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Helping consumers to evaluate annual percentage rates (APR) on credit cards

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Abstract

To help consumers make informed decisions, regulators often impose disclosure requirements on financial institutions. However, disclosures may not be informative for consumers if they contain difficult-to-evaluate attributes, such as annual percentage rates (APRs). To improve a consumer's ability to evaluate the relative attractiveness of products with difficult-to-evaluate attributes, evaluability theory suggests providing consumers with distributional information. Here, we tested whether credit card disclosures containing graphs of the distribution of APRs in the credit card market help consumers estimate the relative costs of credit and evaluate credit cards. In two studies, we found that consumers using standard credit card disclosures (without distributional information) underestimated the costs of credit card APRs relative to the market. We then built on the graph design literature to design different graphs for presenting distributional APR information. A comparison of the graphs we designed showed that a histogram was most successful at improving consumers' estimates of APR costs relative to the market and modifying consumers' evaluations of an expensive credit card. We discuss the implications of our findings for evaluability theory, graph design, and communication efforts that aim to provide consumers with meaningful financial disclosures.

Keywords: credit card, financial disclosure, general evaluability theory, graphs

Public significance statement

We examined whether augmenting credit card disclosures with graphs that show the market distribution of credit cards' annual percentage rates (APRs) increased consumers' ability to estimate the a credit card's costs relative to the market and evaluate its relative attractiveness. As compared to the other graphs we tested (e.g., box plot, pie chart, and probability density/cumulative density "combination" graph), a histogram of the distribution of APRs in the market showed the most promise for improving consumers' estimates and evaluations.

Helping consumers to evaluate annual percentage rates (APR) on credit cards

To help consumers make informed decisions about financial products such as credit cards, policymakers have imposed disclosure requirements on financial institutions (Day & Brandt, 1974; Durkin & Elliehausen, 2011; Truth in Lending, 2009). In recent years, policymakers have become interested in studying the impacts of these disclosures on consumers, with efforts being undertaken by the Consumer Financial Protection Bureau (e.g., Johnson & Leary, 2017; Kleimann, 2013), Federal Reserve Board (e.g., Macro International, 2007), and Federal Trade Commission (e.g., Lacko & Pappalardo, 2007), among others. In doing so, policymakers have generally concentrated on increasing consumers' "verbatim" recall of absolute numbers that are disclosed (Reyna, 2008). For example, studies have tested whether consumers correctly identify the absolute annual percentage rates (APRs) presented on disclosures (e.g., an open-ended question asking "What is the annual percentage rate, that is, the APR, for Loan M?" Lacko & Pappalardo, 2007). Unfortunately, verbatim recall of absolute numbers may not be sufficient for helping consumers to evaluate the relative attractiveness of credit card offers, or to decide whether specific credit offers are worthwhile (Reyna, 2008).

Evaluability Theory

The current research applies evaluability theory (Hsee & Zhang, 2010) to credit card annual percentage rate (APR) disclosures to determine whether modified disclosures can better help consumers evaluate offers they receive. Evaluability theory suggests that a consumer's ability to evaluate the relative attractiveness of an attribute like APR is based on characteristics including the nature of an attribute and the consumer's access to information about that attribute.

Below, we describe these two characteristics and their application to credit card APR disclosures.

Nature of Attributes

A first premise of evaluability theory is that consumers' ability to evaluate the relative attractiveness of specific product attributes (including absolute APR) depends on an inherent physiological or psychological reference system (or the "nature" of an attribute) (Hsee & Zhang, 2010). For instance, without knowing the distribution of programming experience for computer programmers, it is not possible to evaluate how good or bad it is that a programmer has written 15 computer programs. In contrast, inherent physiological systems in your body will tell you whether that programmer's handshake causes you pain (Gonzales-Vallejo & Moran, 2001; Hsee & Zhang, 2010). Similarly, likely because people lack inherent reference systems for financial concepts like APR, they tend to incorrectly estimate the relationship between APR and various dollar amounts (Soll, Keeney, & Larrick, 2013; McKenzie & Liersch, 2011), incorrectly estimate relative costs on loans over varying time periods (Benzion, Granot, & Yagil, 1992), and fail to choose mortgages that would be cheapest for them (Lino, 1992). These misunderstandings are ironic given that APR was originally intended to serve as a measure that would allow consumers to quickly and easily compare total finance costs across products (Durkin & Elliehausen, 2011).

Access to distributional information

A second premise of evaluability theory is that it is possible to increase a consumer's ability to evaluate the relative attractiveness of an attribute by providing distributional information about that attribute (Hsee & Zhang, 2010). Indeed, "an attribute is said to be easy to evaluate if the decision maker knows its distribution information and thereby knows whether a given value on the attribute is good or bad" (Hsee, 1998, p. 109). For example, in one experiment, participants were asked to evaluate hypothetical job candidates for a computer programming job based on the absolute number of computer programs that candidate had written. Participants were more likely to incorporate the absolute number of computer programs into their evaluations when they were provided with distributional information to raise the evaluability of that attribute: the range of computer programs completed across all job candidates (i.e., between 10 and 100 programs) (Gonzales-Vallejo & Moran, 2001).

