Title:
Framing Conservation Tillage: The Role of Economic, Altruistic and Environmental Values

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Abstract:

By defining the essence of a policy problem, a frame shapes how individuals think about an issue. In this research, we investigate framing effects among knowledge domain experts, an understudied yet increasingly important set of individuals in the policymaking process. Because experts have extensive and highly structured knowledge on a particular topic, they are likely to actively process issue frames to which they are exposed. Consequently, we hypothesize that frames consistent with experts' values will be particularly influential, whereas frames inconsistent with their values will lead to contrast effects. We test our hypotheses on a unique set of experts by examining professional farmers' attitudes toward no-till agriculture. Farmers and other landowners are required to change their management or use of land in order to be eligible to supply ecosystem services to markets or to meet regulatory obligations. Using an experimental design that includes profit, community and environmental stewardship frames, we find evidence that environmental values interact with frames to influence farmers' interest in no-till, especially when farmers are exposed to a novel frame.

1. Introduction

Issue frames are persuasive messages that define what policy problems are "really about," and as a result they shape how the public understands issues at hand (Gamson & Modigliani, 1987). Frames vary in their effect on different citizens, including based on the degree to which a frame is consistent with the audience members' core values and beliefs. In particular, politically knowledgeable individuals have the motivation and ability to assess the consistency between their predispositions and the frame, making their values even more important in determining a particular framing effect.

Yet framing scholars have not examined the potentially distinctive influence of issue frames on a group of growing political importance: experts in various policy relevant subjects. These so-called "domain experts" are increasingly important in politics (Jones & Baumgartner, 2005; Weible, 2008), across a wide variety of areas ranging from healthcare to environmental protection to finance. They also are similar to individuals with high political knowledge in some ways that suggest the potential for greater motivation and ability to actively interpret an issue frame. Yet, the extent to which domain experts—that is, authorities within specific policy fields—internalize and respond to relevant issue frames is unclear.

Based on a theoretical expectation that domain experts will be active receivers who pay greater attention to frames in their area of expertise, we hypothesize that these experts will also respond to issue frames based substantially on how those frames interact with their prior core beliefs and values. Employing a field experiment, we investigate these claims in the context of a distinctive and important class of domain experts: professional farmers. Farmers have faced lengthy efforts to persuade them to adopt new conservation practices on their land, including the "no-till" form of planting crops that limits disturbance of the soil. Despite extensive efforts to

promote no-till agriculture since its introduction in the 1960s, some farmers remain resistant to the practice (Andrews, Clawson, Gramig, & Raymond, 2013; Gramig, Barnard, & Prokopy, 2013). Our experimental findings indicate that farmers' environmental values are an important predictor of their response to different issue frames promoting no-till, consistent with the idea that they are actively processing such frames and only responding to those that are consistent with their core beliefs.

2. How do Issue Frames Influence Experts?

2.1 Framing effects

Policy actors use issue frames to define "the essence of the issue" (Gamson & Modigliani, 1987, p. 143), identifying what is at stake and the considerations that the public should use to evaluate political issues (Chong & Druckman, 2007d; Gamson & Modigliani, 1987, 1989). Frames are verbal or visual messages that highlight specific dimensions of policy issues to influence individuals' perceptions of those issues. According to the belief importance model, frames alter the relative importance of the considerations individuals use to form attitudes toward framed policy issues by creating as well as reinforcing connections between political problems and specific considerations (Nelson, Clawson, & Oxley, 1997; Nelson, Oxley, & Clawson, 1997). For example, individuals tend to weigh considerations of civil liberties more heavily in establishing their support or opposition for a prospective hate speech rally than those of public order when exposed to frames that discuss the rally as a "freedom of speech" issue (Nelson, Clawson, et al., 1997). The resulting change in attitude toward the issue can be described as a framing effect (Chong & Druckman, 2007a). Elites, therefore, try to harness the

potential power of issue frames over public opinion by competing to make their frame dominant in the public discourse and consciousness (Nelson & Kinder, 1996, p. 1058).

2.2 Issue Frames, Values, and Political Knowledge

Individuals do not blindly accept issue frames; the extent to which frames influence individuals' attitudes depends in part on the predispositions that audience members bring to the table (Clawson & Waltenburg, 2003). For instance, individuals may use their values—that is, abstract beliefs "that a specific mode of conduct or end-state of existence is personally or socially preferable" (Rokeach, 1973, p. 5)— as a basis to judge the strength and validity of political information, such as issue frames. In doing so, individuals evaluate the compatibility of policies, candidates, or actions depicted in the information they have received with their value system (Feldman, 1988, 2003). Framing an issue or policy in terms of values that are more amenable to frame recipients will typically generate stronger framing effects (Barker, 2005; Marietta, 2008). On this account, frames that are inconsistent with individuals' values are less likely to change recipient attitudes on the issue (Brewer, 2003).

Scholars suggest that, in the event the value interpretations presented within issue frames *challenge* those held by audience members, some individuals will defend their own values (Brewer, 2002; Marietta, 2008). As a result, individuals holding values that are inconsistent with the message of the frame may experience no framing effect at all by merely disregarding or counter-arguing against the frame without experiencing an attitudinal response (see Arikan & Bloom, 2013; Zaller, 1992). Alternatively, some research suggests respondents may experience a negative change in attitude—one that is contrary to the purpose of a frame—when their own value interpretations are inconsistent with those presented within issue frames (Chong & Druckman, 2007a). In this so-called "contrast effect," individuals emphasize the difference

between their own position and the position of those they disagree with (Sniderman, Brody, & Tetlock, 1993 chap. 2). Thus, a frame designed to generate *greater* support for an issue may actually generate *weaker* support due to the information's inconsistency with individuals' values (Marietta, 2008; Petersen, Slothuus, & Togeby, 2010).

This values-driven model of the framing process, however, assumes that individuals have the motivation and ability to actively process the information presented in issue frames. The active evaluation of information is taxing, thus to expend the necessary cognitive energy individuals must have some incentive, or drive, to think about a particular policy issue (Cacioppo, Petty, Feinstein, Blair, & Jarvis, 1996; Petty, Cacioppo, Sedikides, & Strathman, 1988). Likewise, individuals must have the intellectual capacity to think about and understand policy issues and information (Petty & Cacioppo, 1981, 1984; Petty et al., 1988).

Politically knowledgeable individuals tend to demonstrate this higher level of cognitive motivation and ability, making them more likely to actively process political information in messages such as issue frames (Chong & Druckman, 2007a; Nelson, Oxley, et al., 1997). In many cases, this means that politically knowledgeable individuals respond differently to frames they evaluate as being more or less consistent with their values (Brewer, 2003; Kam, 2005). By contrast, the politically less informed have lower levels of political motivation (Delli Carpini & Keeter, 1996, p. chap 5; Eveland, 2004) and have relatively low levels of cognitive engagement (Alvarez & Brehm, 2002; Sniderman et al., 1993; Zaller, 1992, p. chap. 3). As a result, greater political knowledge seems to provide individuals with an edge when it comes to making connections between their values and the arguments presented in an issue frame.

2.3 Issue Frames, Values, and Domain Expertise

Although many scholars have examined political knowledge as a moderator of framing effects, there is surprisingly little research on the effect of other forms of knowledge or expertise on the influence of frames. Unlike those who are generally knowledgeable about politics, "domain experts" are individuals with extensive and organized knowledge that emerges from substantial experience and practice *within a particular field* (Hoffman, 1998). Such experts are increasingly important in many controversial policy domains such as public health, environment, or foreign affairs, as both the creators and the recipients of different issue frames. Yet framing research has paid scant attention to how this distinctive form of expertise might moderate framing effects.

