Animal Welfare, Altruism and Policy Support

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Abstract

Animal welfare provision by dairy farmers has implications that go well beyond the individual dairy farm. In this study, we assess dairy farmers' willingness to pay to support a policy aimed at improving calf welfare and link this to altruism. We conceptualise the farmer's decision into private reasons, and motivations to improve animal welfare on their own farm or eliminate bad practices elsewhere. Our data comes from a survey with over 400 Irish dairy farmers that included an experimental component. Specifically, we used a contingent valuation referendum method to elicit farmers' willingness to pay. We measured altruism with a financially incentivised social value orientation scale. Our findings indicate that most farmers are supportive of a policy scheme to improve animal welfare, and altruism is positively associated with higher willingness to pay. Specifically, our findings suggest that altruists are willing to pay €429 per annum, while individualistically minded farmers are willing to pay €220 per annum to support the new initiative. Our findings have important policy implications as we show that the majority of farmers are willing to financially support the implementation of a policy that can help to prevent public bads.

Keywords Animal welfare, altruism, willingness to pay, dairy industry.

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1 Introduction

Public acceptance of farming practices relating to animal welfare is an ongoing concern (Lagerkvist and Hess, 2011; Lusk and Norwood, 2011). Failure to maintain acceptance could drive negative perceptions, lowering consumer demand and creating legislative or regulatory pressures. Recent studies show that many dairy industry practices are perceived negatively by the public, including lack of pasture access (Schuppli, Von Keyserlingk, and Weary, 2014), disbudding or dehorning without pain relief (Robbins et al., 2015; Widmar et al., 2017), tail docking[1] (Weary, Schuppli, and Von Keyserlingk, 2011) and separating calves from dams soon after birth (Ventura et al., 2013).

Calf welfare offers a unique case, as specialized operations that raise calves are a common feature of the US and EU dairy industry, involving the movement of calves within days or few weeks of birth, sometimes across large distances. These transactions have the potential to create serious animal welfare concerns among consumers, if they become aware of sub-optimal practices. In addition, calf welfare is likely to elicit strong emotional responses of sympathy. This is particularly relevant as most people feel empathy and have altruistic preferences for animals above and beyond private benefits from improved animal well-being (Cowen, 2006; Lusk and Norwood, 2012).

What makes matters worse is that some dairy farmers see surplus calves[2] as an unwanted by-product of dairy production (Osawe et al., 2021), which can have implications on their treatment. For example, bull calves, which represent the majority of surplus calves, are less likely to receive adequate colostrum administration relative to heifer calves (Shivley et al., 2019). The quality of neonatal care provided at the dairy farm plays a critical role in calf welfare, because suboptimal colostrum management and navel care are key risk factors for mortality and morbidity. Thus, poor treatment of dairy calves has knock-on effects (Renaud et al., 2017; Shivley et al., 2019), which can be exacerbated if markets fail to represent the

[1] This practice is no longer commonplace.
[2] Surplus calves are dairy calves that are not used for dairy production.

full value of calf well-being in sale prices.

One market-based solution to improve animal welfare is to increase the monetary value of surplus calves and thereby incentivize good management practices. A breeding strategy that combines the use of sexed semen to generate replacements and beef semen on remaining dams has the potential to minimize the number of unwanted bull dairy calves and increase the number of dairy-beef crosses which can sell at higher prices (Holden and Butler, 2018).

This is particularly pertinent in Ireland, where the number of surplus dairy calves has increased significantly over the last decade, in line with a 57% increase in the national dairy herd between 2010 and 2020 (Central Statistics Office, 2020). Unconstrained milk production facilitated by the EU milk quota abolition in 2015 also resulted in a breeding focus on better milk production characteristics (Kelly et al., 2020). This led to a large number of bull calves with poor beef characteristics and therefore low economic value (Osawe et al., 2021). The higher number of surplus calves produced due to the increase in the national dairy herd meant that new market outlets for dairy calves needed to be found. Consequently, Irish dairy calf markets have come under pressure and the number of calves exported for veal production or slaughtered shortly after birth has increased significantly (Osawe et al., 2021). Coverage by the Irish media including video footage of abuse of live exported calves has exacerbated the situation and fuelled consumer disapproval. Therefore, the welfare of dairy calves has developed into a pressing issue, which causes concern about the reputation of the dairy industry.