In a similar fashion, the current research tested whether it would be possible to increase the evaluability of credit card APRs by providing consumers graphs showing the distribution of credit card APRs in the credit card market. Our goal was to design graphs to convey the distribution of credit card APRs.[1] Unfortunately, most research on graph comprehension has not focused on how to best communicate distributions but rather on how to communicate risk (Chua, Yates, & Shah, 2006; Garcia-Retamero & Cokely, 2013; Garcia-Retamero & Galesic, 2009; Spiegelhalter et al., 2011), differences between groups (e.g., Cohen & Cohen, 2006; Lane & Sándor, 2009), trends over time (Lipkus & Hollands, 1999), or extreme values in a distribution, such as expected high and low temperatures (Savelli & Joslyn, 2013).

We based our research on the only prior study that systematically tested different types of graphs for communicating distributional information (Ibrekk & Morgan, 1987). It showed participants nine graphs containing distributional information about expected snowfall, including

[1] Research suggests graphs should be designed to address specific communication goals; for instance, line graphs are recommended for communicating trends, because people viewing line graphs are more likely to make inferences about trends than those viewing equivalent data in a bar graph format (Lipkus & Hollands, 1999; Shah & Hoeffner, 2002). Conversely, bar graphs are better than line graphs at communicating differences between groups (Lipkus, 2007). Here, we focused on graphs designed for communicating distributions (e.g., Ibrekk & Morgan, 1987).

a histogram, pie chart, modified box plot, probability density chart, and cumulative density chart (Ibrekk & Morgan, 1987). Participants were asked to interpret the graphs by reporting the probability that snowfall would be greater than some value, x, or within some range, a to b, and were also asked which display they preferred. No single chart performed best on all measures; for instance, participants preferred histograms and pie charts, but estimated a 95% confidence interval most accurately after viewing a modified box plot. As a result, the authors speculated that "it seems likely that the best strategy is to combine displays to obtain the best features of each" (p. 528), and recommended that future research test a "combination" probability density/cumulative density chart. The current research compares four graphs from that study, including the previously untested combination chart, in an attempt to communicate distributions of credit card APRs.

Overview of the Current Research

The current research applied evaluability theory (Hsee & Zhang, 2010) to credit card disclosures. The first study asked the following research questions: How well can consumers using standard disclosures (a) identify absolute APR and (b) estimate relative costs of APRs, and (c) do consumers' estimates of relative costs improve when they correctly identify absolute credit card APRs? The second study explored disclosures with distributional information, asking: (d) Does providing a graph showing the distribution of APRs in the credit card market affect consumers' identification of absolute APR, estimates of relative costs, or evaluations of a credit card offer, and (e) If so, which of four graphs that we designed (a histogram, box plot, pie chart, and "combination" probability density/cumulative density chart) is the most effective method for improving identification, estimates, and evaluations?

Study 1

Study 1 was designed to answer the following research questions: How well can consumers who are presented with standard credit card disclosures (a) identify absolute APR and (b) estimate relative costs of APRs, and (c) do consumers' estimates of relative credit costs improve when they correctly identify absolute credit card APRs?

Method

Participants. This study and Study 2 were approved by the Institutional Review Board at Carnegie Mellon University. We recruited 193 U.S. residents online using Amazon's Mechanical Turk website (www.mturk.com; see Buhrmester, Kwang, & Gosling, 2011) for a 10-minute "Credit Card Study," paying $.50. Participants were eligible if they had successfully completed at least 95 percent of their previous tasks. Participants from MTurk samples are just as likely to commit standard decision-making biases as participants from other samples (Goodman, Cryder, & Cheema, 2013), yielding similar effect sizes for a range of experimental tasks (Paolacci, Chandler, & Ipeirotis, 2010).

We excluded 23 participants who started but did not complete the study, leaving a final sample of 170 (64 women; 42.1% college educated; M_{age} = 30.6 excluding two participants who did not report age, SD = 10.0; $Mdn_{annual\ income}$ = \$30,000 to \$40,000). Consistent with prior research on MTurk, our participants had higher education and lower income levels than the general U.S. population (Paolacci, Chandler, & Ipeirotis, 2010).

APR variation in disclosures. Participants were asked to review a standard, non-graphical credit card solicitation (similar to Figure 1, but without a histogram). It conformed to legal requirements for disclosures provided by credit card issuers to consumers. Participants were randomly assigned to a disclosure that contained one of four absolute values for APR

(11.99%, 17.99%, 23.99%, or 29.99%). Together, these absolute APR values covered a range of realistic costs (Mintel, 2014). Participants could review the credit card disclosure on subsequent screens by clicking on a button.