Domain experts have knowledge structures that allow them to actively process domain-relevant information more efficiently and effectively (Nuthall, 2012; Wiley, 1998), while at the same time enhancing the need to evaluate the practical implications of relevant information. Thus, domain experts' engagement with, and understanding of, specific issue areas creates a heightened motivation and ability to collect and process issue-relevant information. The extent and implications of this engagement are different for domain experts, however, than for merely knowledgeable populations (Cellier, Eyrolle, & Marine, 1997; Wiley, 1998). The strength of domain experts' engagement with a specific issue area makes their knowledge of the issue part of their personal identity (Fiske, Lau, & Smith, 1990). Their direct and personal stake in outcomes within their area of specialization gives experts a high need to evaluate relevant policy issues and options. Moreover, experts retain a heightened awareness of the direct consequences their attitudes and behaviors have on conditions within their area of expertise (Hoffman, 1998; Johnson, 1988). This suggests that, compared to those with general political knowledge, experts

may be even more likely to actively process issue frames related to their domain of interest, and to reference their values while doing so.

Thus, we hypothesize that domain experts will be active recipients of frames in their area of knowledge, and therefore use the values highlighted by a given issue frame when formulating or updating their attitude on that issue, much like politically knowledgeable individuals. This leads us to two specific hypotheses related to expectations of both positive and negative framing effects for this distinctive population:

H_1: Domain-relevant issue frames that emphasize values domain experts accept will lead to positive attitude change, i.e., a framing effect.

H_2: Domain-relevant issue frames that emphasize values domain experts reject will lead to negative attitude change, i.e., a contrast effect.

3. Research Design

3.1 Case Selection: Farmers and No-Till Agriculture

To test our hypotheses, we examine framing effects related to an important issue—farming techniques—among a distinctive population of domain experts—professional farmers. Although scholars have traditionally resisted applying the label of "expert" to farmers, instead reserving the term "agricultural expert" for those with a high level of formal agricultural education, recent scholarship demonstrates that farmers, too, demonstrate expert characteristics (Cerf, Papy, & Angevin, 1998; Morton, 2011; Nuthall, 2012). From this perspective, expertise emerges as farmers incorporate new information and practices to their knowledge as they develop a detailed understanding of the interdependent components of a farming operation. In

doing so, experienced farmers cultivate the requisite systems-knowledge to incorporate negative feedback and engage in abstract thinking characteristic of expert reasoning (Mauro, McLachlan, & Van Acker, 2009; Nuthall, 2009).

The selection of a tillage method is fundamental to farming operations due to the implications for the long-term management and productivity of agricultural land (Rousse, 2008; Uri, Atwood, & Sanabria, 1999). Farmers have several options for tilling their soil to plant their crops, including the "no-till" crop management system in which agricultural land is undisturbed between harvest and planting, thereby reducing soil erosion and agricultural runoff while also increasing biodiversity (Horowitz, Ebel, & Ueda, 2010; Lankoski, Ollikainen, & Uusitalo, 2006). As efforts to promote no-till adoption continue to emerge, the practice has garnered substantial attention within agricultural as well as policy communities, particularly as a mechanism for carbon sequestration in the fight against climate change (CAGG 2010; Rousse, 2008; Uri et al., 1999). Although most farmers are now familiar with the practice of no-till, a significant portion of the farming community continues to hold negative attitudes toward the practice (Andrews et al., 2013).

3.2 Experimental Design

The core of our research was a field experiment using random assignment to expose professional farmers to one of three different treatments describing the benefits of no-till farming. Each treatment included an issue frame designed to invoke one of three specific environmental values commonly measured in environmental psychology. Using a pre-/post-test design, we estimated whether frame exposure led to an increased, decreased, or no change in subjects' attitudes toward no-till. To test our first hypothesis, we expected subjects who agreed more strongly with the value emphasized by each frame to experience a positive attitude change

toward no-till. For our second hypothesis, we expected subjects who disagreed more strongly with the value emphasized by each frame to experience negative attitude change.

Experimental subjects were recruited from a population of experienced row-crop farmers attending the annual Fort Wayne Farm Show in January 2012 (N=174). Subjects were provided $20 for participating in the experiment, and all responses were anonymous. Because of our focus on domain experts, we pre-screened potential subjects and only accepted individuals for whom farming was their primary occupation and who were either the sole or one of the major decision-makers pertaining to farm management practices. T-tests confirmed random assignment to our treatment groups for other key variables—education, acres farmed, years farming, age, gross receipts from crop sales, race, and gender. Given our theoretical interest in domain expertise and the presentation of our experimental treatments, however, we include controls for the length (in years) of subjects' farming career as well as trust in trade journals (measured on a 4-point Likert scale where higher values indicate greater trust).

The experiment began with an initial instrument offering a series of questions pertaining to current farming practices, as well as a question designed to measure attitudes toward no-till agriculture: "Some farmers are quite interested in no-till techniques, while others are not as interested. What about you?"[1] Subjects were asked to respond to this question according to a 7-point Likert-scale in which 1 represented not interested and 7 represented very interested. This question was asked again immediately following the administration of the framing treatment in order to assess attitude change.

The initial instrument asked subjects to respond to a set of questions designed to measure their support for three different environmental values. These questions were designed to

[1] All instruments and experimental treatments will be available as an on-line appendix to the article.

measure support for environmental egoism, environmental altruism, and environmental biospherism, which have been identified as separate value constructs by previous research in environmental psychology (see Dietz, Stern, & Guagnano, 1998; Stern & Dietz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995). According to this work, *environmental egoists* are concerned about the environment in terms of its potential impact on themselves and their future, whereas *environmental altruists* are concerned about the impact of the environment on other individuals. *Environmental biospherists*, finally, favor environmental protection for the sake of other species and ecosystems (Dietz et al., 1998; Schultz, 2001; Stern & Dietz, 1994; Stern et al., 1995).

To measure support for these values, we used a five-point Likert-scale to note how strongly subjects agreed or disagreed with seven different statements designed to correspond with a particular value (following Schultz, 2001). For example, subjects agreeing with the statement "I am concerned about environmental problems because of the consequences for people in my community" would score high on the environmental altruism scale, whereas those agreeing with the same statement applied to "my future" or "my health" would score higher on the environmental egoism scale.[2] We created a measure of subjects' value support by creating a mean index of subject responses for the questions appropriate for each value, as confirmed by a principle component factor analysis.

Once subjects completed the pretest, they returned that section to the researchers and received the second portion of the experiment. In this second part, subjects were asked to read a randomly assigned framing treatment presenting a frame designed to evoke a particular

[2] The complete set of statements for measuring these values all started with the phrase: "I am concerned about environmental problems because of the consequences for _____" and then concluded with the following terms: "all people," "future generations," and "people in my community" (altruism); "my future," and "my health" (egoism); and "wildlife," and "ecosystems" (biospherism).

environmental value (see Table 1). The framing treatment was administered on a separate page stapled to the second half of the experimental instrument. Subjects were told the article was written for a leading farm magazine. The article was printed in color, and formatted to resemble an article from *Farm Journal*, a well respected national farm magazine.

