

# When in Doubt, Throw It Out! The Complicated Decision to Consume (or Waste) Food by Date Labels

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Have you ever walked into your kitchen, opened the cabinet, found a jar of spaghetti sauce with a “use by” date label, and the date printed on it has passed? What would you do? You may say this product has “expired,” and it is no longer safe to consume. You may worry that the spaghetti sauce may taste bad, and you do not want to eat it. Either way, you end up throwing out the product, unopened. Alternatively, you may say that the product is fine and proceed to eat it. Which of these options would you choose if the date label stated, “best if used by”? Would you dispose of the spaghetti sauce and say, “When in doubt, throw it out”? Would your responses differ if the product were a carton of eggs?

If you would opt to throw out a product in any of these scenarios, you are not alone. We have had this question in our own homes. When presenting related research to academic and nonacademic audiences, we are often asked what these date labels really mean. Is the product safe? After stating that we are not food scientists, we proceed to explain the limited regulatory environment of date labels. We frequently hear of stories of domestic squabbles where one partner is perfectly content to consume the “expired” product, while the other believes that product will inflict harm or is unwilling to take the risk given uncertainty about the meaning of the label and the posted date.

Groups like ReFED (<https://www.refed.com/>) and the Harvard Food Policy Law Clinic have suggested that the confusion around date labels is a contributing factor to food waste in the United States. This argument appears in the preamble of the May 18, 2016 U.S. Senate bill S.2947: “Confusion over the meaning of date labels is estimated to account for 20% of consumer waste of safe, edible food, leading to approximately \$29,000,000,000 of wasted consumer spending each year.” As of May 19, 2016, U.S. House bill H.R.5298 states that “date labeling practices on food packaging cause confusion with ‘sell-by,’ ‘best-by,’ ‘use-by,’ and ‘best before’ dates, leading up to 90% of individuals in the United States to occasionally throw out still-fresh food.” Recent publications suggest that consumers are confused about or uncertain of the meaning of the labels or ascribe meaning to the labels beyond what is legally required (Broad Leib et al., 2013; Wilson, Miao, and Weis, 2018). Roe et al. (2018) presented evidence that participants anticipated wasting more milk when a date label was present relative to no date label. However, they did not look at differences across date labels.

The confusion comes in part from the lack of federal policy that clearly defines the meaning and proper use of date labels (Broad Leib et al., 2013). In response, public and private entities—including the U.S. Department of Agriculture (USDA), Food Marketing Institute (FMI) with the Grocery Manufacturers Association (GMA), and Congress—have suggested moving toward two date labels: one for quality and another for safety. However, the bills in Congress suggest “best if used by” for quality and “expires on” for safety. The GMA and FMI suggest “best if used by” for quality and “use by” for safety (GMA, 2018). The Food Safety and Inspection Service of the USDA suggests simply using “best if used by” (U.S. Department of Agriculture, 2016). Using a survey, we explore

consumption responses to date labels about safety and quality, and we describe the policy implications of these labels.

The current study is inspired by Ellison and Lusk (2018), who used a vignette study to evaluate food waste. We draw mostly from the “expired” milk example. In their study they asked participants:

Imagine this evening you go to the refrigerator to pour a glass of milk. While taking out the carton of milk, which is [one quarter; three quarters] full, you notice that it is one day past the expiration date. You open the carton and the milk smells [fine; slightly sour]. [There is another unopened carton of milk in your refrigerator that has not expired; no statement about replacement]. Assuming the price of a half-gallon carton of milk at stores in your area is [\$2.50; \$5.00], what would you do? (Ellison and Lusk, 2018, p.623)

Ellison and Lusk (2018) found that smell was the only factor that contributes to increased waste, though differences exist given the demographics of the participants. In their analysis, they did not explicitly look at the role that date labels may have on waste. Our study explores how participants respond to a trio of products based on date labels, given prices.