Identification of absolute APR. We asked participants "What was the APR for purchases for the credit card offer you saw?" They responded by typing a value into an open text box. We used text screening to identify correct and incorrect responses.

Estimates of relative costs of APR. We asked participants to estimate the costs of a given APR relative to the credit card market. We asked, "How do you think the card you saw compares to other credit card offers, in terms of APR?" Participants responded by filling a number from 0% to 100% in the statement "I think it is more expensive than ___% of offers."

Credit use and demographics. The final section of the survey asked about credit card use and demographic characteristics. Questions included whether participants had credit cards ("Approximately how many credit cards do you have in total?") and whether APR was an important feature the last time they thought about getting a new credit card ("Yes," "No," and "I have never thought about getting a credit card.") To measure credit scores, we asked "How do you think banks would rate your credit?" Responses were given on a 10-point scale, with endpoints labeled "Very poor (1)" and "Excellent (10)." This question has been found to have a .85 correlation with actual credit scores (Lynch et al., 2010, cited in Fernandes, Lynch, & Netemeyer, 2014) and is likely easier to report than numeric credit score. We also asked participants for basic demographic information (age, education, income, and gender). For the purposes of this research, we concentrate on experimental comparisons and do not discuss these variables further.

Accuracy of estimates of relative costs. To assess the accuracy of participants' estimates of relative credit card costs, we collected information on actual direct mail credit card solicitations using data from the Mintel Comperemedia Mailout Survey (Mintel, 2014). Each month Mintel contacts a nationally representative sample of approximately 9,000 U.S. households, asking them to submit the credit card solicitations they receive. Approximately one third of the households respond.[2] The June 2014 responses were the most recent data available at the time of designing this study. This dataset contains 6,096 solicitations with APRs ranging from 5% to 36% ($M = 15.0$, $SD = 4.0$). Using these data, we calculated that the four APRs we showed were more expensive than 28.0%, 84.0%, 97.5%, and 99.6% of credit card solicitations in terms of APR, respectively. We created an accuracy measure by subtracting these actual costs from participants' estimated costs.

Results

How well can consumers using standard disclosures estimate relative costs of APRs? Using data on credit card solicitations from Mintel, we found that participants perceived the three higher APRs (i.e., all except 11.99%) as less expensive than they actually were, relative to the credit card market (Table 1). For instance, the offer of 17.99% was more expensive than 84% of offers mailed to consumers, but rated by participants as more expensive than only 36.1%, resulting in a discrepancy of 47.9 percentage points. Across the four APR values, average accuracy of participants' estimates differed, $F(3,166) = 42.8$, $p < .001$. Post-hoc comparisons between the APR values using a Tukey test showed that participants' estimates in the 11.99%

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[2] Households were stratified by demographic and risk characteristics and weighted by historical categorical response rates to create a nationally representative sampling frame. However, the resulting sample may not be nationally representative because households that respond may differ from those that do not.

APR value condition were significantly more accurate than those who saw one of the other three APR values (all ps $< .001$). However, none of the estimates provided in the remaining three conditions were significantly different from one another (all ps $> .58$).

How well can consumers using standard disclosures identify absolute APR? Across the four presented APRs, we used the same strict procedure to determine whether participants correctly identified the verbatim absolute APR value. For example, for those in the 11.99% condition, the reported APR was coded as correct if participants included "11.99" in their answer. This strict procedure meant that even slightly deviating answers (e.g., 11.9, 11.95) were marked as incorrect. Nevertheless, 86.5% of participants gave the correct response. The proportion correct did not vary across the four presented APRs, $\chi^2(3, N = 170) = 3.78$, $p = .286$ (Table 1). Relaxing these standards to include any correct response within one percentage point of the true APR (i.e., 10.99 to 12.99 for the 11.99% APR) raised the proportion correct to 97.1%., which also did not vary across the four presented APRs, $\chi^2(3, N = 170) = 5.13$, $p = .16$.

Do consumers' estimates of relative costs improve when they correctly identify absolute credit card APRs? The accuracy of estimated relative costs (calculated as estimated costs less actual costs) was not significantly different between participants who accurately identified the verbatim absolute APR value as suggested by the strict classification method ($M = -30.9$, $SD = 34.9$) and those who did not ($M = -38.1$, $SD = 31.7$; $t(168) = -.94$, $p = .35$). In other words, participants who were able to identify absolute APR values (vs. not) were no better at accurately estimating costs relative to the credit card market. This result did not change when classifying responses within one percentage point of the disclosed APR as correctly identified (M identified $= -31.23$, $SD = 34.43$; M not identified $= -51.59$, $SD = 33.65$; $t(168) = -1.30$, $p = .19$).