[Insert Table 1 Here]

Each treatment included language that was consistent across all three treatments as well as content that was unique for each frame. The consistent language included a two-paragraph presentation of the basic rationale of no-till farming. The frame was presented in subsequent paragraphs as well as the article header. After reading the experimental treatment, subjects were then asked a series of questions pertaining to their attitudes on no-till farming, as well as some general demographic questions. Table 1 illustrates the association of each frame with the relevant environmental value. For example, the profit frame highlighted the ability of no-till farming to reduce a farmer's costs in terms of time, labor, and reduced wear on machinery. This frame promotes no-till by presenting the farmer as the ultimate beneficiary of the conservation practice, thereby appealing to environmental egoism values. A second frame emphasized the benefits of no-till for neighboring communities in order to elevate environmental altruism. For example, this frame stressed no-till's benefits for swimming and fishing in local waterways due to reduced soil erosion, and improving the health of local community members. The final frame invoked the value of environmental biospherism by focusing on stewardship and the role of farmers as the 'keepers' of the earth. This frame promoted no-till as helping to promote biodiversity and protect the environment for future generations.

After exposure to the framing treatment, subjects completed a short set of final questions, including a post-test measurement of their interest in no-till. In order to capture the change in interest in the technique due to the framing treatment, we subtracted the pre-test level of interest from the post-test level of interest. Given our interest in the direction of change, as opposed to the magnitude of change, as well as the small sample size, we collapsed this variable. Individuals whose pre- and post-test measurements of interest were equal to one another were coded as having 'no change' in their interest in no-till. Individuals whose post-test levels of interest were higher than their pre-test levels were coded as having 'increased' interest in no-till, while those who expressed lower levels of interest post-test were coded as having 'decreased' interest. Table 2 summarizes the descriptive statistics for these levels of interest in no-till before and after the framing treatments, as well as support for each environmental value and other important characteristics of the sample**.**

[Insert Table 2 Here]

3.3 Hypothesis tests

Due to our theoretical interest in either positive, negative, or no change in attitudes, we use ordered logit for statistical tests of our hypotheses. This allows us to isolate and calculate the predicted probability of experiencing a positive change, no change, or a negative change in interest due to frame exposure. By testing the effects of frames and values on each outcome of our dependent variable, we are functionally able to use the same statistical model to test both H_1 as well as H_2.

To confirm or reject our hypotheses, we examine the effects of the interactions between frames and values on interest in no-till. We are particularly interested in the relationship between exposure to a given frame and degree of support for that frame's relevant value in predicting a

positive or negative attitude change. Thus, we find support for our hypotheses if an *increase in support for the value* emphasized by an issue frame leads to a greater predicted probability of *increased interest* in no till, or a positive framing effect (H_1). Similarly, we find support for our second hypothesis if a *decrease in support for the value* emphasized by an issue frame is associated with a greater predicted probability of *decreased interest* in no till (H_2), or a negative framing effect. For instance, we will find support for H_1 if higher levels of environmental egoism lead to a statistically significant increase in the predicted probability of an increased level of interest when exposed to the profit frame. By contrast, we will find support for H_2 if *lower* (higher) levels of environmental egoism lead to a statistically significant increase in the probability of experiencing a *decreased* (increased) level of interest when exposed to the profit frame. We have no expectations concerning the observation of no change in interest, which is the third level of our dependent variable.

4. Results

4.1 Main Effect of Issue Frames on Expert Attitudes

Before turning to the empirical tests of our hypotheses, we first consider the independent impact of issue frames on our subjects' interest in no-till (see Model A in Table 3). Overall, issue frames did not directly influence attitudes toward framed policy issues among our experts. Likelihood ratio tests indicate the joint impact of issue frames has little to no influence on farmers' attitudes. Additionally, Model A does not reach conventional levels of overall significance. However, the statistical significance of the first cut point in Model A warrants a more detailed examination of predicted probabilities.

[Insert Table 3 Here]

Table 4 suggests that the community frame is most likely to increase interest in no-till among our farmers. Tests of pairwise comparison indicate that individuals are less likely to experience no framing effect ($p<0.10$) in response to the community frame than the stewardship frame, and more likely to experience a positive framing effect ($p<0.10$). Differences between the expected effects of the community and profit frames reflect a similar pattern, although they do not reach conventional levels of statistical significance.

[Insert Table 4 Here]

4.2 The Conditional Relationship between Issue Frames, Values, and Expert Attitudes

Our research hypotheses relate to the interaction of frames with their targeted values. As noted in the research design, testing these hypotheses requires the inclusion of multiplicative interaction terms within statistical models. Although we designed each frame to activate a different environmental value (see Table 1), we allow for the possibility that an individual frame could activate more than one environmental value by including interactions of all three framing treatments and all three environmental values in Model B of Table 3 with profit as the omitted category. Likelihood ratio tests examining the joint influence of the interaction terms included in Model B relative to Model A suggest that accounting for these interactive relationships significantly improves our ability to explain the impact of issue frames on experts' attitudes, consistent with our overall hypothesis that farmers' values condition the impact of frames.

Due to our use of interactions and ordered logit, to statistically test our hypotheses we calculate the marginal effects of frames and values on the predicted probability of experiencing attitude change. We expect that greater agreement with the value emphasized by an issue frame will lead to a positive attitude change (H_1), whereas greater disagreement with the emphasized

value will lead to a negative attitude change, or contrast effect (H_2). These hypotheses effectively present expectations concerning two of the three levels of our dependent variable. Tests of both hypotheses are dependent on the marginal effect of *specific* environmental values for each frame (see Table 1) and level of the dependent variable. We calculated the marginal effect of environmental values—that is, the average impact of a one-unit increase in subjects' acceptance of each value—for each frame and type of attitude change (see Table 5).

[Insert Table 5 Here]

4.2.1 H_1: Value Acceptance and Positive Framing Effects

Our first hypothesis is supported if the marginal effect of an increase in the environmental value designed to be activated by a given frame has a *positive and significant effect* on the predicted probability of experiencing a *positive attitude change* (see the first three rows of Table 5). We do not find support for this hypothesis in the interactions of environmental egoism with the profit frame, or with biospherism and the stewardship frame, neither of which reaches conventional levels of statistical significance. We do find support for H_1, however, in the significant and positive interaction between environmental altruism and the community frame ($p<0.01$).

Figure 1 illustrates the strength of this relationship: the probability of becoming more interested in no-till in response to the community frame dramatically increases among farmers with greater affinity toward environmental altruism. In fact, there is an 80% probability that farmers with the greatest acceptance of environmental altruism (5 out of 5 on the Likert scale) will express greater interest in no-till when presented with the community frame. Conversely, the probability of those with the least support for the value (1 out of 5 on the Likert Scale) experiencing a positive attitude change in response to the community frame is less than 1%.

[Insert Figure 1 Here]

4.2.2 H_2: Value Rejection and Contrast Effects

Similar to tests for H_1, we examine the marginal effect of specific environmental values on the probability of experiencing a lower level of interest in no-till as a result of frame exposure to test our hypothesis (H_2) regarding contrast effects (see the last three rows of Table 5). As the marginal effect represents the average change in the predicted probability given a unit *increase* in an environmental value, a *negative* marginal effect indicates that those who disagree with or have rejected a value are more likely to experience a *negative* attitude change when exposed to the frame than those who accept the value. Thus, if the marginal effect of activated values is *negative* and significant, we will have found support for H_2, a contrast effect.

