associated with needs for quality or honesty, but it can be associated with the communication process itself. Good communication is essential for long lasting and effective relationships (e.g., Griffith, 2002; Karayanni, 2015), but precise prices overcomplicate these communication processes and thereby foster uncertainty. Therefore, precise prices might be used less in cultures with higher LTO because they increase uncertainty, as they are more difficult to understand. This leads to the following hypotheses regarding long-term orientation (LTO):

Hypothesis 3: The more long-term oriented countries are, (a) the higher the prevalence of round prices, (b) the lower the prevalence of just-below prices, and (c) the lower the prevalence of precise prices can be expected.

3 Methodology

We pre-registered all our hypotheses, our data collection procedure, and our analysis plan on the Open Science Framework [OSF project (see text footnote 1)]. We made all data, code, and supplemental materials publicly available within the same OSF project.

3.1 Data collection

To test our hypotheses empirically, we gathered data on price endings of various product categories and countries from a multi-national, online consumer-to consumer (C2C) marketplace. To access this price-ending information from the online marketplace, we used a web scraping approach (Glez-Peña et al., 2014). Web scraping is "the process of extracting and combining contents of interest from the web in a systematic way" (Glez-Peña et al., 2014, p. 789) allowing us to accurately collect data from various countries and prices. This enhances extant studies which looked at a few countries as they manually collected the data. We used the R package *rvest* to scrape all the necessary and openly available information from the international online marketplace (Wickham and Wickham, 2016; please refer to the OSF project for a detailed R script).

Specifically, we scraped the price-ending information, the price category, the currency of the price, and the country of the retailer. This process consisted of two steps that were repeated for each country. In a first step, we read out and saved the weblinks to the products web page. In a second step, these weblinks were then called up and the information about the price and about the country of origin of the product were read out and stored in our database. For countries that have a currency other than the Euro, a Virtual Private Network (VPN) connection via a server of the respective country had to be used to read out the prices in the native currency (i.e., to avoid having prices automatically converted to €prices which would have altered the native price endings). The data collection took place from 14th July to 16th July 2020.

3.2 Selection of the online marketplace

We selected an C2C online marketplace to scrape the database for the present study for several reasons: the C2C company is an online marketplace for selling and buying handmade products covering a wide-range of products from art to fashion and cosmetics.[2] This C2C had more than 2 million retailers and 90 million buyers making it a huge online-marketplace. The selected online marketplace is globally active and offers a total of more than 50 million articles (as of 7th July 2020) with a wide range of products. To identify the respective cultural background of each price, the shop provides the country of origin of the respective product which is closely related to the cultural affiliation of the retailer. The marketplace provides a total of 31 different currencies (as of 7th July 2020), which allows us to investigate the price prevalence in the native currency of each country, while keeping the online platform, type of products, and C2C purchase process identical across countries

3.3 Selection of product categories

We next selected product categories. The variation of the product range is an important feature, as research has shown that the product type significantly impacts the functioning of price endings (Choi et al., 2014). Indeed, the price prevalence can sometimes differ between products (e.g., Stiving and Winer, 1997; Lee et al., 2009; Jeong and Crompton, 2017). For this reason, we conducted a preliminary online study to determine a suitable range of products for our web scraping approach.

In the preliminary study, participants ($n = 51$) were asked to rate 10 different product categories on the scales of hedonic (HED; sample item: "unenjoyable–enjoyable") and utilitarian (UT; sample item: "ineffective–effective") using a German translation of the Hedonic/Utilitarian-Scale (Voss et al., 2003). After reading the instructions, participants provided their written consent to participate in the study. Our goal was to select four product categories representing all four quadrants of the HED/UT dimensions. Figure 2 illustrates the key findings of this preliminary study. Based on these data, we decided to scrape prices for the product categories "Handmade Jewelry" (high hedonic/low utilitarian), "Face Masks" (low hedonic/high

2 Due to privacy concerns and legal reasons, the name of the online marketplace will not be disclosed.

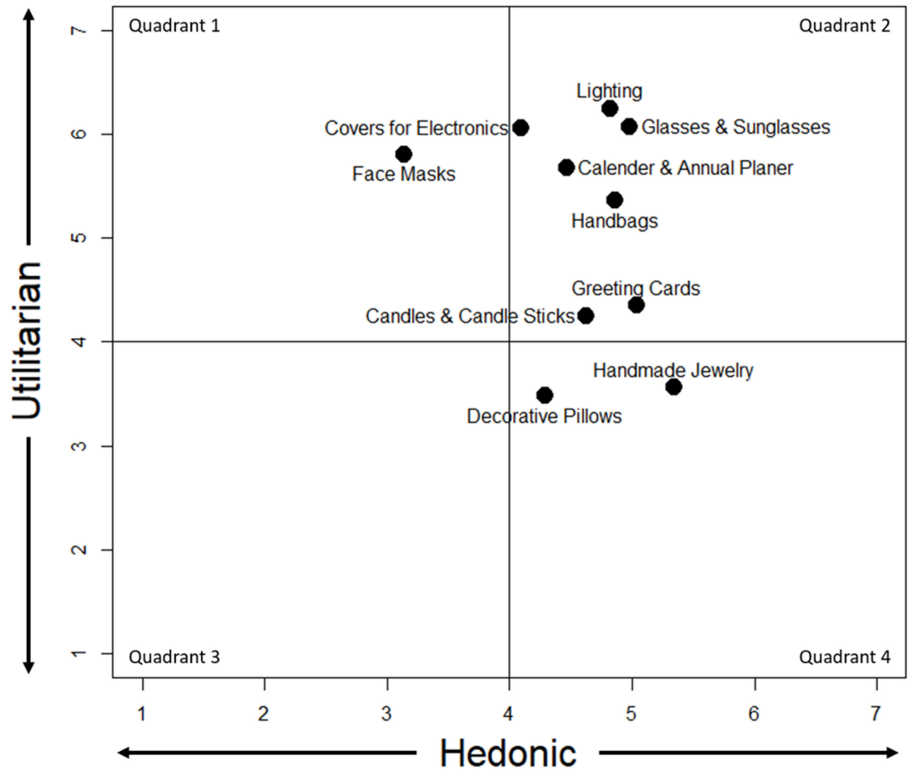

FIGURE 2
Classification of product categories in the preliminary study. This figure shows the ratings of the product categories on the dimensions hedonic and utilitarian (for more detailed methods and results of the preliminary study refer to the OSF project at osf.io/zg4k2).