Discussion

In this study, we asked: How well can consumers using standard disclosures (a) identify absolute APR and (b) estimate relative costs of APRs? Our findings suggest that, while consumers' ability to correctly identify verbatim absolute APR values on credit card disclosures is high, their ability to estimate costs relative to the credit card market is more limited. In particular, estimates of relative costs varied from actual costs by 47 percentage points on average. Because the presented disclosures followed legal requirements, presenting absolute APR but not relative credit costs, consumers may have found it difficult to estimate the relative costs of a given credit card APR. From a consumer welfare perspective, the resulting errors are concerning because consumers underestimated relative costs of expensive credit cards, suggesting that standard disclosure of absolute APR values may not equip them to avoid expensive offers.

This study also explored whether consumers' estimates of relative costs improved when they accurately identified absolute credit card APRs. We found that those who were able to correctly identify verbatim absolute APR values were no better at estimating the costs of a credit card APR relative to the market. The literature on evaluability theory suggests that consumers may be better able to evaluate the relative attractiveness of attributes if they are given distributional information about the attribute (Gonzales-Vallejo & Moran, 2001; Hsee & Zhang, 2010). The next study tests this idea by providing consumers with disclosures containing information on the distribution of APR values in the credit card market.

Study 2

This study was primarily designed to answer the following research questions: (d) Does providing a graph showing the distribution of APRs in the credit card market affect consumers' identification of absolute APR, estimates of relative costs, or evaluations of a credit card offer, and (e) If so, which of four graphs that we designed (a histogram, box plot, pie chart, and "combination" probability density/cumulative density chart) is the most effective method for improving identification, estimates, and evaluations? In auxiliary analyses, we also gauged whether participants preferred certain graphs. Finally, to replicate results from Study 1, we measured whether consumers' estimates of relative credit costs improved when they correctly identified absolute credit card APRs.

Method

Participants. We recruited 107 students from Carnegie Mellon University's Center for Behavioral Decision Research and 285 U.S. residents using MTurk. The student sample participated in a university laboratory for course credit while MTurk participants performed the task online for $0.50. We dropped data from 38 people who started but did not complete the study. Our remaining sample had 354 participants (186 women with two participants not reporting gender; 42.4% college educated; M_{age} = 31.4 excluding four participants who did not report age, SD = 11.8).

Standard disclosures vs. disclosures containing distributional information. Participants were randomly assigned to one of five conditions, each of which presented a credit card solicitation with an APR of 18.99%. The control condition involved a standard disclosure without a graph, which conformed to regulations on credit card disclosures. The four experimental disclosures each added a different graph to the standard disclosure, to display distributional information about credit card APRs based on the Mintel survey data discussed in Study 1 (Mintel, 2014). The four graphs were a histogram, box plot, pie chart, and probability density/cumulative density "combination" graph (Figure 2), which together formed the set of preferred and recommended graphs from previous research testing ways to communicate distributions of snowfall (Ibrekk & Morgan, 1987). All graphs contained a visual indicator for the current offer placed at 18.99%, because our pilot tests suggested that this labeling made the graphs easier for participants to understand.

All participants had access to the disclosures throughout the study. Student participants had a paper copy of the disclosure, whereas online participants could view the disclosure on each screen by clicking on a button.

Estimates of absolute APR. We measured identification of verbatim absolute values of APR using the same question as in Study 1, "What was the APR for purchases for the credit card offer you saw?" Responses were provided in an open-ended text box.

Estimates of relative costs of APR. We asked participants to estimate the relative costs of the presented credit card APR, "How do you think the Purchase APR on the card compares to other credit card offers that are available?" ("I think it is more expensive than ___% of offers"). Using the Mintel data, we calculated the correct answer to this question to be 85.6%.

Evaluations of credit card offer. We gauged overall evaluations for the credit card offer using two statements, "If I were looking for a credit card, I would be interested in the offer I saw," and "I would apply for this credit card if I received this offer in the mail" (seven-point scale from “Strongly disagree” to “Strongly agree”). Responses to the two statements were highly correlated, $r = .78$, $p < .001$, so we averaged them into a single measure.[3]

Preferences among graphs. We asked participants in the experimental conditions to rate how difficult the graphs were to understand, with response options ranging from “Very easy” to “Very difficult.” Consistent with Ibrekk and Morgan (1987) and recommendations from Lipkus and Hollands (1999), we also gauged all participants’ preferences for the graphs by simultaneously showing them all four graphs. We asked “Imagine that you were designing credit card documents and had the chance to include a graph with information on what APRs are available. If you had to pick one of these graphs to include, which would you pick?”

Credit use and demographics. We asked the same questions as in Study 1 regarding credit use and demographic characteristics. For exploratory purposes, we also added three true/false questions on credit card knowledge adapted from previous research (Chen & Volpe, 1998; Robb & Sharpe, 2009; with correct answers provided here in parentheses): “The higher the APR, the cheaper the card” (false), “Customers with better credit are likely to have credit cards with lower APRs” (true), and “The APR should be used to compare the cost of different loans” (true). Participants could also indicate “I don't know.” To concentrate on experimental effects, we do not consider these variables further.