## Quality versus Safety Labeling

We evaluate how date labels and prices affect the probability of consuming a product that has “expired”, or passed its posted date. We hypothesized that when we expose study participants to a product 1 day after the posted date, they are more likely to consume (i.e., not waste) the product if the product has a date label about quality than if it has a date label about safety. Following policy proposals discussed by the GMA and FMI, we used “best if used by” to indicate quality and “use by” to indicate safety. We expected this result to hold across multiple products. Given that the value of the product may matter, we controlled for the price of the product as well. We also considered the effect on anticipated consumption. We hypothesized that more participants would consume the product if the product were of greater value. Further, we assessed how the date label and price effects may differ by product.

We conducted a survey as part of a larger food experiment on date labels. In the larger experiment, we brought 206 participants into laboratories in Auburn, AL (104 participants), and Ithaca, NY (102 participants), to evaluate deli meat and spaghetti sauce under different date label treatments. Five respondents were dropped from the sample due to incomplete data. Table 1 provides sociodemographic variables of our sample. We attracted a random sample of participants to the laboratories in university communities. Our sample is not nationally representative, with a heavier representation of college educated and higher income participants than the U.S. population.

To the participants, we posed three vignette questions about anticipated consumption for the two experimental products (deli meat and spaghetti sauce) and eggs. We asked participants

“You find in your refrigerator a carton of 12 eggs marked (“best if used by”/“use by”), which is yesterday. You paid (\$3/\$4) for the eggs. Do you use the eggs or throw out the eggs?”

All respondents saw this question for eggs and the same questions for deli meat and spaghetti sauce. All respondents saw the products in this order. Typically, we would have randomized the order of the products, but because this survey was part of a larger experiment that focused on spaghetti sauce and deli meat, we began this part of the survey with the different product, eggs. In the experiment, the participants evaluated spaghetti sauce and deli meat with the date labels “best by” and “use by.” Thus, we anticipated the participants would evaluate eggs similar to how they evaluated the other two products. However, we randomized respondents into one of four settings for each product in the survey portion. These settings are four possible combinations of two date labels (“best if used by” and “use by”) and two prices (\$3 and \$4).

Participants were asked whether they would consume or waste the product. If they stated that they would consume the product, they indicated the number (eggs) or percentage (deli meat and spaghetti sauce) that they would consume. In this article, we focus only on the choice to consume. We first test whether the responses under

one date label differ from those under the other date label. In this test, we compare whether the date label leads to greater consumption of the “expired” product. We further test whether the date label makes a difference by product. Lastly, we explore whether the chances of consumption differ by the price or the date labels by estimating a model for each product. We include a group of sociodemographic variables as well.

In Table 1 and Figure 1, we provide evidence that participants respond differentially to the date labels. Overall, 89% of respondents would consume the products labeled “best if used by,” compared to 82.1% when labeled “use by” (see Table 1). However, by product we see differences (see Figure 1). For eggs, 92.2% of respondents would consume eggs labeled “best if used by,” while 98% of respondents would

**Table 1. Summary Statistics of the Sample**

	<i>N</i>	Mean	Std. Dev.	Minimum	Maximum
<b>Share of Participants Who Would Consume the Product 1 Day After Posted Date</b>					
All products					
Best if used by	201	0.894		0	1
Use by	201	0.821		0	1
<b>Summary Statistics of Demographic Variables</b>					
Age (in years)	193	40.472	14.203	20	73
Income groups					
Lower income	184	0.348		0	1
Middle income	184	0.429		0	1
Higher income	184	0.223		0	1
Female	198	0.700		0	1
White	201	0.662		0	1
Married/partner	194	0.634		0	1
College educated	201	0.856		0	1

*Note:* The income groups are divided as follows: lower income (<\$85,000), middle income (\$85,000–\$115,000), and higher income (>\$115,000).

consume eggs labeled “use by,” a reversal of the general pattern. The difference of 5.8 percentage points, which is relatively small and statistically insignificant, suggests that the response to the date labels for eggs is not meaningful. For deli meat, 80% of respondents would consume meat labeled “best if used by,” compared to 63.4% who would consume meat labeled “use by.” The 16.6 percentage point difference is large and statistically significant, suggesting a meaningful difference in the response to the date labels for deli meat. Lastly, 95% of respondents would consume spaghetti sauce with “best if used by,” compared to 85.3% of respondents when the sauce has “use by.” Though smaller, the 9.7 percentage point difference is sufficiently large to suggest that participants respond differently to the date labels for spaghetti sauce. This summary suggests that consumers may have different interpretations of date labels across products.