utilitarian), "Handbags" (high hedonic/high utilitarian) and "Decorative Pillows" (low hedonic/low utilitarian). These products best represented each of the four HED/UT quadrants.

Although our focus is on these specific products, they offer valuable insights for a broader range of items as they represent each quadrant. The selected products are widely used by consumers and do not require extensive knowledge to use. Instead, consumer choices are primarily driven by preference or liking. While face masks may be closely associated with the COVID-19 pandemic, they also provide insights into other high-utilitarian, low-hedonic products, such as protective gear like helmets. For more details on this preliminary study, please refer to the supplemental online material (see OSF project). Although not at the heart of the present research, we also examined whether the type of product would moderate the reported findings (please refer to the OSF project for a detailed analysis).

3.4 Selection of countries

In terms of selecting countries, a set of a-priori criteria was established to reduce complexity of the data analysis and to ensure comparability. Only those countries that met all of the following four criteria were included (i.e., a total of 31 countries out of 71 were retained):

(1) The country's native currency must be selectable (n = 12 eliminated).

(2) Certain Asian countries (i.e., China, Taiwan, South Korea, Japan, Singapore, Hong Kong) were excluded because the "8" is a symbol of good fortune and is frequently used (e.g., Boyol Ngan et al., 2018). Consequently, comparability to other nations is reduced.[3] As interesting as this unique 8-ending effect is, it is distinct from the present research focus and would have artificially over-emphasized precise price-endings (n = 6 eliminated).

3 The "8" as a symbol of luck and good fortune is predominantly true for China, as well as the countries heavily influenced by the Chinese culture (e.g., Taiwan, Singapore, and Hong Kong); this is supported by relevant literature (Parsa and Hu, 2003; Simmons and Schindler, 2003; Westjohn et al., 2017). For Japan, Schindler (2009) discusses that the 8 "... connotes that things or people become better, happier, and more prosperous as time goes on" (p. 18). He finds a high prevalence of the "8" in the rightmost salient-ending digit, backing up this claim. Further, searching the web, it was very easy to find claims that the "8" can be perceived as lucky in South Korea (again derived from the Chinese culture). On the other hand, Jeong and Crompton (2017) used South Korea as a control group because "in contrast to the U.S. and China, there appeared to be no cultural attachment to any given digit in Korea". Based on this inconsistent information, we ultimately decided to exclude South Korea to not have our regression analyses and findings impaired by a country with uncertain data foundation.

(3) Our target sample size per country was to read out 400 actual product prices, divided equally between the four product categories (4 × 100) to avoid that an overrepresentation of certain products in specific countries would artificially bias the proportion of price-endings. Countries for which this was not possible, were not included ($n = 22$ eliminated).
(4) The values for the three cultural dimensions individualism, uncertainty avoidance, and long-term orientation were taken from the "Hofstede-Insights" website [Hofstede-Insights (n.d.)]. Countries without a value for the three dimensions were excluded ($n = 0$ eliminated). The cultural dimensions were measured on a scale from 0 to 100.

3.5 Operationalization of prices

Based on our conceptualization, we grouped all prices into the categories round, just-below, and precise prices (for similar conceptualizations, see Holdershaw et al., 1997; Stiving, 2000; Wieseke et al., 2016). The three prices are defined and operationalized as follows:

(1) Round price: a price in which at least half of the right-hand digits are zero and these zeros must fill the positions from the far right without interruption (e.g., $5,350.00, $16.00, $3.00). Additionally, a round price cannot include a nine (e.g., $29.00; $99.00), which would be deemed a just-below price, except for the left-most digit (e.g., $95.00, $925.00).
(2) Just-below price: a price that is slightly lower than a round full-integer price and includes at least one nine that is not in the left-most position (e.g., $30.90, $15.99, $9.90, $2.29).
(3) Precise price: all prices that do not fall into one of the two categories mentioned above (e.g., $210.50, $12.23, $4.57).

The condition of round prices being comprised of zeros for at least half of the right-hand digits seeks to ensure that a price corresponds more to a round price than to a precise price, regardless of the length of the price. The main advantage of this proposed operationalization is the independence of price categorization from price length and currency-specific price structures (e.g., 10.00 Euro vs. 1000.000 Japanese Yen).

4 Analysis

We were able to read out prices from 31 different countries. This corresponds to a total sample size of 12,400 actual prices (31 times 400 prices = 12,400). Table 1 shows the scores on individualism, uncertainty avoidance, and long-term orientation as well as price prevalence (in %) for each country. Based on these descriptive results, we determined our final database. For some countries ($n = 8$; see "Excluded Countries" in Table 1), a conspicuously large share of prices were precise (> 50%) and unusually few prices were round (< 10%). This likely results from the fact that retailers from these countries (e.g., Poland) deliberately set a price in a non-national currency (e.g., EUR) to address international consumers (e.g., from the European Union) who are (more) familiar with a more widespread currency like the EUR or the USD (vs. Polis "Złoty"). Our approach to scrape prices in the national currency might then lead to precise prices after currency translation, while the retailer originally set another price. Thus, eight countries were excluded from further analysis, leading to 23 countries and 9,200 prices (23*400 prices) included in the dataset.