[3] For exploratory purposes, we also measured overall understanding of credit card market by asking participants to estimate the APRs on the most and least expensive credit card offers available (“What do you think is the Purchase APR on the [most/least] expensive credit card offer that is currently available?”) and three true/false statements (with the correct answer provided here in parentheses): “The Purchase APR on the credit card I saw is higher than the APR on half of the credit card offers available” (true), “All credit card companies charge approximately the same rates” (false), and “More credit cards have a Purchase APR below 20% than above 20%” (true). We omit analyses of these measures to concentrate on our primary measures of interest (Table 2); in brief, the histogram was also beneficial for raising knowledge of the most/least expensive credit cards (odds ratios of 2.37, 2.71, respectively), but had no effect on the true/false statements.

Results

Does providing a graph showing the distribution of APRs in the credit card market affect consumers' estimates of relative costs? On average, participants estimated that the presented credit card offers with the 18.99% APR were more expensive than 49.0 percent (SD = 24.9) of the credit card market, which is 36.6 percentage points lower than the true relative cost of 85.6 percent.[4] However, their estimates differed significantly across conditions. A regression of costs on variables representing each of the graphical conditions showed that relative cost estimates were significantly higher (and therefore more accurate) for participants who saw a disclosure with a histogram (M = 53.0, SD = 24.8), combination graph (M = 51.3, SD = 24.0), or pie chart (M = 56.3, SD = 23.0) versus participants in the control group (M = 38.9, SD = 22.7) who did not see a graph (Table 2).[5] Follow-up tests suggested that none of these graphical conditions performed significantly better than the others (ps > .21). There was no significant improvement for participants viewing the box plot.

Does providing a graph showing the distribution of APRs in the credit card market affect consumers' evaluations of a credit card offer? A regression predicting evaluations from the experimental conditions showed that, as compared to participants in the control condition (M = 2.96, SD = 1.49), only participants viewing the histogram gave lower ratings (M = 2.38, SD = 1.36; Table 2).[6] The average ratings for the boxplot (M = 2.54, SD = 1.55) combination graph (M = 2.62, SD = 1.24) and pie chart (M = 2.98, SD = 1.54) were not significantly different from

[4] Four participants gave non-numeric responses and were omitted from this calculation.
[5] A power analysis shows that with 69 people per condition, we could have detected an effect size of 11.9 percentage points (that is, the following parameters yield an n per condition of 70: $\mu 1 = 49$ and $\mu 2 = 60.9$, $\sigma = 25$, $\alpha = .05$, $\beta = .80$).
[6] A power analysis shows that with 70 people per condition, we could have detected an effect size of approximately .69 (that is, the following parameters yield an n per condition of 70: $\mu 1 = 2.7$ and $\mu 2 = 3.39$, $\sigma = 1.45$, $\alpha = .05$, $\beta = .80$).

the control. As such, the histogram was the most successful at communicating the relatively low attractiveness of this credit card as compared to the overall credit card market.

Does providing a graph showing the distribution of APRs affect consumers' identification of absolute APR? We used the same text screening procedure as in Study 1 to classify APR identification as correct or incorrect. We found that, consistent with Study 1, the majority of participants (91.8%) correctly identified the verbatim absolute APR value for this offer as 18.99%. There were no significant differences in the proportion of participants correctly identifying the verbatim absolute APR value across conditions, $\chi^2(4, N=354) = 4.96$, $p = .29$. Calculating correct identification including any response within one percentage point of 18.99% raised the rate of correct identification to 94.4%, with no significant differences across conditions, $\chi^2(4, N=354) = 2.93$, $p = .57$.

Do consumers' estimates of relative costs improve when they correctly identify absolute credit card APR? There was no difference in estimates of costs relative to the credit card market between participants who accurately identified the verbatim absolute APR and those who did not using precise identification of 18.99% APR (M identified = 49.29, SD = 24.70; M not identified = 46.16, SD = 27.01; $t(348) = -0.61$, $p = .55$) or the method that allowed for one percentage point of variation in APR (M identified = 49.24, SD = 24.62; M not identified = 42.50, SD = 31.97; $t(345) = -0.99$, $p = .32$). There was also no difference in evaluations between those who accurately identified the verbatim absolute APR using precise identification (M identified = 2.71, SD = 1.45; M not identified = 2.64, SD = 1.51; $t(352) = -.25$, $p = .80$) or identification within one percentage point of APR (M identified = 2.71, SD = 1.46; M not identified = 2.64, SD = 1.51; $t(352) = -0.25$, $p = .80$).