In this paper, we explore dairy farmers' willingness to pay (WTP) to improve calf welfare, and the role of their altruistic preferences. As it is difficult to directly assess how farmers value animal welfare, we focus on solutions to improve calf welfare. This is a similar concept used by previous studies that focused on farm animal welfare programmes (Latacz-Lohmann and Schreiner, 2019) and traceability (Schulz and Tonsor, 2010) when eliciting farmers' preferences. As such, we focus on a new policy initiative with the potential to improve calf welfare. Specifically, we assess the implementation of a sexed semen laboratory (lab)

in Ireland to facilitate greater uptake of sexed semen in the Irish dairy industry, which, as mentioned, has the potential to reduce the number of unwanted bull dairy calves. To date, available sexed semen in Ireland is of lower genetic quality than conventional semen, as top bulls were not used for sexed semen due to the unavailability of a national lab. While the implementation of a national sexed semen lab will increase supply of semen from top bulls, and as such facilitate greater uptake, other factors that impede the use of sexed semen, such as lower conception rates and higher prices per straw, would still remain. However, significant concerns of Irish dairy farmers about the reputation of the dairy industry in relation to surplus calves (Osawe et al., 2021), will likely further stimulate farmers' interest in sexed semen.

We develop a conceptual framework that outlines farmers' motivations to financially support a policy to improve animal welfare. We explain that animal welfare provision can be divided into private and public reasons. Once the profit maximizing level of animal welfare is reached, support of a policy scheme is driven by public good motivations to supply improved animal welfare and concerns to eliminate bad practices elsewhere (public bads), which increase with altruistic preferences.

We conducted a survey with over 400 Irish dairy farmers, which included a double-bounded dichotomous referendum question where farmers voted on the implementation of a new sexed semen lab, which was associated with an annual fee per cow. We then used an experimental method to elicit farmers' altruistic preferences by implementing a financially incentivised form of the dictator game. Specifically, we used the social value orientation (SVO) scale developed by Murphy, Ackermann, and Handgraaf (2011) that measures the magnitude of concern people have for others. We then link SVO to farmers' WTP and find that increasing altruistic preferences are positively related to higher WTP. In fact, when grouping farmers based on their SVO reveals that altruistically minded farmers are willing to forgo more profit than less altruistically minded farmers. When linking this to motivations to support the new policy, we find that private reasons are main motivating factors, followed

by industry reasons, while animal welfare improvements played the least important role. In line with our conceptual framework, we find that animal welfare provision is motivated by a mix of reasons.

We contribute to the animal welfare economics and general agricultural economics literature as follows. First, we explicitly consider altruistic preferences of producers in our empirical framework, and in contrast to previous studies that have conceptualised altruism in animal welfare (Cowen, 2006; Lusk and Norwood, 2012) we quantify the altruism effect. This is a new contribution to the literature. Second, our study is one of the first economic studies that explicitly consider dairy calf welfare from a producer point of view, which is surprising given ample evidence of dairy calf welfare issues (e.g., (Renaud et al., 2017)). Third, our study is one of the few studies that focuses on farmers' WTP for improved animal welfare, as the bulk of existing economic animal welfare studies elicit consumer responses (see Lagerkvist and Hess (2011) and Clark et al. (2017) for overviews). Finally, our study also speaks to the general agricultural economics literature by eliciting farmers' WTP for a new policy incentive to reduce public bads. This is in contrast to the vast majority of existing ex-ante policy assessments that focus on farmers' willingness to accept (Krishna et al., 2013; Schulz, Breustedt, and Latacz-Lohmann, 2014).

The article proceeds as follows: we explain the background in the next section, and outline relevant literature in section 3. We develop a conceptual framework in section 4. Section 5 describes the survey, while section 6 provides a description of the data. This is followed by the methodology section. We then present and discuss the the results from our empirical specifications, while the last section provides some concluding remarks.

2 Background

Dairy farming is centred around the production of milk. With replacement rates ranging from as low as 18% (Teagasc, 2020) to much higher replacement rates depending on country

and production system, not all dairy calves are needed for dairy production. Also, when using conventional semen, approximately 50% of calves will be bull calves, which are not suitable for dairy production for obvious reasons. These 'surplus calves' need to be marketed somehow, if they are not reared on the dairy farm for slaughter.