4.1 Statistical assumptions

We analyzed the data using logistic regression analysis. Before we ran our analysis, we tested two statistical assumptions for logistic regression analysis. First, Backhaus et al. (2016) recommend at least 25 observations for each group of the categorical dependent variable—this requirement is adequately met. Second, we tested the (multi-)collinearity assumption indicated by tolerance values and the VIF index (i.e., Variance Inflation Factor). Following Field (2013), tolerance values less than 0.1 and a VIF index over 10 are concerning. The tolerance values fell between 0.6 and 0.8 ($T_{IND} = 0.66$; $T_{UA} = .66$; $T_{LTO} = 0.80$) and the VIF index between 1.2 and 1.6 ($VIF_{IND} = 1.52$; $VIF_{UA} = 1.51$; $VIF_{LTO} = 1.26$); indicating no excessive multi-collinearity.

4.2 Statistical approach

Our analysis follows a two-step approach. First, we ran binominal logistic regression analyses for each predictor (individualism, uncertainty avoidance and long-term orientation) separately (see Table 2). Second, we ran a logistic regression analysis with all three cultural dimensions simultaneously as multiple predictors in one regression model.

4.3 Results

4.3.1 Investigating cultural dimensions separately

To test our hypotheses, we first ran three binomial logistic regressions for each of the investigated cultural dimensions to compare round, just-below, and precise prices in their prevalence in comparison to the other two price categories (Table 2).

We tested whether the dimension IND (cultural dimension as predictor) significantly predicts the prevalence of round (H1a), just-below (H1b), and precise prices (H1c). Indeed, IND was a significant predictor for the differences between all price categories (all $p_{adj} < 0.001$; see Figure 3 for an overview). The odds ratio for round prices was $OR_{rIND} = 1.044$. An odds ratio of 1.044 indicates that an increase in a step of ten[4] on the cultural dimension scale

4 Before running our analyses, we divided the cultural dimensions values by ten. This linear transformation does not change Model-Fit statistics or significance values but changes the interpretation of the odds ratios in a way that equals a step of ten (rather than a step of one) in the cultural dimension. The decision to transform the interpretation is based on the fact that a comparison in individual steps on the cultural dimensions has little practical relevance and thus larger steps allow for a more intuitive interpretation of the results.

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TABLE 1 Descriptive statistics of relevant variables.

Country	Cultural dimensions[a]				Price endings (in %)		
	Individualism	Uncertainty avoidance	Long-term orientation	Currency[b]	Round	Just-below	Precise
Australia	90	51	21	AUD	49.8	28.5	21.8
Austria	55	70	60	EUR	56.0	31.5	21.5
Belgium	75	94	82	EUR	59.8	26.8	13.5
Canada	80	48	36	CAD	42.5	29.0	28.5
Estonia	60	60	82	EUR	53.3	19.5	27.3
Finland	63	59	38	EUR	25.8	17.0	30.3
France	71	86	63	EUR	72.0	19.3	8.8
Germany	67	65	83	EUR	35.3	51.0	13.8
Greece	35	100	45	EUR	53.0	16.8	30.3
Ireland	70	35	24	EUR	58.5	18.0	23.5
Italy	76	75	61	EUR	63.2	21.3	15.5
Latvia	70	63	69	EUR	39.0	20.8	40.3
Lithuania	60	65	82	EUR	57.5	19.5	33.0
Mexico	30	82	24	MXN	21.0	29.0	50.0
Netherlands	80	53	67	EUR	42.0	36.0	22.0
New Zealand	79	49	49	NZD	59.5	18.3	22.3
Portugal	27	99	28	EUR	57.5	17.0	25.5
Puerto Rico	27	38	0	USD	84.0	15.0	2.0
Slovakia	52	51	77	EUR	53.8	30.8	15.5
Spain	51	86	48	EUR	52.3	20.0	27.8
Switzerland	68	58	74	CHF	53.3	23.8	23.0
U.K.	89	35	51	GBP	32.5	41.5	26.0
U.S.	91	46	26	USD	51.7	32.0	16.3
Total[c]	-	-	-	-	51.7	25.3	23.0
Excluded countries[d]							
Czech Republic	58	74	70	CZK	0.8	42.8	56.5
Hungary	80	82	58	HUF	3.8	31.0	65.3
Indonesia	14	48	62	IDR	0.3	42.5	57.3
Israel	54	81	38	ILS	9.5	32.0	58.5
Malaysia	26	36	41	MYR	5.8	28.0	66.3
Poland	60	93	38	PLN	0.3	36.3	63.5
Thailand	20	64	32	THB	5.8	41.3	53.0
Turkey	37	85	46	TRY	3.0	34.5	62.5

This table shows relevant descriptive characteristics for the dataset.
[a]The values were taken from the Hofstede cultural model [Hofstede-Insights (n.d.)].
[b]An overview of the native currencies can be found on Nationsonline (n.d.).
[c]The sample size of each country contains 400 prices, so the total sample consists of 9,200 prices.
[d]These countries have been excluded as their distribution of price categories seems to indicate that in these cases the assumption that prices are mainly set in the native currency does not seem to be reasonable.

of individualism increases the probability of choosing a round price over another price category by relative 4.4%.[5] Thus, countries

5 An example to illustrate the economic relevance of this value: Suppose we had 50% round prices before, which after a step of ten in individualism is now 0.5 + (0.5 * 0.044) = 52.2%. Assuming that round prices lead to a 10% increase in the sale of products, then a total of (0.5 * 0.044) * 0.1 = 0.22% more products would be sold. With a turnover of 1,000 products, this would lead to an additional sale of 2.2 products—little if considered in isolation, but

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TABLE 2 Results of the binomial regressions investigating cultural dimensions separately.