Which graphs do participants prefer? A regression comparing each of the graphs to the histogram (omitting participants in the control group, who did not see any graph) showed that participants rated the combination graph as significantly more difficult to understand (Table 2). There were no other significant differences in difficulty ratings relative to the histogram ($p > .10$). When participants viewed all of the graphs simultaneously, they preferred the pie chart (44.1%), followed by the histogram (27.1%), box plot (16.4%), and combination chart (12.4%). We found, however, that graph choice varied across conditions, $\chi^2(12, N=359) = 31.71$, $p = .002$, with participants being more likely to choose the graph that they had seen during the study. As such, we also separately examined graph preference for participants in the control condition, who had not previously viewed any of the graphs. Among that group, the pie chart remained the most preferred choice (46.4%), followed by the histogram (27.5%), combination graph (15.9%) and the box plot (10.1%).

Discussion

In Study 2, we asked whether providing consumers with graphs of the distribution of credit card APRs would affect their estimates of the costs of a credit card's APR relative to the market, their ability to identify APR, and their evaluations of a credit card offer. Specifically, we compared standard, legally required disclosures of absolute APR values to disclosures that contained one of four different graphs that we designed (based on Ibrekk & Morgan, 1987). We found that, relative to a standard disclosure without a graph, the histogram, combination graph, and pie chart we designed increased participants' ability to estimate relative costs – without reducing participants' ability to identify the absolute APR value. However, only the histogram led to more negative evaluations of the attractiveness of the credit card offer. Furthermore, the histogram was the second most preferred graph by participants. Given the high performance of the histogram across these measures, we conclude that this graph was the most successful of the graphs that we tested.

General Discussion

Providing consumers with product disclosures is a near-ubiquitous policy intervention (Lacko & Pappalardo, 2010), one that has been called “lawmakers’ favorite technique” (Ben-Shahar & Schneider, 2014, p.1). Given this reliance on presenting consumers with information, it is reasonable that researchers and policymakers attempt to make disclosures more effective. However, evaluability theory suggests that consumers also need distributional information to understand the relative attractiveness of attributes such as APR. In the current research, we therefore built on insights from evaluability theory (Hsee & Zhang, 2010) and graph design to examine whether we could design credit card disclosures that improved consumers’ assessments of absolute as well as relative APR.

We first explored consumers’ ability to identify and understand credit card terms when using standard, legally required disclosures that do not contain distributional information. We found that the majority of consumers using such disclosures accurately identified verbatim absolute APR values. However, they also tended to underestimate the relative cost of expensive cards compared to the overall credit card market (Study 1), and this underestimation occurred regardless of whether they correctly identify verbatim absolute APR values.

We next explored whether providing distributional information about APR affected consumers’ estimated costs of a credit card relative to the market, their ability to identify APR, and their evaluations of credit card offers. We found that providing graphs of APR distributions helped consumers to accurately estimate the relative costs of a credit card without negatively affecting their ability to identify verbatim absolute APR (Study 2). Perhaps more important from a policy perspective, this graphical information of credit card APR distributions helped consumers view an expensive credit card offer as less attractive (Study 2).

In providing distributional information, we compared different graphical displays to find an effective way to display APR distributions (Study 2). Consistent with previous research (e.g., Garcia-Retamero & Cokely, 2013; Lipkus & Hollands, 1999; Shah & Hoeffner, 2002; Vessey, 1991), our results showed variation in the effectiveness of the graphs we tested, with some graphs (e.g., the boxplot) having negligible benefits for improving consumer understanding of costs relative to the credit card market, and others (e.g., the pie graph) having no effect on consumers' evaluations of the credit card offer. Among the graphs we designed, the histogram was the most useful in helping participants estimate costs and form evaluations.

Policy implications

Policymakers are becoming increasingly interested in the effects of disclosures across many domains (see Ben-Shahar & Schneider, 2010, 2014; Johnson & Leary, 2017; Kleimann, 2013). The research here addresses the general problem of helping consumers realize that a product is expensive relative to other options that are available; as such, our findings may apply to other consumer markets characterized by price variation, including mortgages (Alexandrov & Koulayev, 2017) and mutual funds (Fisch & Wilkinson-Ryan, 2014). Additionally, we build on previous policy research by studying subjective evaluations of financial products in addition to "verbatim" understanding of specific terms (c.f., Kleimann, 2013; Lacko & Pappalardo, 2007; Macro International, 2007). When we contrasted these two sets of measures, we found that the ability to identify absolute levels of APR did not translate to making more accurate estimates of the relative costs. As such, policymakers who are interested in promoting more informed decisions about credit card use must be willing to design disclosures that go beyond the presentation of verbatim facts.