In general, there are several possible outlets for surplus dairy calves. They may be euthanised on the dairy farm, or sold to an abattoir when they are a few days old for skins, pet food or rennet. Other outlets are veal or beef markets, which both require transport to the respective rearing farms. The markets for dairy calves vary by country and depend on consumer preferences (Haskell, 2020).

Traditionally, Ireland has a large beef sector and many dairy calves went into beef production. However, the major dairy industry expansion initiated by the EU milk quota abolition in 2015 meant that dairy cow numbers in Ireland increased from one million dairy cows in 2010 to 1.57 million dairy cows ten years later (Central Statistics Office, 2020). This almost 60% increase in dairy cow numbers had significant effects on the number of surplus calves that needed to be marketed. Coupled with a spring calving system where the vast majority of calves are born in March and April, meant that many more surplus dairy calves were produced that could be handled by national markets. An increased breeding focus on better milk characteristics (Kelly et al., 2020) further aggravated the problem, as these calves are less suitable for beef production. In fact, the majority of beef farmers in Ireland indicated that they were not willing to rear dairy bred calves for beef (Maher et al., 2021). Furthermore, unconstrained milk production post-quota allowed greater specialisation in milk production, while during quota restrictions diversifying farm businesses (e.g. beef production) were the only means to increase income. Therefore, with an increased focus on dairy production, many dairy farmers reduced rearing their own calves for beef, which put additional pressure on calf markets.

This led to a sharp increase in dairy calves that were culled prematurely or sold for live exports to the EU for veal production. For example, in 2019 almost 30,000 dairy calves

were slaughtered and almost 190,000 were live exported between birth and six weeks of age (Department of Agriculture and the Marine, 2019). The problem is that these market outlets for unweaned calves imply a series of stress factors such as transportation over long distances for veal production, food withdrawal, and movement through markets, and are therefore a cause for animal welfare concerns (Haskell, 2020; Pardon et al., 2014).

3 Literature Review

There is an increasing expectation by consumers that animal-based food products are produced with consideration for the welfare of farmed animals (Lusk and Norwood, 2011; Veissier et al., 2008). This increasing public expectation and awareness of animal welfare has led to an increase in economic studies that focus on farm animal welfare, beginning with the work by McInerney (1993) conceptualising the economics of animal welfare and Bennett (1995) discussing the need to value animal welfare.

Since this early work, there are several contributions in the agricultural economics literature that discuss animal welfare from a conceptual point of view. Lusk and Norwood (2011), for example, outline how animal welfare relates to production economics, public economics, welfare economics and consumer economics.

Insights from production economics can facilitate our understanding of the optimal level of animal welfare provision based on a profit maximization goal by farmers. It is generally accepted that farm animals who receive better care are likely to be more productive, and will thus lead to more profit (Lusk and Norwood, 2011). In addition, productivity and reproductive attributes are sometimes regarded as potentially effective measures of animal welfare (Curtis, 2007). This illustrates that there is a private benefit for the farmer to consider the welfare of farmed animals. However, Norwood and Lusk (2011) show that maximizing animal welfare is not equivalent to maximizing profit, as maximizing profit can lead to stocking animals beyond a level that maximizes animal welfare. It can also

lead to sub-optimal treatment of animals. For example, bull dairy calves, which are of lower economic value than heifer dairy calves, are less likely to receive adequate colostrum administration relative to heifer calves (Shivley et al., 2019).

Given that maximizing animal welfare is generally not equivalent to maximizing profit suggests that there is market failure in relation to animal welfare, as animal welfare is often not priced in any conventional way (Lusk and Norwood, 2011). Animal welfare labels try to overcome this problem, but have by no means eliminated the economic problem that animal welfare creates an externality. For example, providing pasture access to dairy cows results in a positive externality for other farmers who benefit from consumers associating dairy farming with high animal welfare (Schuppli, Von Keyserlingk, and Weary, 2014), without having to provide pasture access themselves. In turn, farmers sending unweaned calves for live exports can create a negative externality that affects all dairy farmers, if the public becomes aware and disapproves of such practices.