		95% CI for odds ratio				Uncorrected	Adjusted
	B (SE)[a]	Lower	Odds ratio[b]	Upper	χ^2 (*df*)	*p*	*p*
Individualism							
Constant	−0.34 (0.07)***						
Round vs. others	0.43 (0.01)***	1.021	1.044	1.066	15.18 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.002$						
Constant	1.75 (0.09)***						
Just-below vs. others	−0.10 (0.01)***	0.879	0.902	0.925	63.91 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.010$						
Constant	0.92 (0.09)***						
Precise vs. others	0.05 (0.01)***	1.020	1.047	1.073	12.41 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.002$						
Uncertainty avoidance							
Constant	−0.02 (0.07)						
Round vs. others	−0.01 (0.01)	0.917	0.992	1.013	0.58 (1)	0.446	0.892
	Nagelkerke's $R^2 = 0.000$						
Constant	0.72 (0.08)***						
Just-below vs. others	0.06 (0.01)***	1.033	1.059	1.085	20.88 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.003$						
Constant	1.52 (0.09)***						
Precise vs. others	−0.05 (0.01)***	0.929	0.953	0.977	14.32 (1)***	<0.001***	<0.001***
	Nagelkerke's $R^2 = 0.002$						
Long-term orientation							
Constant	−0.27 (0.05)***						
Round vs. others	0.04 (0.01)***	1.022	1.040	1.059	19.49 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.003$						
Constant	1.40 (0.06)***						
Just-below vs. others	−0.06 (0.01)***	0.924	0.943	0.962	32.46 (1)***	< 0.001***	< 0.001***
	Nagelkerke's $R^2 = 0.005$						
Constant	1.18 (0.06)***						
Precise vs. others	0.01 (0.01)	0.986	1.007	1.028	0.38 (1)	0.537	0.892
	Nagelkerke's $R^2 = 0.000$						

This table presents the results of the single binomial logistic regressions.

[a]* $p_{adj} < 0.05$; ** $p_{adj} < 0.01$; *** $p_{adj} < 0.001$; The adjusted *p*-values were corrected using the Bonferroni-Holm correction.

[b]Note that the values of cultural dimensions were divided by 10. The odds ratios can be considered as a step of 10 on the respective dimension. All other indicators do not change due to this transformation.

with higher scores on individualism showed a significantly higher prevalence of round prices which is contrary to H1a. For just-below prices, an $OR_{\text{jbIND}} = 0.902$ suggested, surprisingly, that more individualistic cultures use fewer just-below prices (relative −9.8% for an individualism increase by ten)— contradicting H1b. Finally, for precise prices, an $OR_{\text{pIND}} = 1.047$ suggested, in line with our H1c, that more individualistic cultures showed a higher prevalence of precise prices (relative +4.7% for a 10-step IND increase). Chi²-statistics indicated that the models including IND as a predictor explained more variance than the original models without this predictor ($\chi^2_{\text{rIND}}[1] = 15.18$, $p_{adj} < 0.001$; $\chi^2_{\text{jbIND}}[1] = 63.91$, $p_{adj} < 0.001$; $\chi^2_{\text{pIND}}[1] = 12.41$, $p_{adj} < 0.001$). In sum, while H1c was supported, H1a and H1b were not supported by the data.

Binomial logistic regressions with UA as a predictor established significant results for just-below and precise prices (both $p_{adj} < 0.001$) but not for round prices ($OR_{\text{rUA}} = 0.992$, $p_{adj} = 0.892$; see Figure 4 for an overview) which is contrary to H2a but in line with

potentially a lot for a small adjustment if applied specifically together with the other findings.

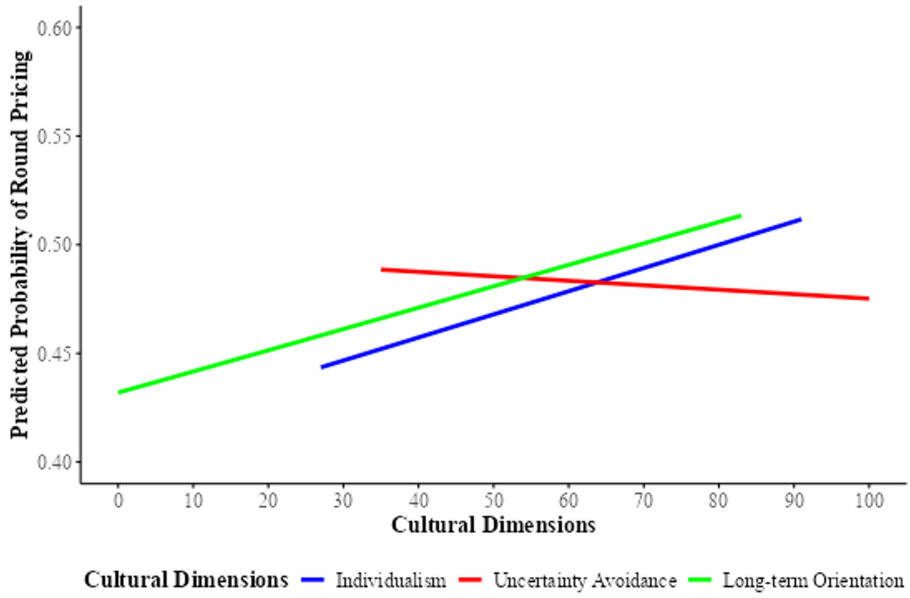

FIGURE 3
Visual representation of the results of the binomial regressions for round prices. This figure visualizes the results of the binomial regressions. The values shown represent the probability predicted by the individual cultural dimensions that a price will be set as a round price. The changes correspond to the direction and strength of the reported odds ratios of the respective analyses.