Although not a central focus of our work, Study 2 also revealed a discrepancy between preferences and our other dependent measures. Specifically, participants preferred the pie chart, even though this graph produced mixed results for evaluations. This pattern is consistent with previous research showing that participants like pie charts (Ibrekk & Morgan, 1987) even though they often convey limited benefits in terms of improving understanding (Schonlau & Peters, 2012). One possible explanation for pie charts' low performance is that they are confusing when showing ordinal categories because the highest and lowest categories are presented next to each other. While it is unfortunate that participants did not prefer the most beneficial chart, our experiment suggests that with repeated exposure, all graphs will be liked more. Specifically, participants were more likely to prefer the graph that they saw during the study. It could be the case that, consistent with research on the mere exposure effect, participants grew to like visual stimuli that they had seen previously (Kunst-Wilson & Zajonc, 1980). We leave it to future research to further examine the relationship between familiarity with disclosures, preference, and efficacy, and to build on the results presented here to further refine graph designs.

Limitations and future directions

Disclosure research tends to be critiqued on two fronts: overreliance on laboratory methods, since disclosures are likely to be more salient in the lab than they would be in other settings (c.f. Chin & Beckett, 2018), and disregard for the reactions of financial institutions, since these institutions partially determine how effective disclosures will be in the market (Loewenstein, Sunstein, & Golman, 2014; Perry & Blumenthal, 2012). For instance, if credit card disclosures were to be modified to include distributional information about APR, it is possible that credit card issuers would respond by creating new features or obscuring distributional information to reduce its impact (see Barr, Mullainathan, & Shafir, 2008). The current research can be rightly criticized on both of these points. Although we tried to improve the policy relevance of our research by using realistic stimuli and a relevant set of participants (see Harrison & List, 2004), we tested hypothetical decisions and did not capture reactions from financial institutions. Nevertheless, given that disclosures could have negative welfare consequences for consumers, it seems reasonable to test them in laboratory settings before moving to the field.

Conclusion

This research demonstrates that modifying financial disclosures to include graphs with distributional information about credit costs can improve consumers' understanding of relative credit costs and associated evaluations of the attractiveness of credit card offers. However, not all graphs of distributional information showed the same benefits. It remains to be seen whether graphical interventions have consistent benefits in the real world that would justify the compliance and regulatory costs of inclusion.

Beyond the specific disclosure that we studied here, our findings point to the benefits of experimental comparisons and quantitative evaluations for developing consumer-facing information, a methodological choice advocated by previous authors (Perry & Blumenthal, 2012). As such, our research contributes to growing efforts among researchers and policymakers to make disclosures more effective (e.g., Chin & Beckett, 2018; Johnson & Leary, 2017; Lacko & Pappalardo, 2010; Kleimann, 2013). Such work is essential for creating meaningful disclosure policy and for effectively informing consumer decision making.

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Figure 1. Example credit card disclosure.

National Savings Bank
Consumer Credit Card Agreement
VISA® and MASTERCARD®
Effective 6/1/2014

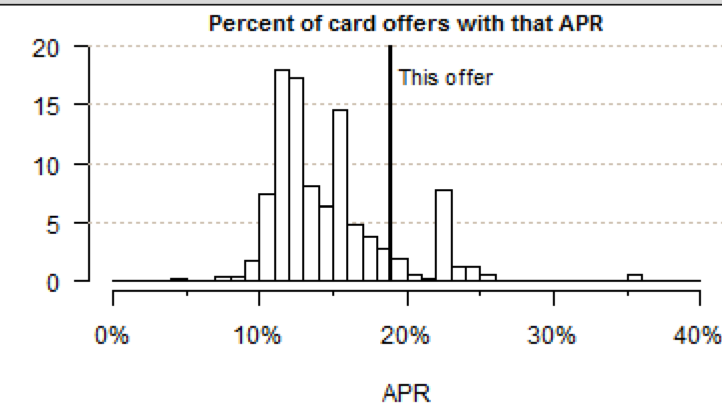
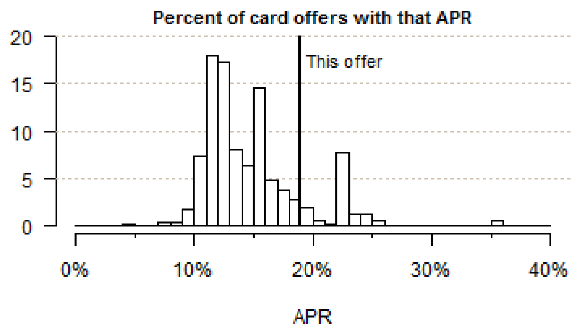
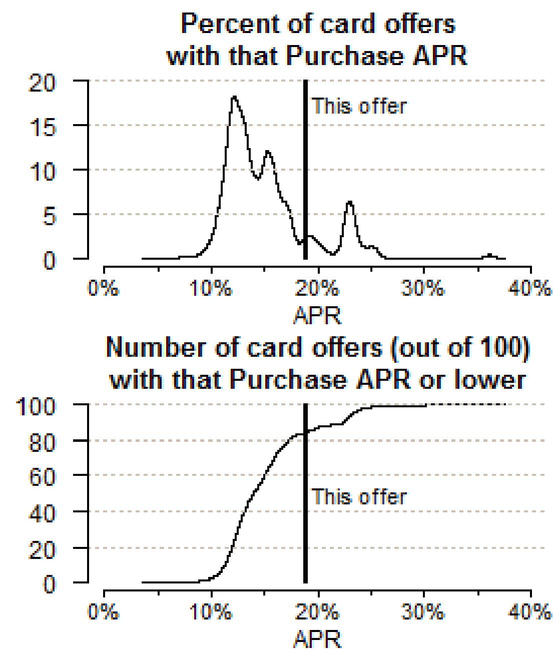
INTRODUCTORY PROVISIONS AND DISCLOSURES: The following information on interest rates, interest charges, and fees are accurate as of the effective date of this agreement and may have changed after that date. To find out what may have changed, contact us.	
Interest Rates and Interest Charges	
Annual Percentage Rate (APR) for Purchases	**18.99%** 
APR for Cash Advances and Quasi Cash Transactions	**18.99%**
Paying Interest	Your due date is at least 25 days after the close of each billing cycle. We will not charge you any interest on purchases if you pay your entire balance by the due date each month.
Minimum Interest Charge	If you are charged interest, the charge will be no less than $1.
For Credit Card Tips from the Consumer Financial Protection Bureau	**To learn more about factors to consider when applying for or using a credit card, visit the website of the Consumer Financial Protection Bureau at http://www.consumerfinance.gov/learnmore**
Fees	
Annual Fee	None
Transaction Fees • **Balance Transfer** • **Cash Advance** • **Foreign Transaction**	 **1.0%** of the amount of each balance transfer. **1.0%** of the amount of each cash advance. **1.0%** of each transaction in U.S. dollars.
Penalty Fees • **Late Payment** • **Returned Payment**	 Up to **$25** Up to **$25**