As with our tests of H_1, we find no evidence of environmental egoism or biospherism generating a contrast effect among subjects exposed to the relevant frames. We do, however, find support for H_2 when we consider environmental altruism and the community frame ($p<0.05$). On average, a one-unit increase in farmers' agreement with environmental altruism leads to a substantial decrease in the probability they will respond negatively to the community frame. Figure 2 illustrates the strength of the relationship. Here, we see that individuals least supportive of environmental altruism (i.e., those with a score of 1 on our scale) have a 90% probability of experiencing a contrast effect when presented with the community frame, while those with the highest levels of environmental altruism are extremely unlikely (less than 10% probability) of experiencing a contrast effect. These results indicate, then, that the community frame not only fails to resonate among those who have rejected environmental altruism, but also leads many of these individuals to express greater opposition to the practice of no till.

[Insert Figure 2 Here]

To summarize, our data offer mixed support for both H_1 and H_2. The direction of the marginal effects of support for environmental egoism and biospherism with each frame is consistent with our hypotheses, but fails to achieve conventional levels of statistical significance. More importantly, support for environmental altruism has a significant and substantial effect on the probability of both positive and negative attitude change on subjects exposed to the community frame. These results suggest that there is something unique about the community frame, relative to the profit and stewardship frames. More specifically, farmers appear to use their values when processing the community frame, but not the profit or stewardship frames.

4.2.3 Interactions between the Community Frame and Other Environmental Values

Consistent with the community frame having the largest effect on our subjects, Table 5 also indicates that this frame interacted significantly with other environmental values besides the expected value of environmental altruism. Specifically, we find that support for environmental egoism also has a significant ($p<0.001$) influence on the impact of the community frame on all three possible types of attitude change. Unlike support for environmental altruism, however, support for egoism significantly *reduces* the probability that farmers will experience a positive framing effect in response to the community frame. Panel A of Figure 3 illustrates this relationship in more detail. Here, we see the probability of experiencing a positive attitude change for subjects exposed to the community frame is only 15% for those with high levels of environmental egoism compared to approximately 99% for those with the lowest level of value acceptance. Table 5 also indicates that greater levels of environmental egoism significantly ($p<0.001$) *increase* the probability that farmers will respond *negatively* to the community frame. Panel B of Figure 3 illustrates that as farmers' support for environmental egoism rises, so does the probability of experiencing a contrast effect in response to the community frame. For

example, an increase from 4 to 5 on the environmental egoism scale leads to approximately a 30 percentage point increase in the likelihood of responding negatively to the frame.

[Insert Figure 3 Here]

Thus, environmental egoism appears to have a substantial effect on the predicted probability of responding either positively or negatively to the community frame that competes with the effects of support for environmental altruism. Although it is tempting to attribute this result to environmental egoism and altruism being in opposition, research in environmental psychology identifies environmental egoism and environmental altruism as distinctive values rather than two ends of the same value construct. In other words, individuals may support both values at the same time. The values do not define one another but rather co-exist within individuals' cognitions. The significant and clashing impact of environmental altruism and environmental egoism, then, raises the question of how individuals reconcile these competing values when responding to the community frame.

We explore this relationship through Model C in Table 3, which builds on Model B by including a three-way interaction among issue frames, environmental egoism, and environmental altruism. Though the estimated coefficients for these interactions are not significant, some informative marginal effects are. We tested the statistical significance of these marginal effects by calculating the marginal effect of a change in environmental altruism while holding the treatment variable constant for the community frame and allowing environmental egoism to vary. Results indicate that a change in environmental altruism significantly ($p<0.05$) influences the probability of experiencing both a positive framing effect and a contrast effect in response to the community frame across most of the environmental egoism scale (between 1.4 and 4.8, and between 1 and 4.2 respectively; see Appendix A). Hence, we find that rejection or acceptance of

environmental egoism moderates the impact of a unit change in environmental altruism on the probability of experiencing either a positive framing effect or a contrast effect when presented with the community frame. This does not necessarily imply, however, that environmental egoism erases the influence of environmental altruism.

Panel A of Figure 4 shows us that greater agreement with environmental altruism increases the probability farmers will experience a positive framing effect when presented with the community frame across a wide range of support for environmental egoism. Although this effect is stronger among those with low levels of environmental egoism, even those with high levels of egoism still demonstrate a positive relationship between their support for altruism and the probability of a positive attitude response to the community frame. Moreover, those who score equally high (score of 4) on support for environmental egoism and environmental altruism demonstrate a 50% probability of experiencing a positive framing effect in response to the community frame. This is a substantial finding given our use of a three-level dependent variable, implying that these individuals are more likely to experience a positive framing effect than no attitude change or a contrast effect. In terms of a positive attitude change, we again find support for our first hypothesis: individuals who maintain agreement toward the value emphasized by an issue frame are likely to experience a positive framing effect even when they also support alternative values associated with a weaker response to the frame in question. We find similar results concerning the impact of environmental altruism and the community frame on the probability of experiencing a contrast effect across a wide range of values for environmental egoism (see Panel B of Figure 4). Again, we find that the community frame will likely elicit a contrast effect among individuals who reject the value of environmental altruism, across a wide range of support for environmental egoism.

[Insert Figure 4 Here]

Notably, the responses of farmers with low levels of environmental egoism to the community frame appear to be quite sensitive to variation in levels of environmental altruism. The impact of environmental altruism on the probability expert farmers will respond negatively toward the community frame, however, becomes almost linear with greater prior acceptance of environmental egoism. This supports previous findings concerning the stability of values and their importance to information processing. Individuals' values provide structure and consistency to their cognitions. As a result, those who maintain a high affinity toward a particular value will not completely disregard the value when presented with an issue frame that activates an alternative value. Instead, experts are likely to evaluate issue frames based on values they traditionally use *in addition* to those activated by an issue frame. The value activated by the issue frame, however, does appear to be more influential over the experts' evaluations.

5. Conclusion

Despite the growing recognition of the importance of experts in the development and implementation of many types of public policies, we know surprisingly little about how such expertise influences the effectiveness of framing. Building on evidence that political knowledge increases active processing of issue frames, this study investigated two hypotheses regarding the important role of prior values in moderating attitude change for any particular issue frame among a population of subject matter experts: professional farmers. Our experimental results confirm that domain experts also appear to be active processors of frames, responding differently to a particular issue frame based on the frame's consistency with their values. In general, frames in our experiment designed to elevate a particular environmental value led to a greater probability of positive attitude change toward a farming technique designed to protect environmental quality

among subjects who expressed support for that value, and a greater probability of no attitude change or a negative attitude change among those who did not support that value. In addition, this effect persisted even when a frame appears to have elevated more than one value, with experts being more likely to experience a positive attitude change to the degree they supported the targeted value even when they also supported a second value that was associated with a negative response to the frame.

Although we consistently find that issue frames that present value interpretations consistent with those of audience members tend to have a positive impact, and those that are inconsistent lead to a contrast effect, the magnitude and the statistical significance of these findings varied across framing treatments. One frame in particular was most effective in shifting attitudes according to farmer values: a frame stressing the importance of local community benefits from reduced tillage of the soil. Although it is impossible to know why this particular frame was most effective in changing attitudes, especially among farmers who supported the associated value of environmental altruism, we speculate that this was due to the relative unfamiliarity of the frame. The other two frames in the experiment have been more widely used to promote no-till, making it likely that farmers were more familiar with those messages (Andrews et al., 2013). In this respect, it is possible that the greater influence of the community frame on the probability of attitude change was similar to the effectiveness of "conflict-displacing" frames in other contexts (e.g., Dardis, Baumgartner, Boydstun, De Boef, & Shen, 2008), which get individuals to think of an issue in terms of a new value rather than the same values they have been using previously. By introducing a new value to the issue, such as environmental altruism, the community frame may have generated greater support for no-till

among farmers than more familiar frames related to increasing farmer profit or being a "good steward" of natural systems.