H2c. For just-below prices, an $OR_{jbUA} = 1.059$ suggested, counter to H2b, that countries with higher uncertainty avoidance scores had a higher prevalence of just-below prices (relative +5.9% for a 10-step UA increase). For precise prices, an $OR_{pUA} = 0.953$ indicated that, in line with our hypothesis, countries with higher UA scores showed a lower prevalence for precise prices (relative −4.7%). Chi²-statistics corroborated this pattern ($\chi^2_{rUA}[1] = 0.580$, $p_{adj} = .892$; $\chi^2_{jbUA}[1] = 20.88$, $p_{adj} < 0.001$; $\chi^2_{pUA}[1] = 14.32$, $p_{adj} < 0.001$). Whereas, the data supported H2c, H2a and H2b were not supported.

Binomial logistic regressions with LTO as predictor established significant effects for round and just-below prices (both $p_{adj} < 0.001$) but not for precise prices ($OR_{pLTO} = 1.007$, $p_{adj} = 0.892$; see Figure 5 for an overview, not supporting H3c). For round prices, an $OR_{rLTO} = 1.040$ indicated that in more long-term oriented countries round prices were more prevalent (relative +4.0%); in line with H3a. For just-below prices, an $OR_{jbLTO} = 0.943$ indicated that in more long-term oriented countries just-below prices were less common (relative −5.7%), again supporting H3b. Chi²-statistics corroborated these findings ($\chi^2_{rLTO}[1] = 19.49$, $p_{adj} < 0.001$; $\chi^2_{jbLTO}[1] = 32.46$, $p_{adj} < 0.001$; $\chi^2_{pLTO}[1] = 0.38$, $p_{adj} = 0.892$). In sum, the data supported H3a and H3b but not H3c.

4.3.2 Investigating the three cultural dimensions simultaneously

The prior analyses treated the cultural dimension as separate predictors. However, the dimensions could co-vary and jointly predict price prevalence. Hence, we decided to investigate their predictive power of price prevalence simultaneously (Table 3). Specifically, we ran three multiple binomial logistic regressions and introduced the predictors (IND, UA, LTO) in a forward procedure (Field, 2013). The results showed that for all price endings a model with multiple predictors was reasonable. Hence, we listed predictors from most to least explained variance.

For round prices, a model ($\chi^2_r[2] = 28.09, p < 0.001$) consisting of LTO ($OR_{rLTO} = 1.034$, $p < 0.001$) and IND ($OR_{rIND} = 1.034$, $p = 0.003$) emerged. UA ($p = 0.821$) did not explain any further variance. These multiple logistic regression results corroborate the prior findings in that both LTO and IND can predict the prevalence of round prices, while UA does not add significant predictive power. The results further indicate that both predictors explain separate parts of variance in price prevalence.

For just-below prices, the model ($\chi^2_{jb}[3] = 89.35$, $p < 0.001$) contained all three predictors, IND ($OR_{jbIND} = 0.931$, $p < 0.001$), LTO ($OR_{jbLTO} = 0.945$, $p < 0.001$), and UA ($OR_{jbUA} = 1.045$, $p = 0.006$). These multiple logistic regression results corroborate the prior findings in that all three predictors can predict the prevalence of just-below prices. In addition, the results indicate that all three predictors explain separate parts of the variance of price prevalence.

Finally, for precise prices, the analysis suggested a model ($\chi^2_p[2] = 18.23$, $p < 0.001$) with two predictors, UA ($OR_{pUA} = 0.966$, $p = 0.016$) and IND ($OR_{pIND} = 1.029$, $p = 0.047$). LTO was left out of the model ($p = 0.484$). Again, these multiple logistic regression results corroborate the prior findings in that both UA and IND can predict the prevalence of round prices and that LTO does not add significant predictive power. Additionally, the results indicate that both predictors explain separate parts of variance of price prevalence.

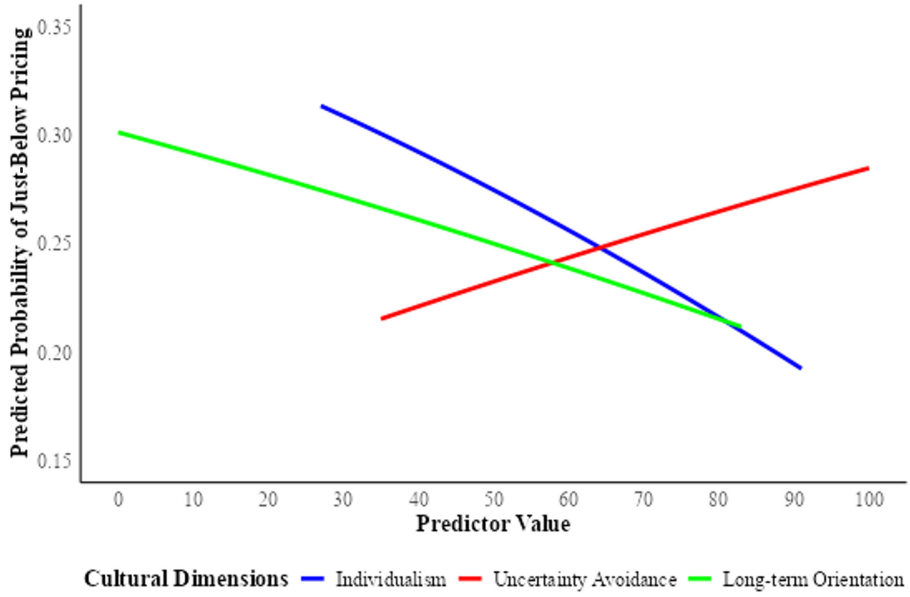

FIGURE 4
Visual representation of the results of the binomial regressions for just-below prices. This figure visualizes the results of the binomial regressions. The values shown represent the probability predicted by the individual cultural dimensions that a price will be set as a just- below price. The changes correspond to the direction and strength of the reported odds ratios of the respective analyses.