Figure 2. Graphs used to provide distributional information (Study 2).

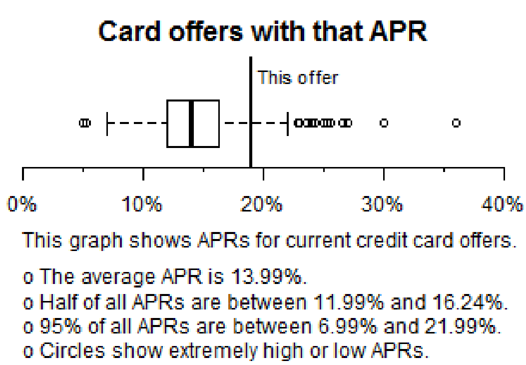
Histogram:



Combination graph:



Box plot:



Pie chart:

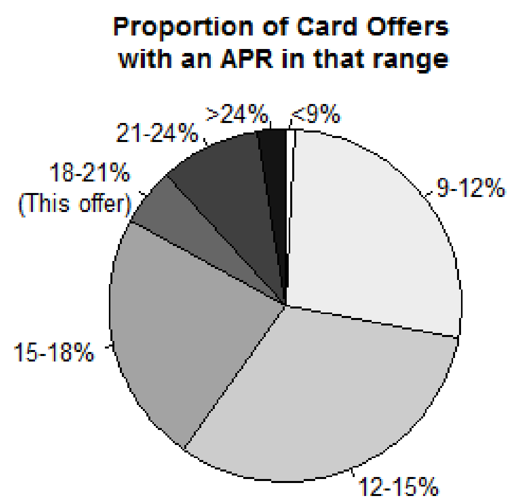


Table 1. Estimated costs and actual costs (Study 1).

	11.99% APR	17.99% APR	23.99% APR	29.99% APR
Estimated costs relative to credit card market				
M	35.5	36.1	56.9	54.5
SD	(24.4)	(22.7)	(26.5)	(30.3)
n	42	45	40	44
Actual relative costs (percentile)	28.0	84.0	97.5	99.6
Difference between estimated and actual costs (percentage points)	7.5	-47.9	-40.6	-45.1

Note. Estimated costs are calculated based on data from study participants. Actual costs are calculated based on data from the Mintel Comperemedia Mailout Survey.

Table 2. Estimate of relative costs, evaluations, and disclosure ratings (Study 2).

	Estimated costs relative to credit card market B (se)	Evaluations of credit card offer B (se)	Graph easy to understand B (se)
Disclosure condition			
Histogram	14.19***	-.58*	[Omitted]
	(4.07)	(.24)	
Box plot	4.96	-.42+	.30
	(4.24)	(.25)	(.20)
Combination graph	12.49**	-.35	-.75***
	(4.14)	(.24)	(.20)
Pie graph	17.48***	.01	.18
	(3.99)	(.24)	(.19)
Intercept	38.85***	2.96***	2.21***
	(2.93)	(.17)	(.14)
R^2	.07	.03	.05
Adj. R^2	.06	.02	.04
N	351	354	290

Note. *** p < .001, ** p < .01, * p < .05, + p < .10.