These results suggest that various forms of *expertise* are relevant to our understanding of cognition and framing effects, beyond the basic and widely tested factor of *political knowledge*. Future work on the psychological mechanisms of framing effects would do well to consider the ways in which the distinctive cognitive processes of experts might affect issue framing beyond simply increasing active processing and also the importance of value consistency. In addition, these results suggest the importance of tailoring issue frames to the specific values of issue experts across multiple policy domains. Many professionals are "expert" in a wide range of policy-relevant areas, ranging from farmers to medical practitioners to educators. As public policies seek to influence the attitudes and behaviors of these policy-relevant communities of experts, it will be important to carefully consider their prior values in any framing messages.

6. References

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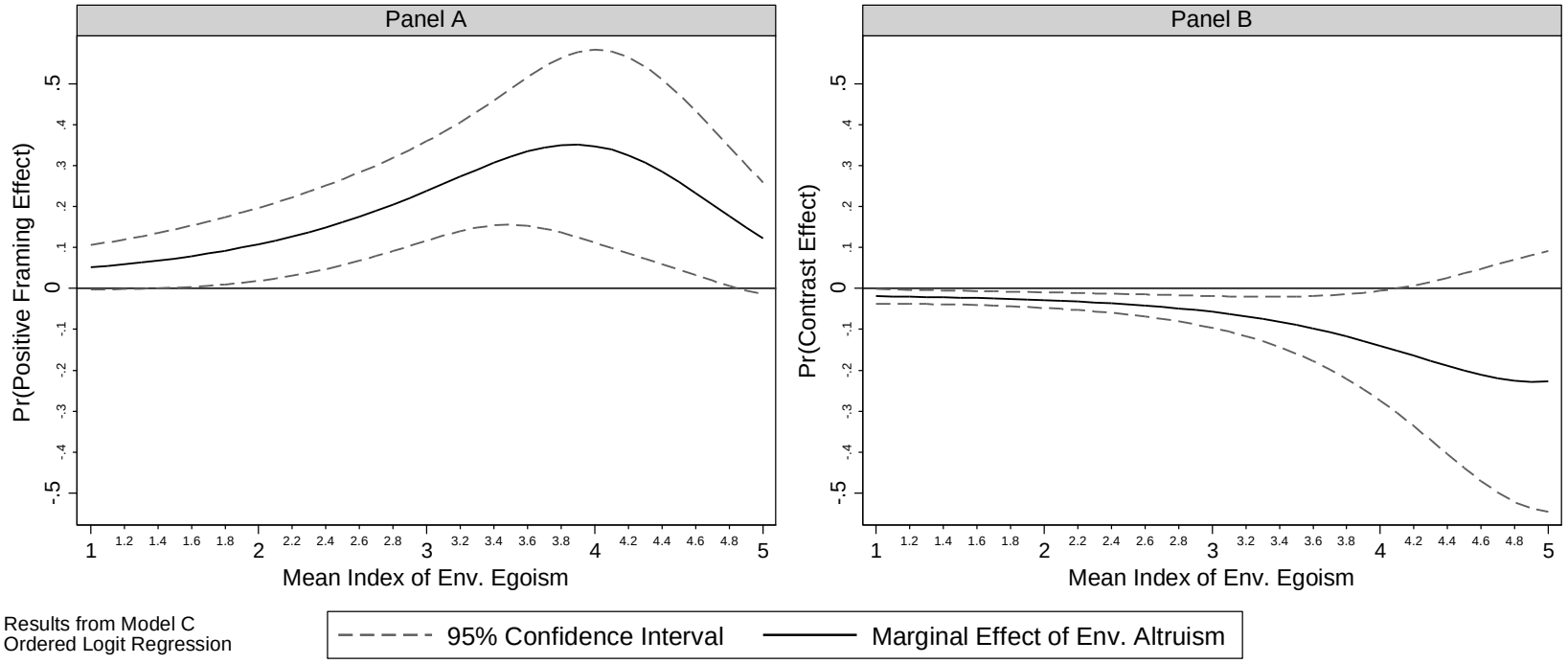
Appendix A: Significance Test of the Interaction between Environmental Egoism and Environmental Altruism holding the Community Frame Constant



Results from Model C
Ordered Logit Regression

95% Confidence Interval Marginal Effect of Env. Altruism

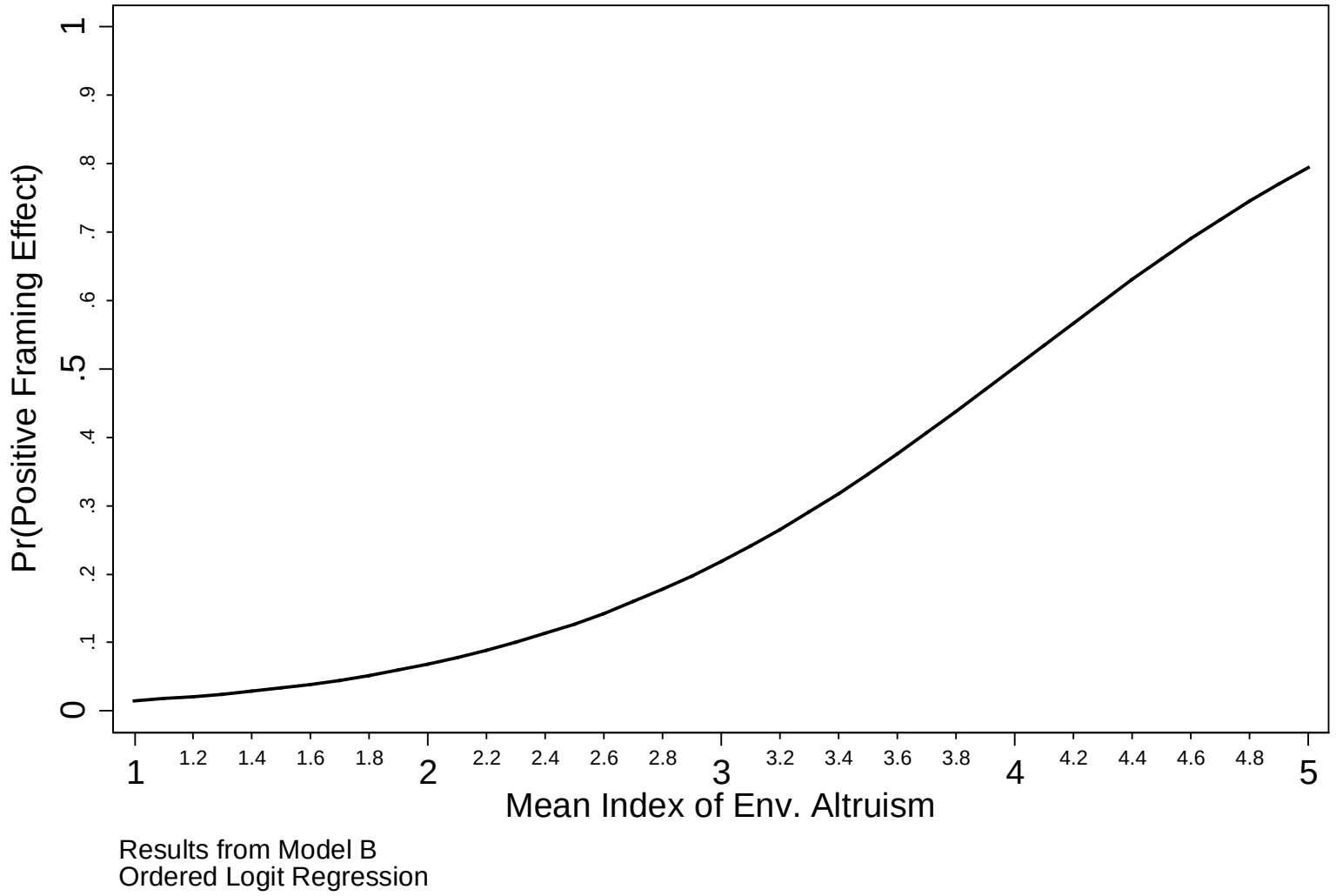


Figure 1: Predicted Probability of Community Frame Leading to a Positive Framing Effect across Environmental Altruism