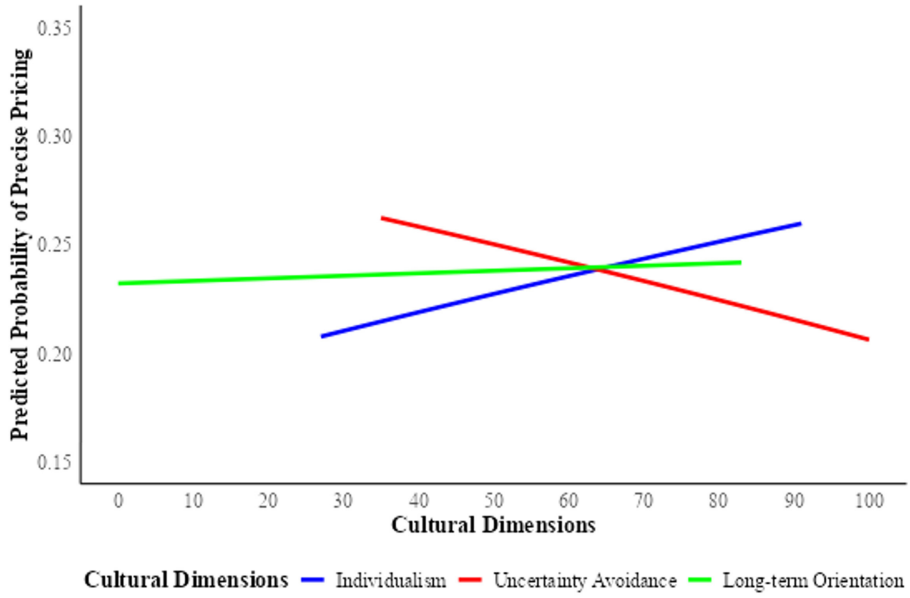

FIGURE 5
Visual representation of the results of the binomial regressions for precise prices. This figure visualizes the results of the binomial regressions. The values shown represent the probability predicted by the individual cultural dimensions that a price will be set as a precise price. The changes correspond to the direction and strength of the reported odds ratios of the respective analyses.

5 Discussion

In today's globalized markets, it is increasingly important to take the cultural background of consumers into account. A plethora of research has suggested that price-ending prevalence differs between countries. Evidently, retailers seem to consider cultural specificities when defining their price endings. Despite this research, surprisingly little is currently known about how cultural characteristics—such as the degree to which consumers avoid uncertainty, are individualistic, and have a longer-term orientation—can explain whether certain price endings are more (vs. less) prevalent. The present work expands the pricing literature by establishing that Hofstede's (1984) cultural model can predict differences in price-ending prevalence based on a diverse database

TABLE 3 Results of the binomial regressions investigating cultural dimensions simultaneously.

			95% CI for odds ratio			
	Entry step	B (SE)[a]	Lower	Odds ratio[b]	Upper	χ^2 (df)[c]
Round vs. others						
Constant		−0.45 (0.08)***				
Long-term orientation	1	0.03 (0.01)***	1.015	1.034	1.053	19.49 (1)***
Individualism	2	0.03 (0.01)**	1.011	1.034	1.057	28.09 (2)**
Uncertainty Avoidance	–					
	Nagelkerke's $R^2 = 0.004$					
Just-below vs. others						
Constant		1.57 (0.17)***				
Individualism	1	−0.07 (0.02)***	0.903	0.931	0.961	63.91 (1)***
Long-term orientation	2	−0.06 (0.01)***	0.924	0.945	0.966	81.73 (2)***
Uncertainty Avoidance	3	−0.04 (0.02)**	1.013	1.045	1.077	89.35 (3)**
	Nagelkerke's $R^2 = 0.014$					
Precise vs. others						
Constant		1.25 (0.16)***				
Uncertainty Avoidance	1	−0.04 (0.01)*	0.939	0.966	0.994	14.32 (1)***
Individualism	2	0.03 (0.02)*	1.000	1.029	1.059	18.23 (2)*
Long-term orientation	–					
	Nagelkerke's $R^2 = 0.003$					

This table presents the results of the three multiple binomial logistic regressions in which we introduced the predictors (IND, UA, LTO) in a forward procedure. We list predictors from most to least explained variance. For reasons of completeness, we also list predictors that did not explain any further variance and, thus, were not included in the respective model.

[a] $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[b] Note that the values of cultural dimensions were divided by 10. The odds ratios can be considered as a step of 10 on the respective dimension. All other indicators do not change due to this transformation.

[c] The Chi²-values are given for the respective model after each step.

of an online marketplace including 9,200 prices from 23 different countries. To our knowledge, the present work offers the most comprehensive analysis on the impact of cultural differences on the prevalence of price endings to date.

First, we investigated the cultural dimension individualism, in which higher scores indicate a culture in which individuals are primarily concerned about themselves while lower scores foster the integration into cohesive in-groups that distinguish themselves from out-groups (Hofstede et al., 2010). With higher individualism scores, we found an increased prevalence of round prices and a reduced prevalence for just-below prices. The prevalence of precise prices increased with higher individualism scores. Second, we investigated uncertainty avoidance which describes a culture's ability to cope with uncertain or ambiguous situations (Hofstede et al., 2010, p. 191). We found no relationship with round prices, while just-below prices were more prevalent with higher uncertainty avoidance. Higher uncertainty avoidance, additionally, contributed to a lower prevalence of precise prices. Finally, we investigated long-term orientation, which describes the degree of how future oriented cultures are (Hofstede et al., 2010). The results show that an increase in long-term orientation is associated with an increase in the prevalence of round prices and a decrease in the prevalence of just-below prices. Contrarily, long-term orientation showed no significant association with precise prices.

