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What drives public acceptance of second-generation biofuels? Evidence from Canada

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ABSTRACT

North American publics are currently much more supportive of second-generation biofuels than of conventional biofuels like corn-based ethanol. But what is the likely future trajectory of consumer acceptance of advanced biofuels? This study considers whether increased awareness of the potential unintended consequences of increasing the production of advanced biofuels could lead to a decline in public support for the technology. Using an experiment embedded in an original survey of Canadian adults, we test for the effect of two anti-biofuels arguments on Canadians' support for policies meant to encourage the production of biofuels. We find that support for biofuels policies was reduced in our experiment when respondents were exposed to an argument about the potential impact of biofuels production on food prices and when they were told that the use of woody biomass as a feedstock for the production of cellulosic biofuels might lead to an increase in commercial logging. In both cases, however, support was reduced only among respondents who did not perceive climate change to pose a significant risk. Overall, our results suggest that public support for advanced biofuels is potentially vulnerable to arguments that focus on the unintended consequences of producing biofuels from non-food feedstocks.

1. Introduction

In the past ten years, biofuels policy in the United States has increasingly focused on supporting the development of an advanced biofuels industry that does not use food crops as its principal feedstock [1]. The *Energy Independence and Security Act* (EISA) of 2007, for example, established a revised Renewable Fuel Standard (RFS) that expands its production mandates beyond conventional biofuels. The *Food, Conservation, and Energy Act* of 2008, moreover, created a subsidy for advanced biofuels, while the long-standing subsidy for corn ethanol was not renewed in 2012.

In Canada, the federal government has also pursued policies to support the development of the biofuels industry [1]. It imposed a 5 percent renewable content mandate on gasoline in 2010, as well as a mandate of 2 percent renewable content for diesel fuel and heating oil in 2011. Some Canadian provinces have imposed equivalent or higher gasoline content mandates [2], and federal direct incentive payments for ethanol production were available from 2008 to 2010 through the EcoENERGY for Biofuels program [3]. While neither the

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federal nor provincial biofuels policies in Canada include specific targets for cellulosic ethanol [1,4], second-generation biofuel sources from agricultural waste products and forest biomass are proving increasingly attractive to Canadian industry [4].

Given the lack of specific policy support for advanced biofuels in Canada, the future success of the industry in that country will likely depend on the robustness of consumer demand for more sustainable biofuels. Similarly, while the U.S. RFS does mandate production of cellulosic and advanced biofuels, the existing supply of conventional ethanol is already sufficient to supply the existing market demand for 10% ethanol blended fuel (E10) [5]. The extent to which a market for cellulosic ethanol emerges in the United States, then, will depend in part on the extent to which U.S. consumers demonstrate a preference for E10 made with cellulosic ethanol, as well as on their willingness to purchase flex-fuel vehicles capable of running on 85% ethanol-blended fuel (E85). Given that North Americans' general attitudes towards biofuels are predictive of more specific purchase intentions [6], their general perceptions of advanced biofuels speak to the possibility that consumer preference for advanced biofuels could lead to larger markets for cellulosic ethanol in Canada and the United States.

At the moment, consumer perceptions of advanced biofuels in the United States are much more positive than attitudes towards corn-based ethanol [7–10], and support for biofuels policies is strong in Canada [11]. As we argue below, however, public attitudes towards biofuels in both the United States and Canada are based on relatively low levels of information about the technology, and are therefore relatively weak and subject to change [6]. Indeed, other work has shown that while U.S. consumers' attitudes towards corn-based ethanol were initially positive, support declined over time as the potential economic, social, and environmental costs of the technology were pointed out by those opposed to biofuels policies [10,12]. It is possible, then, that as North American consumers become more familiar with cellulosic ethanol and are exposed to arguments that oppose its widespread adoption, approval for this type of biofuel could also decline in the coming years, which could threaten the future of the biofuels industry in North America.

In this article, we investigate the rhetorical mechanisms through which such a change in attitudes might take place. Specifically, we explore public perceptions of advanced biofuels using data from a recent original survey of Canadian adults, focusing in particular on how three specific arguments relating to the use of biofuels might influence Canadians' attitudes towards different types of biofuels. We use an embedded split-ballot experiment to test the conditions under which common arguments against biofuels influence the public's perceptions of both advanced and conventional biofuels and of the government policies that have been put in place to support the biofuels industry in Canada. The results suggest that while cellulosic biofuels are viewed extremely positively in Canada at the moment (as is the case in the United States), the potential exists for Canadians' attitudes to become much more negative in the future if they are exposed to arguments that point out the potential negative environmental effects of widespread adoption of cellulosic biofuels.

2. Background & hypotheses

In this section, we draw on the extensive literature on public perceptions of biofuels in the United States to derive a set of hypotheses about the probable drivers of Canadian perceptions of advanced biofuels. Given the relative dearth of Canadian studies, using the U.S.-focused literature to generate hypotheses about Canadian attitudes is a necessary strategy, and it is reasonable in light of the cultural, linguistic, and economic similarities between the two countries. Indeed, the Canadian data that do exist suggest that, other than the difference in political polarization on the issue in the two countries, Canadian and American perceptions of biofuels are broadly similar [11]. Overall, the literature points to three general features of U.S. opinion that are of particular relevance to the present study: 1) biofuels produced from non-edible feedstocks are much more popular in the U.S. than corn-based ethanol, 2) Americans' perceptions about the severity of the threat posed by climate change are a key predictor of their attitudes towards biofuels, and 3) Americans nonetheless do differentiate between the different types of feedstocks that could be used to produce advanced biofuels.

2.1. *Preference for non-corn feedstocks over corn-based ethanol*

The literature suggests that bio-ethanol suffers from a branding problem among the American public. Cacciatore et al. [13] conducted a split-ballot survey experiment in which participants were randomly assigned to two groups and were asked to evaluate biofuels on several dimensions. The only difference between the groups was that one group was asked to evaluate "biofuels" and the other "ethanol." Respondents who were asked to evaluate ethanol "were significantly more likely to believe the fuel was more damaging to the environment than gasoline, and significantly less likely to believe that production of the fuel will increase jobs … in the US" Ref. [13], p.5. American consumers, moreover, have a clear preference for second-generation biofuels over corn-based ethanol [7], showing, for example, a greater willingness-to-pay (WTP) a premium for an E85 fuel blend produced from switchgrass than for corn-based E10 [8] and a small but significant preference for wood-based over corn-based ethanol [9]. Indeed, while Delshad and Raymond [10] found weak support for policies promoting biofuels production in their sample of respondents, the one exception was a subsidy for producers of cellulosic biofuels, which received 67% support. Overall, then, evidence from U.S. consumer attitudes provides a testable hypothesis in the Canadian context:

H1 (corn): Canadians will prefer biofuels produced from feedstocks other than corn over corn-based ethanol.

At the same time, Americans do not appear to view all types of cellulosic biofuels in the same positive light. Jensen et al. [8], for example, find greater WTP for E85 fuel made from switchgrass than for E85 made from either corn or wood waste. In fact, Americans appear to be particularly wary of using woody biomass as a feedstock to produce biofuels. In an earlier survey, Wegener and Kelly [14] found that while large majorities of their respondents agreed that biofuels made