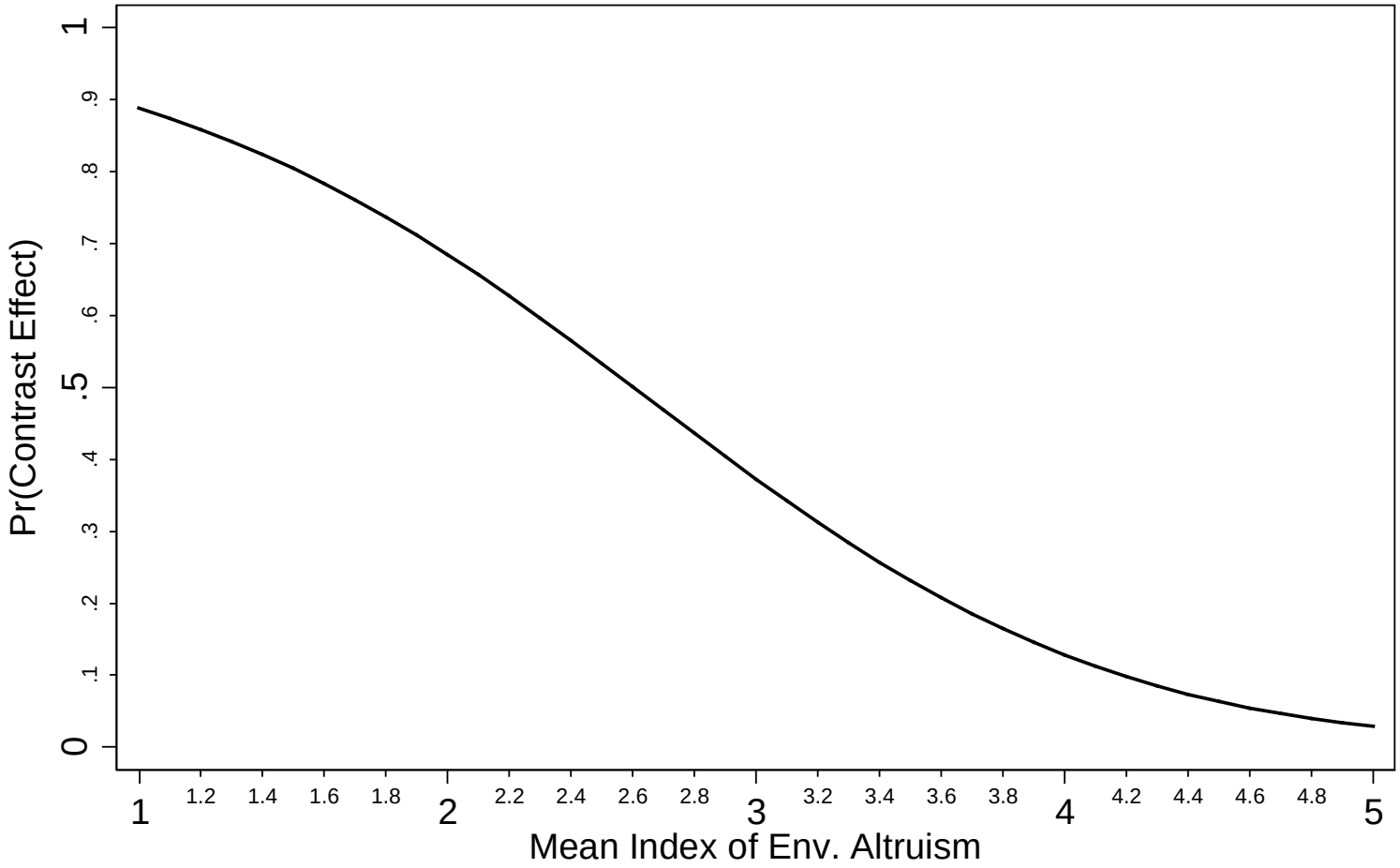
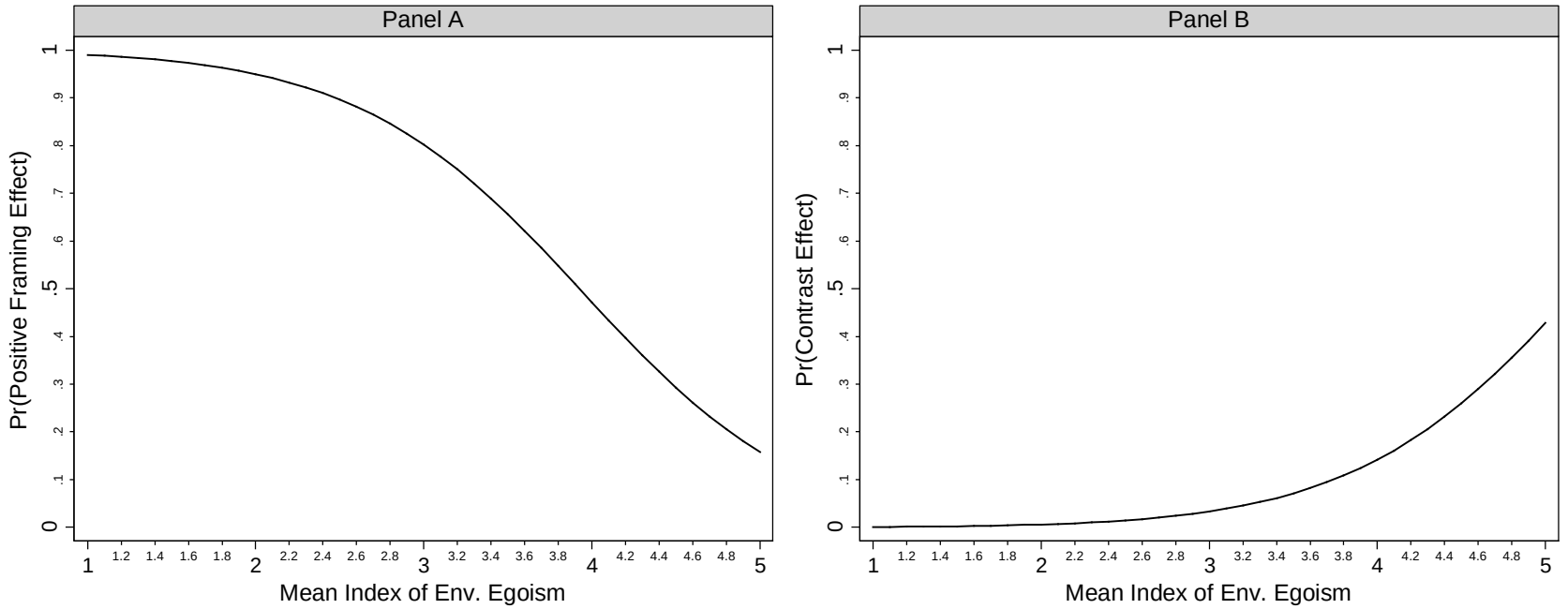