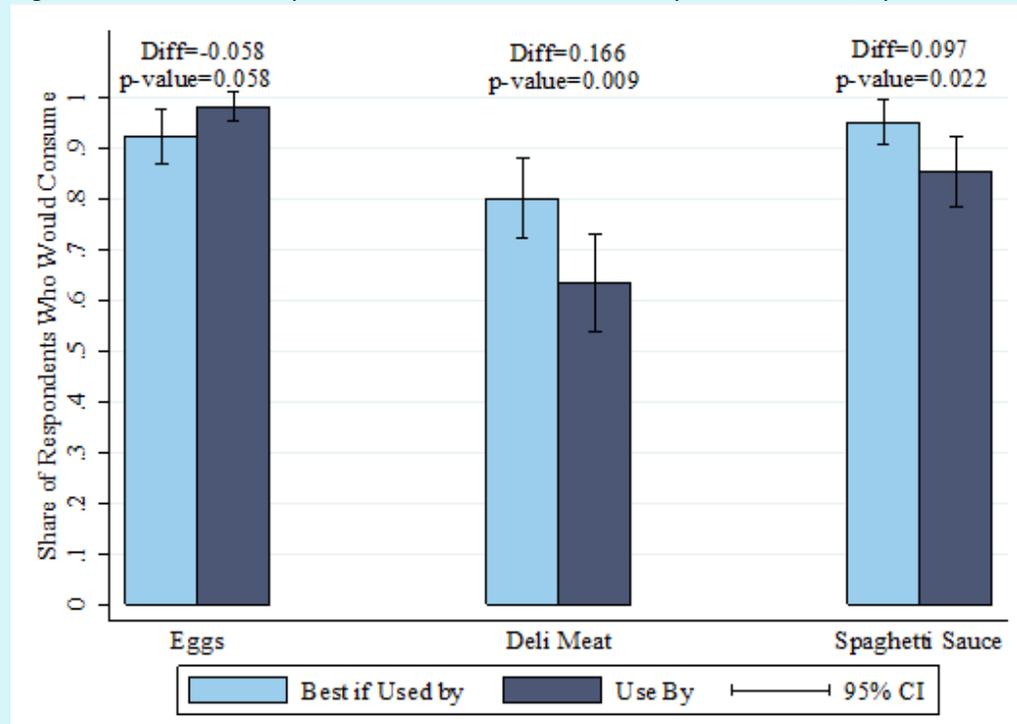
While these findings are compelling, we consider a fuller analysis. Since date labels appear to have differential effects across products, we estimate models for each product separately. To control for potential price effects, we assess consumption of products given high (\$4) and low (\$3) prices. We include a series of sociodemographic variables in the models because participant characteristics may matter.

We estimated a linear probability (ordinary least squares) model of the date labels, prices, and sociodemographic variables. Figure 2 illustrates the estimated effect of each factor. The value of the estimated effect is denoted by the dot; lines (95% confidence intervals) that extend from the dot represent the range of values of the estimated effect. An effect greater than 0 means that the presence of the factor (e.g., the high price) contributes to a greater chance of consumption than the alternative (e.g., the low price). An estimated effect of less than 0 means that the factor is associated with a lower chance of leading to consumption, while an estimated effect of 0 suggests that the factor has no meaningful effect on consumption. If the line crosses the reference line, we argue that the factor

has no effect on consumption; this is true regardless of the length of the line or the distance of the dot from the reference line.