5.1 Contributions

The present results expand the literature by offering a more detailed understanding of how cultural dimensions are associated with different price ending prevalence. Previous empirical research painted a rather ambiguous (and scattered) picture on the prevalence of price endings across various studies conducted in diverse countries (e.g., Suri et al., 2004; Nguyen et al., 2007). The present study integrates various cultures and tries thereby to disentangle and further illuminate the scattered findings based on the validated cultural model from Hofstede (1984).

Before we discuss our findings in more detail, it should be kept in mind that we focused on one specific online marketplace, while the extant literature is based on various different marketplaces. This marketplace focuses on consumer-to-consumer (i.e., C2C) selling and is globally active but diverges from the frequently studied big online retailers on several dimensions that might affect price ending prevalence. First, our C2C marketplace does not represent big corporations but consumers selling their products. Even though consumers also must consider their prices when selling products, they might do so to a lesser degree. Second, our study focuses on an online marketplace making it easier to use precise prices which often produce inconvenience in offline stores as they result

in consumer's waiting for and receiving change (see Wieseke et al., 2016).

For present purposes, it seems warranted to mention a few of the most recent findings from pricing research. Specifically, a recent meta-analysis (Troll et al., 2023) contrasted round and just-below prices in their effects on consumers' perceptions: this meta-analysis found a small effect for just-below (vs. round) prices signaling a "good deal" but no significant evidence for the frequent suggestion that round (vs. just-below) prices signal higher quality. It seems that consumers' perception of just-below vs. round prices is not as straightforward as suggested by extant literature and prior theorizing (e.g., Schindler, 1991). This meta-analysis also finds that price prevalence in the respective country moderated pricing effects on consumer perceptions—the more prevalent just-below prices were in a country, the smaller their advantageous effect of signaling a "good deal". Thus, the price prevalence itself seems to affect consumers' price perceptions. This moderation also suggests that actively using "sub-optimal" pricing (based on the assumption that the present research model represents an "optimal" pricing strategy) may in fact be the right decision depending on the complex structure of the target market, creating mixed results.

Although we derived our hypothesis using up-to-date consumer and pricing research, we found mixed results for the widely-used and empirically investigated round and just-below prices, further expanding the complexity of this research field. For instance, contrary to our hypotheses, we find that an increase in individualism positively predicts the prevalence of round prices and negatively predicts the prevalence of just-below prices. Hence, more trust in the retailer might not be the reason for just-below prices. Although empirical evidence on the often proposed quality image effect is mixed (see Troll et al., 2023, for a meta-analysis), retailers might still assume that just-below prices signal a lower quality (Schindler et al., 2011). This association, in turn, might lead to a decrease in the prevalence of just-below prices because retailers do not want to signal low quality and because they want to offer high-quality products for consumers to fulfill their individuality (Schindler and Kibarian, 2001; Guido and Peluso, 2004; Levy et al., 2020). In line, as round prices are also quite prevalent in individualistic cultures and retailers still want to signal high quality, they might do so independent of the trust that consumers have in retailers in these cultures (Schindler and Kibarian, 2001; Guido and Peluso, 2004; Levy et al., 2020). Hence, consumers in highly individualistic cultures might explicitly want to purchase high quality products and therefore retailers rely on round instead of just-below prices.

Further, we expected that higher uncertainty avoidance increases the prevalence of round prices and decreases the prevalence of just-below prices. Contrary to our expectation, we found no such relationship for round prices and indeed a higher uncertainty avoidance coincided with a higher prevalence of just-below prices. Contrary to our hypotheses but based on the same literature, it can also be argued that a higher uncertainty avoidance might lead to a higher prevalence of just-below prices. The reason being that, if retailers and consumers want to decrease uncertainty, one way to achieve this is by making the product appear less expensive. Indeed, as stated above, just-below prices are associated with generally a lower price and "a good deal" (Schindler and Kibarian, 2001; Guido and Peluso, 2004; Schindler et al., 2011; Levy et al., 2020). This could explain why retailers opt for signaling lower prices in high uncertainty cultures. A similar argument can be made for round prices: in accordance with a recent price-ending meta-analysis (Troll et al., 2023), it may well be that retailers and consumers do not associate "good quality" with round prices, which is why these prices are not used as frequently after all and not able to reduce uncertainty.

Our results on precise prices—which have received relatively little attention in the price ending literature up to now—largely support the pre-registered hypotheses. Precise prices were more prevalent in high individualism cultures and less common in cultures with high uncertainty avoidance. This is in line with our assumption that precise prices are less common compared to other prices on an absolute level (Lee et al., 2009) and, as a result, are likely perceived as more unique and innovative. The present results corroborate that precise prices are indeed less prevalent compared to just-below and round prices in a wide range of countries (see Table 1). These differences in price-ending prevalence likely also affect consumers' price perception (see Troll et al., 2023). For instance, research showed that just-below prices signal lower quality and to be "the lowest price around" (Schindler and Kibarian, 2001). However, after years and decades, during which consumers were confronted with these prices on a regular basis, the meaning of these price endings may have changed. Recent research suggests that consumers perceive just-below prices as possibly deceptive and manipulative (Jeong and Crompton, 2018). In contrast, precise prices form a new price-ending strategy that might not (yet) signal any form of manipulation or deception attempts to consumers.