Figure 2: Predicted Probability of Community Frame Leading to a Contrast Effect across Environmental Altruism



Results from Model B
Ordered Logit Regression

Figure 3 Predicted Probabilities of Community Frame Leading to Framing Effects or Contrast Effects across Environmental Egoism

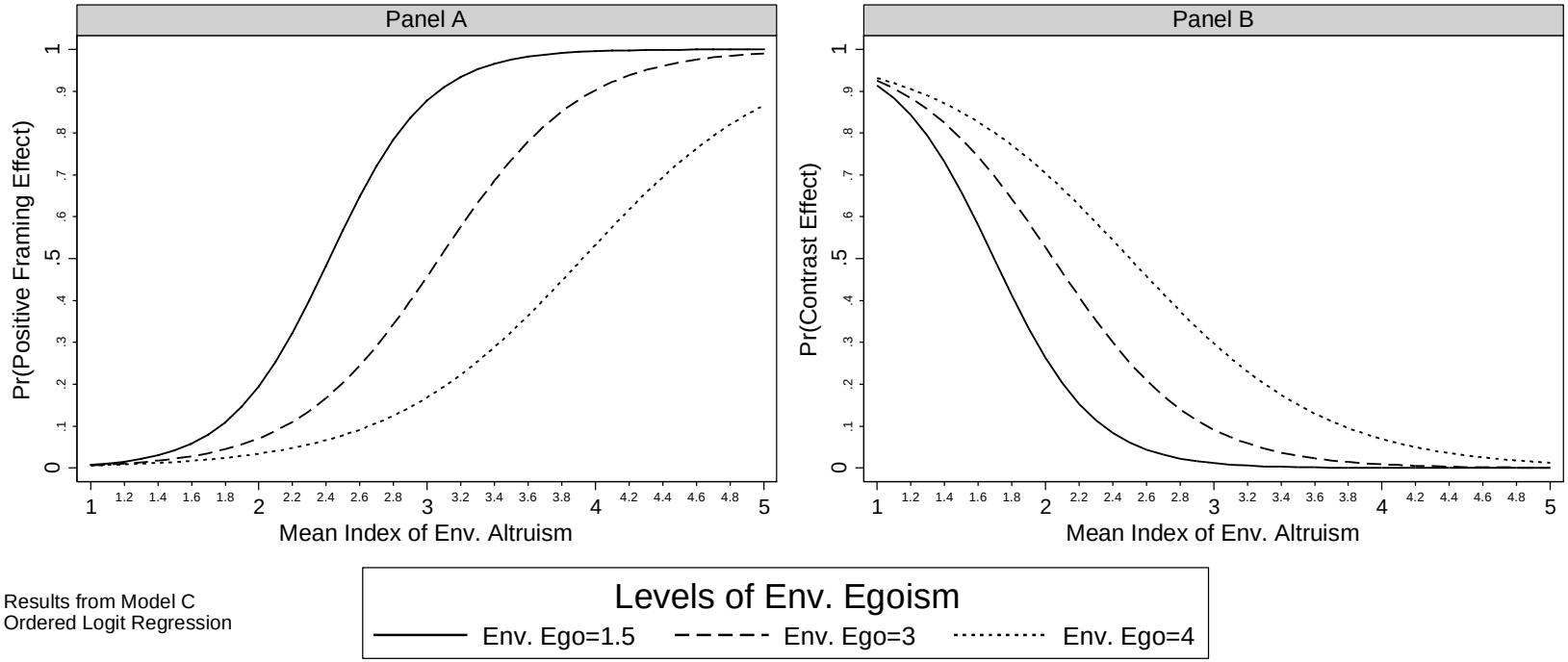


Figure 4 Predicted Probabilities of the Community Frame Leading to Framing Effects or Contrast Effects across Environmental Egoism and Altruism

Table 1: Frames and Values

Frame	Argument	Relevant Value
Profit	No-till is able to increase farms' profits by decreasing production costs, such as labor, fuel, and machinery costs.	Environmental Egoism
Community	No-till reduces soil erosion and agricultural runoff, thereby increasing water and ambient air quality. This has a positive impact on community member's health.	Environmental Altruism
Stewardship	No-till increases and maintains the long-term productivity of the land, ensuring the viability of use for future generations while also increasing biodiversity.	Biospherism

Table 2: Descriptive Statistics

	mean	s.d.	min	max	N
Interest in No-Till					
Pre-test Level of Interest	4.32	1.49	1	7	171
Post-test Level of Interest	4.74	1.37	1	7	171
Environmental Values					
Mean Index of Environmental Egoism	3.89	0.76	2	5	170
Mean Index of Environmental Altruism	3.98	0.63	1.67	5	171
Mean Index of Biospherism	3.7	0.86	1	5	171
Farmer Characteristics					
Years Farming	25.38	14.26	1.5	65	164
Trust in Trade Journals[1]	3.07	0.75	1	4	168
Highest Degree Earned[2]	3.03	1.07	1	5	152
Average Acres Farmed	960.8	1053.0	20	8012.5	152
Age	45.45	15.13	18	78	152
Gross Receipts[3]	2.13	1.58	1	7	152
Gender Male	0.99	0.08			152

[1] 4 point Likert scale where 1= “Not at all” 2= “Not Much” 3= “Some” and 4= “A Lot.”

[2] 5 point scale, where 1= “Grade School or less” 2= “High School” 3= “Some College” 4= “College Degree” and 5= “Advanced Degree”

[3] 7 point scale, where 1= “Less than $500,000 “ 2= “$500,001- $999,999” 3= “$1,000,000- $1,499,999” 4= “$1,500,000- $1,999,999” 5= “$2,000,000- $2,499,999” 6= “$2,500,000- $2,999,999” and 7= “$3,000,000 or More”

Table 3: The Effect of Issue Frames and Environmental Values on Farmers' Interest in No-Till

	Model A	Model B	Model C
Stewardship Frame	-0.298	5.126	-3.299
	(0.412)	(3.441)	(12.259)
Community Frame	0.311	3.146	-11.533
	(0.370)	(3.488)	(11.874)
Environmental Egoism Value	-0.420	0.417	-1.016
	(0.262)	(0.545)	(2.715)
Environmental Altruism Value	-0.026	0.040	-1.365
	(0.425)	(0.933)	(2.895)
Biospherism Value	0.422^{+}	0.332	0.393
	(0.249)	(0.468)	(0.473)
Log of Years Farming	-0.124	-0.195	-0.132
	(0.212)	(0.225)	(0.230)
Trust in Trade Journals	-0.232	-0.247	-0.314
	(0.186)	(0.203)	(0.207)
Stewardship Frame x Env. Egoism		-0.777	1.541
		(0.669)	(3.062)
Community Frame x Env. Egoism		-2.361**	1.593
		(0.748)	(2.942)
Stewardship Frame x Env. Altruism		-0.962	1.267
		(1.149)	(3.241)
Community Frame x Env. Altruism		1.728	5.821^{+}
		(1.213)	(3.262)
Stewardship Frame x Biospherism		0.375	0.347
		(0.770)	(0.790)
Community Frame x Biospherism		-0.085	-0.241
		(0.563)	(0.561)
Env. Egoism x Env. Altruism			0.359
			(0.677)
Stewardship Frame x Env. Egoism x Env. Altruism			-0.592
			(0.756)
Community Frame x Env. Egoism x Env. Altruism			-1.034
			(0.744)
cut1	-3.146*	-0.313	-5.628
cut2	-0.832	2.146	-3.133
LR X2	10.211	29.554	33.200
Prob > X2	0.177	0.005	0.007
N[1]	162	162	162