In addition, animal welfare is also a public good (or bad). For example, when a farmer provides high animal welfare, the farmer cannot exclude other farmers from benefiting from it. Similarly, if a farmer treats animals badly, other farmers will also be negatively affected. Animal welfare is also non-rival in the sense that no one can be excluded from benefiting (suffering) that the animals are treated better (worse) (Lusk and Norwood, 2011; McInerney, 2004). This leads to the classic social dilemma problem that justifies government intervention. Traditionally, regulations and quality assurance schemes are main instruments to ensure higher animal welfare (Lagerkvist et al., 2011; McInerney, 2004). McInerney (2004) adds that from a policy perspective to provide a public good, there should be a perceived benefit for a large proportion of the population. Given that 94% of respondents of the Eurobarometer survey believe it is important to protect the welfare of farmed animals (Eurobarometer, 2016), this condition is clearly met.

In addition to public policy, altruism has been recognised as a way to mitigate social dilemmas in general and to provide higher animal welfare specifically. However, for altruism

to be relevant, a person needs to care about the welfare of animals, as otherwise it does not enter the utility function (McInerney, 1993). But views on animal welfare differ widely as animal welfare is often perceived as an emotional topic (Nocella, Hubbard, and Scarpa, 2010). In general, people are inclined to show altruistic tendencies for farm animals beyond the private benefit they may potentially derive from animal welfare (Cowen, 2006). For example, Bennett and Blaney (2003), in their study to elicit UK citizens' WTP to support legislation to phase out the use of battery cages for egg production in the EU, found that in addition to concern for farm animal welfare, higher WTP also appears to be associated with altruistic tendencies such as 'warm glow' effects i.e. the acquisition of moral satisfaction.

Animal welfare has also been discussed from the concept of use and non-use values (Lagerkvist et al., 2011). Use values are derived from animals through productivity, while in relation to animal welfare, non-use values are ethical that are attached to the perception how well the animals are kept (McInerney, 2004). [3] Lagerkvist et al. (2011) develop a model that ingrates livestock producers' decisions between use and non-use values related to animal welfare. Specifically, they derive compensating variation for alternative levels of animal welfare, which equates to the change in expenditure to sustain original utility after non-use value of animal welfare has increased. Hansson and Lagerkvist (2015) explore use and non-use values of Swedish dairy farmers and find that use values relate to business and product quality considerations, while non-use values relate to 'warm glow' and further improvement of animal welfare. In another study (Hansson and Lagerkvist, 2016), the authors identify the types of use and non-use values that motivate dairy farmers and show that the economic value associated with better animal welfare includes use- and non-use values.

In relation to welfare economics, the question arises how to extend the economic utilitarian welfare analysis to account for animal welfare, and Lusk and Norwood (2011) outline how including altruism and the cost and benefits to animals and people complicates the matter.

[3]Non-use value is a common concept in environmental economics that arises if a person benefits from an environmental good, without directly interacting with it (Phaneuf and Requate, 2016). Farmers directly interact with their animals, which may make the concept of non-use value less applicable when considering animal welfare from the farmers' point of view.

Nevertheless, a significant number of studies have set out to measure the economic costs of animal welfare. Despite this increasing volume of work, the bulk of studies explore consumers' views by eliciting their valuation of animal welfare, see Lagerkvist and Hess (2011) and Clark et al. (2017) for meta-analyses and Bennett et al. (2019) for a recent example. Viewer studies use revealed preferences, see Andersen (2011). Specifically, Bennett et al. (2019) examined the benefits and consumers' WTP for farm animal welfare legislation (EU Broiler Directive) using a contingent valuation method. The authors estimated a WTP of £21.50 per household per year for the legislation. Another consumer focused study is Liljenstolpe (2008), who explored WTP for animal welfare attributes when buying pork fillet among Swedish consumers. The study used a choice experiment and accounts for heterogeneity in individual consumer preferences, and finds that consumer preferences are important leading to WTP estimates being positive or negative.

As mentioned, considerably fewer studies focus on farmers' perspectives. However, precedents do exist, see Latacz-Lohmann and Schreiner (2019). They explored willingness to accept higher animal welfare standards among German pig farmers using a discrete choice experiment. They found that farmers who expect to continue their farming business in the long term tend to be more likely to adopt higher animal welfare standards.

In summary, current research provides evidence that altruistic reasons play an important role in animal welfare (e.g. Lusk and Norwood (2012)), and 'warm glow' appears to influence producers' and consumers' motivations to provide/support animal welfare (Bennett and Blaney, 2003; Hansson and Lagerkvist, 2015), but to date no study has directly quantified this effect. Our study aims to fill this gap in the literature.