5.2 Implications

There is a long-standing tradition of pricing research. However, to date, we know surprisingly little on cultural differences on (a) retailers' use of certain price-endings, nor (b) consumers' perception of these price-endings. The present study focused on (a): It focused on cultural differences in price prevalence and found that cultural dimensions (i.e., individualism, uncertainty avoidance, long-term orientation) are able to explain differences in price prevalence. Thus, we hope present findings inspire future research to also systematically investigate the yet open research question (b): do cultural characteristics also affect consumers' perception of certain price endings? Future research should build on the present findings and investigate whether cultural characteristics can indeed explain that consumers perceive certain prices as more (vs. less) unique and innovative, indeed provide more (vs. less) trustworthy information, and signal higher (vs. lower) product quality. There is first empirical precedent that consumers from different countries differ in their price perception (Suri et al., 2004). Future work should expand this research by using a more comprehensive dataset with more complete and diverse country samples rather than contrasting selected, single countries—ideally, while accounting for Hofstede's dimensions to take a broader view on cultural differences.

Further, we developed a categorization of the three most common price categories discussed in the pricing literature (e.g., Wieseke et al., 2016). Importantly, this price-ending conceptualization is independent of price length and the respective currency and empirical analyses are based on a large data set that simultaneously keeps other factors constant (due to the same online setup from the online marketplace). While previous research often focused only on the very last (e.g., Kreul, 1982) or the last two digits (e.g., Schindler, 2001) of a price, our operationalization distinguishes between three price-ending strategies, round, just-below, and the least common precise prices, thereby taking the whole price into account and further differentiating price-ending effects (see also Wieseke et al., 2016). We wish to argue that the specific meaning of a price is not (only) expressed in its very last digits but in the whole price structure. This approach allows us to attain a more holistic picture of price prevalence. We hope that future research builds on the present study by adopting the more nuanced categorization of the price-ending "triad" of round, just-below, and precise prices (for a detailed R-script which categorizes prices accordingly, please refer to the OSF project). For instance, research using big data might use these price-ending categories to systemize prices in existing datasets and follow-up with subsequent empirical analyses. Such approaches promise to shed light on whether price-endings indeed lead to increased (or decreased) real-life consumer purchase behavior, for instance, based on sale numbers in e-commerce.

5.3 Limitations

As with any study, this one has limitations that highlight future research avenues. First, regarding the methodology, our web-scraping approach enabled us to read out prices of a large, multi-national, online marketplace. This may have led to potential biases in the present data due to the exclusion of retailers using a non-national currency (e.g., EUR) to address a wider range of consumers. To prevent this bias from exerting an overly strong effect on logistic regression analyses, we decided to exclude countries that showed an unusually high level of precise prices (and very few round ones) in their national currency (see Table 1; "excluded countries"). Likely, these retailers in the excluded countries originally set their prices in a non-national currency to appeal to a certain (foreign) consumer segment (see results section for more details).

Furthermore, our data collection led to only a few South American, African, and Asian countries in our database. Consequently, the present findings are not readily generalizable to a global scale. However, at least to our knowledge, the present study provides the most comprehensive database to investigate cultural differences in price prevalence to date. We hope that the study inspires more research that assumes a cultural perspective on price-ending practices, ideally including more South American, African, and Asian countries in the sample (see WEIRD people; Henrich et al., 2010a,b; Muthukrishna et al., 2020).

Building on this, our analysis provides some limitations. First, one must acknowledge that there is some inherent dependency between our dependent variables. For instance, an increase in round prices in one culture goes hand in hand with a decrease in the number of just-below and precise prices in the same country. This is in line with the hypotheses arguing that one price-ending is more prevalent than the other. This poses some challenges to identify underlying mechanisms for future research. Future research needs to find ways in which to connect the underlying mechanism with the increase (or decrease) of specific price-endings. This means that one underlying mechanism might be responsible for the increase in one price-ending but that does not tell us why another price-ending decreases.

Lastly, our results are correlational in nature and do not allow for a causal interpretation. Even though it is plausible that cultural dimensions predict price endings (and not vice versa), it should be noted that we did not establish a cause-effect relationship. While our study focuses on the relationship between cultural dimensions and price-ending prevalence, we acknowledge that the "treatment" factor is assigned at the country level. Sellers within the same country share not only the cultural dimensions analyzed but also other factors, such as language, media, and broader cultural or institutional influences—all of which might (also) impact sellers' price-ending decisions. Future research may strive to use an experimental design to establish cause-effect relationships and explore more deeply which cultural, socialization factors specifically account for sellers' price-ending decisions. Further, in our explorative analyses (see SOM), we include gross-domestic product and the GINI index into the analysis. The addition of the control variables GDP and the GINI index to the cultural predictors individualism, uncertainty avoidance, and long-term orientation changed the results. For round prices, only one of two predictors continued to contribute to significant predictions. However, for just-below prices, the prediction patterns remained the same, while for precise prices, they changed completely. The effect sizes indicate that the prevalence of round and precise prices is driven more by economic performance and income distribution. Meanwhile, the prevalence of just-below prices appears to be driven primarily by cultural factors. Nonetheless, both the control variables and the cultural predictors only explain small parts of the overall variance. Future research might dive deeper into further variables, including additional controls, to understand how much variance is explained by the cultural dimensions, thereby directly tackling this endogeneity concern.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: osf.io/zg4k2.

Ethics statement

Ethical review and approval was not required for the main study without human participants in accordance with the local legislation and institutional requirements. For the preliminary study, participants provided their written consent to participate after reading the instructions.

Author contributions

AV: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. ET: Supervision, Writing – original draft. MS: Writing – review & editing. DL: Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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