This analysis confirms results of the earlier comparisons: Participants stated that they were less likely to consume post-dated eggs if the date label was “best if used by” relative to “use by” (the estimated effect is to the left of the reference line). However, participants were more likely to consume deli meat and spaghetti

Figure 1. Share of Participants Who Would Consume 1 Day after the Date, by Product



sauce if the date label was “best if used by” relative to “use by” (the estimated effect is to the right of the reference line, see Figure 2). The effect of high relative to low price did not have a meaningful effect for any of the products. Most of the sociodemographic variables did not influence consumption. However, white participants were more likely to state that they would consume eggs and spaghetti sauce past the date on the labels than nonwhite participants. College-educated participants stated that they were less likely to consume eggs past the date on the labels relative to participants without a college degree. Thus, regardless of product, the key factor affecting consumption was the date label rather than price or characteristics of the participants.

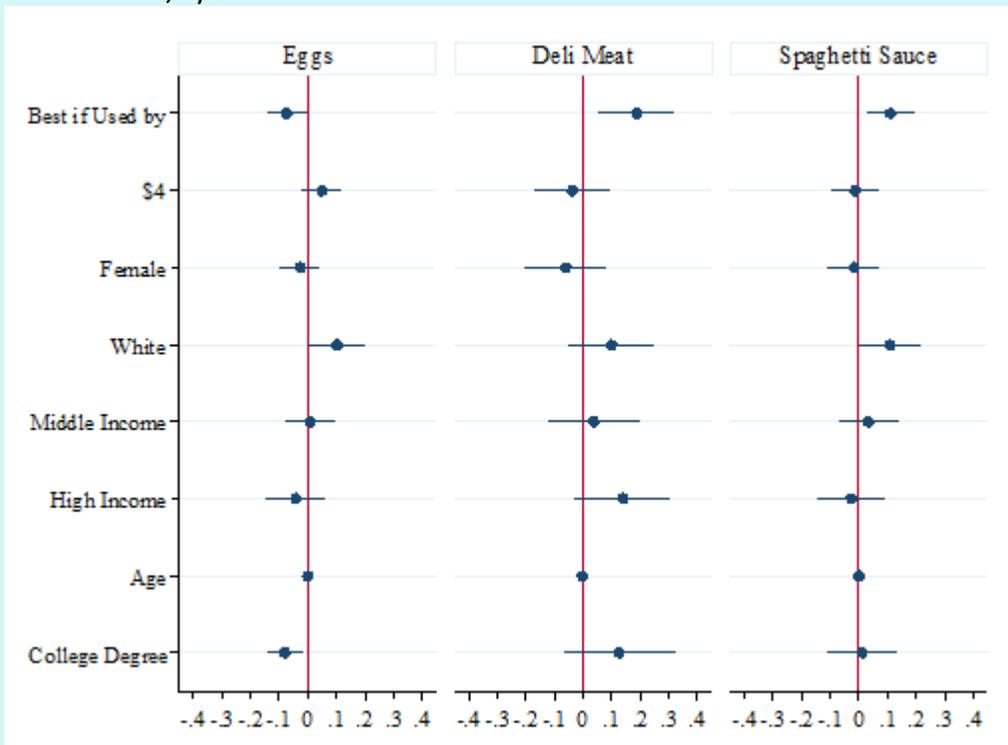
## Discussion

These results suggest that date labels have the power to influence anticipated consumption of products. As suggested by Wilson, Miao, and Weis (2018), who used survey data from the same sample, participants have some level of confusion concerning the meaning of the date labels. This point is made clear, as the effects of the label differ by product. As noted by Broad Leib et al. (2016), no national product labelling standard exists. Further, as Wilson, Miao, and Weis (2018) point out, the survey participants can see at least two different date labels for the same product. Our evidence indicates that consumers respond to date labels differently depending on the product. Even in the case of deli meat and spaghetti sauce, where the response to date labels follows the hypothesized pattern, the two labels yield a difference in the magnitude of response. While we include price as a factor, it does not have a substantial effect.