Results from ordered logit regression; The profit group represents the reference category for all statistical models; Robust standard errors in parentheses

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

[1] 9 of 171 subjects excluded from analysis due to missing information on some of the required independent variables

Table 4: Predicted Probability of Attitude Change by Issue Frame

	Profit	Community	Stewardship
Positive Δ (positive framing effect)	0.395	0.469^{+}	0.328^{+}
No Δ	0.467	0.425^{+}	0.495^{+}
Negative Δ (contrast effect)	0.138	0.106	0.177

Results from Model A ordered logit regression

+ $p<0.10$

Significance levels are based on pairwise comparisons between treatment groups

Table 5: Marginal Effect of Environmental Values on Interest in No-Till for Each Frame

	Profit	Community	Stewardship
Positive Δ (framing effect):			
Egoism	0.092	-0.397***	-0.072
Altruism	0.009	0.361**	-0.185
Biospherism	0.074	0.050	0.142
No Δ:			
Egoism	-0.046	0.227***	0.022
Altruism	-0.004	-0.206**	0.055
Biospherism	-0.036	-0.029	-0.042
Negative Δ (contrast effect):			
Egoism	-0.047	0.171***	0.051
Altruism	-0.005	-0.155*	0.129
Biospherism	-0.037	-0.022	-0.099

Results from Model B: ordered logit regression
* p<0.05, ** p<0.01, *** p<0.001
Shading indicates specific frame-value interactions expected to be significant by our hypotheses.

Online Appendix B: Question Wording for Environmental Values

Please indicate how strongly you agree or disagree with the next few statements.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am concerned about environmental problems because of the consequences for all people.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for future generations.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for people in my community.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for my future.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for my health.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for wildlife.	1	2	3	4	5
I am concerned about environmental problems because of the consequences for ecosystems.	1	2	3	4	5

Online Appendix C: Treatment List

Profit Frame

Saving Money and Increasing Your Bottom Line: No-Tilling All the Way to the Bank

Increasingly, farmers in the United States are recognizing the financial benefits of using no-till farming techniques. Some farmers have been skeptical of the practice in the past, partially due to a small drop in yields in the first few years of using no-till. Yet many farmers have found that over time they achieve similar yields using no-till techniques as with conventional tillage, and have even increased yields in drier years. As a result, no-till methods are becoming more attractive for the average farmer.

No-till is a system of crop production that leaves the residue from the previous crop on the field surface through the planting of the next crop. By limiting tillage operations and residue burial, organic matter in the soil increases over time, ultimately improving soil productivity. Further, crop residue is able to protect top-soil from the elements, thus decreasing soil erosion.

The benefits of no-till extend beyond the effects on farmland. As business owners, farmers need to think about their operation in terms of the bottom line. Many farmers agree that using no-till increases their profits over the long run.

No-till farming decreases the number of trips over the land. By reducing the time spent on a tractor, farmers are able to decrease labor and fuel costs, as well as the substantial expenses associated with maintaining machinery.

In real terms, a 500-acre farm using continuous no-till is able to save as much as:

- 225 hours of labor a year
- 3.5 gallons of diesel fuel an acre, or 1,750 gallons a year
- $5 an acre on machinery wear and costs, or $2,500 a year

By reducing the costs of labor, fuel, and machinery, no-till farming is able to reduce major expenses faced by farmers. Further, in adopting a no-till system farmers are able to save considerable amounts of time, allowing for greater flexibility and scope in managing farming operations.

The impact on farm profits is substantial in any given year, and over time the operation’s bottom line is able to significantly increase. No-till can increase a farm’s profits.

Community Frame

Farming for the Community: No-Tilling to Protect Our Soil, Water, and Air

Increasingly, farmers in the United States are recognizing the benefits of using no-till farming techniques for their communities. Some farmers have been skeptical of the practice in the past, partially due to a small drop in yields in the first few years of using no-till. Yet many farmers have found that over time they achieve similar yields using no-till techniques as with conventional tillage, and have even increased yields in drier years. As a result, no-till methods are becoming more attractive for the average farmer.

No-till is a system of crop production that leaves the residue from the previous crop on the field surface through the planting of the next crop. By limiting tillage operations and residue burial, organic matter in the soil increases over time, ultimately improving soil productivity. Further, crop residue is able to protect top-soil from the elements, thus decreasing soil erosion.

The benefits of no-till techniques extend beyond a farming operation. As the backbone of rural communities, farmers are concerned with how their farming practices affect their friends and neighbors. Many farmers agree that using no-till allows them to protect and "give back" to their communities.

By definition no-till minimizes the amount of soil disturbed and increases the amount of residue on the surface of farmland. This improves soil, water, and air quality for the entire community by:

- reducing soil erosion by up to 90%
- reducing runoff of soil, nutrients, and pesticides into surface water
- reducing fossil fuel emissions from machinery use

By improving soil, water, and air quality farmers are able to reduce community exposure to agricultural inputs, which can negatively affect residents' health. Further, less soil erosion and improved water quality means increased access to clean rivers and lakes. This provides a venue for recreational activity and community development.

The impact is substantial in any given year, and over time these techniques can significantly improve communities. No-till can help farmers protect and support their communities.

Stewardship Frame

Farming As a Steward: No-Tilling to Protect Your Soil, Water, and Air

Increasingly, farmers in the United States are recognizing the benefits of using no-till farming techniques to protect their land. Some farmers have been skeptical of the practice in the past, partially due to a small drop in yields in the first few years of using no-till. Yet many farmers have found that over time they achieve similar yields using no-till techniques as with conventional tillage, and have even increased yields in drier years. As a result, no-till methods are becoming more attractive for the average farmer.

No-till is a system of crop production that leaves the residue from the previous crop on the field surface through the planting of the next crop. By limiting tillage operations and residue burial, organic matter in the soil increases over time, ultimately improving soil productivity. Further, crop residue is able to protect top-soil from the elements, thus decreasing soil erosion. The benefits of no-till techniques extend beyond a farming operation. As stewards of our nation's land, farmers pay close attention to protecting natural resources. Many farmers agree that using no-till is important in preserving the land.

By definition no-till minimizes the amount of soil disturbed and increases the amount of residue on the surface of farmland. This improves soil, water, and air quality, helping farmers be better stewards by:

- reducing soil erosion by up to 90%
- reducing runoff of soil, nutrients, and pesticides into surface water
- reducing fossil fuel emissions from machinery use

By improving soil, water, and air quality farmers are able to promote the improvement of soil structure, benefiting the long term fertility of the land. Further, by protecting and improving the land, farmers ensure that farmland will be valuable and productive for future generations.

The positive impact on the land is substantial in any given year, and over time no-till farming significantly protects natural resources. No-till can help farmers become better stewards of the land.