In this study, we consider the consumption decision after product expiration date when the product is in the home. This differs from Wilson et al. (2017), who considered future consumption at the point of purchase. Interestingly, the findings of this study suggest higher consumption after the product has expired compared to future consumption in an experimental auction with exchange of real products and money. Since this survey was

hypothetical, respondents' consumption response could be biased upward because the responses had no real consequences.

Figure 2. Factors that Influence Whether Participants Would Consume Products 1 Day after the Date, by Product



Note: We used the linear probability model to assess respondents' choice to consume. For each product, we assessed the chance of consumption based on the experimental factors (date label, price, and product) and sociodemographic variables. Dots to the right of the reference line (0), indicate a greater chance of consuming the product, while values less than 0 indicate a lower chance of consuming (thus a greater chance of wasting) the product. Lines that extend from the dots represent the likely ranges of the estimated effect (95% confidence interval). Lines that cross the reference are no different than 0, regardless of the line length. Thus, the factors have no effect on consumption if the estimated value is 0 or if the likely range includes the reference line. The range of possible estimated effects for age in all three models is too small to detect in this figure, but they include the reference value 0.

The reason for the opposite response pattern to date labels for anticipated consumption of eggs relative to the other products is unclear. A potential explanation is that eggs are typically cooked before being consumed, whereas the other two products are typically "ready to eat" (though most consumers warm the spaghetti sauce before use). We hypothesized that the difference would be the same across products as we assumed that participants would waste more product when faced with a concern about safety relative to quality (Wilson et al., 2017). We find that the participants in this study did not adjust their anticipated consumption based on the price of the product. While not a formal hypothesis, we expected participants to anticipate consuming more (wasting less) when the product has a higher price, despite the 0-price effect found by Ellison and Lusk (2018). A potential explanation for this result is that participants do not see a large enough difference in the price beyond the typical

market value, so that the high or low price is not perceived to be sufficiently different to warrant a differential response. If this point holds, it could reflect evidence against the sunk cost fallacy, which suggests that consumers continue consuming a product after it is of little use to the consumer (past date). Further, participants may overstate their consumption and avoidance of waste to avoid the stigma of being identified as a “food waster,” though no one could be identified, in accordance with the study protocol.

Beyond these points, we acknowledge other issues that this study may have. The contradictory response to the date labels by product may be an artifact of the study design. Our sample includes only 201 participants. A larger sample might have given us more refined results. We collected data in the context of an experiment focused on spaghetti sauce and deli meat. However, we asked the egg question first; thus, we expected responses to the deli meat and spaghetti sauce to follow eggs. Another issue is that we used a study design such that individuals did not see all possible date labels and prices for each product; rather, we randomly placed participants into one of four possible combinations of date labels and price conditions for each product. With this study design, we may have inadvertently assigned more participants to a date label group for a product who will consume that product regardless of the date label. These findings suggest that a larger study is needed to confirm these results.

If these results hold with a larger dataset and a different design, we will have evidence that a simplified date label system (a label for quality and another for safety) may not lead to universal reductions in food waste. Rather, we see under this policy a reduction in waste that is greater for some products while an increase in waste for other products. The net result could be positive or negative. A wider array of products needs to be analyzed to see whether the results hold over a more diverse basket of goods.

## Conclusions

Concern over how to manage foods past their posted dates is common in households. This concern may lead to some wasted product, where the magnitude of the waste, as suggested by this study, depends on the date label provided on the product. Unfortunately, labels are not under specific national regulations, and consumers have differential understanding of these labels. As a result, consumers base their responses on limited and often confusing, if not misleading, information.

The current efforts to regulate these labels is a reasonable approach. However, the growing body of evidence about consumer responses to date labels suggests that policy makers need to proceed with care in crafting rules. If this and other work are correct, adjusting date labels may not reduce waste in general—as waste rates for some products rise above the reduction in waste for other products. An important step forward to address this policy question is to conduct careful testing of labels with real evaluation of actual consumption and waste.

## For More Information

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## Additional Information

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