4 Conceptual Framework

In this section, we develop a conceptual framework of farmers' motivations to support a policy to improve animal welfare, and how this relates to altruism. Each farmer faces the

decision of how much animal welfare to provide. Individual animal welfare decisions beyond the minimum required level benefit the entire industry. If the individual farmer does not contribute, others may provide animal welfare, and the farmer can just free ride on their efforts. Conversely, individual decisions to forgo animal welfare can harm the entire industry, and despite other farmers providing higher animal welfare, the actions of one farmer providing low animal welfare can negatively impact on other farmers. Thus, if costly solutions to improve animal welfare for the entire industry exist, the farmer's motivation to support animal welfare policies can be split into improving animal welfare on the own farm or aiming to improve animal welfare on other farms.

Despite obvious impacts of animal welfare (non-) provision on the wider industry (or society), there is a private benefit to the farmer for providing animal welfare up to the point where improvements in animal welfare do not lead to higher profit any more. Note that this increase in profit can be achieved by more productive animals associated with better welfare (Lusk and Norwood, 2011) or higher prices through, for example, animal welfare friendly labelled products.

Once the farmer exceeds the profit maximizing level of animal welfare, animal welfare has public good characteristics. This better treatment of farmed animals can be motivated by two reasons: One reason for the provision of animal welfare beyond private benefits are genuine animal welfare concerns. This is only relevant for the individual farmer if the welfare of animals is part of the utility function, and implies that a person cares about how animals are treated (Cowen, 2006; McInerney, 1993). A second reason are concerns about industry reputation. A positive industry reputation is important for maintaining profits in the long run.

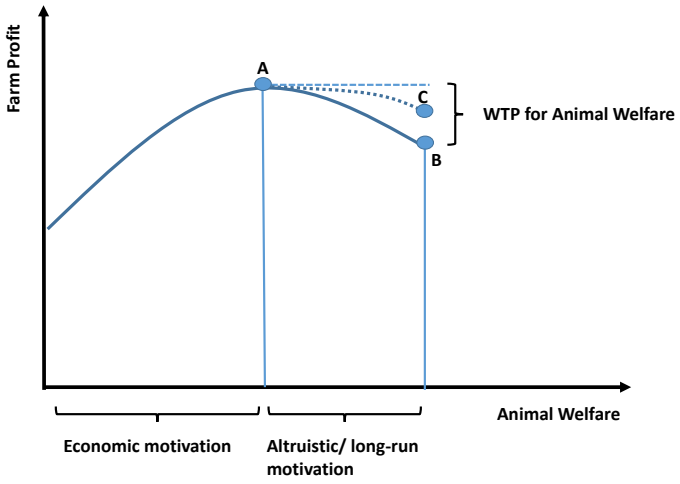
Given that animal welfare has public good characteristics, individual decisions of farmers can benefit or harm the entire industry. Therefore, the farmer's decision to forgo some of the profit in the short run to support a policy for higher animal welfare can be motivated by improving animal welfare on the own farm or eliminating bad practices elsewhere.

The farmer can make a decision to support the policy as this will allow to provide better care for his or her own animals, where better treatment can be motivated by feelings of 'warm glow' or altruism more generally. This will result in other farmers benefiting too, as especially the treatment of calves evokes strong emotional responses from the public (Busch et al., 2017). Altruism motivates farmers to give a public good even if their actions only have a tiny effect on the overall outcome, i.e. the welfare of farmed animals in general (Lusk and Norwood, 2011). However, in the long run, improved animal welfare through, for example, advancing own breeding programmes that can facilitate better marketing of calves (associated with improved welfare) can lead to higher prices for calves and thus higher profits.

The farmer can also make a decision to support the policy to facilitate better treatment of animals in the industry in general. This implies that the farmer's motivation to improve animal welfare can be driven by concerns about industry reputation that affects all farmers, or feelings of sadness that animals are treated badly by others (Lusk and Norwood, 2011). However, maintaining or improving industry reputation is likely motived by profit considerations in the long run.

It follows that a farmer's provision of animal welfare is motivated by a mix of private benefits, and providing public goods or eliminating public bads. We assume that the private benefit part of animal welfare is entirely driven by maximizing profits in the short run, while the public good/bad part is driven by a mix of altruistic preferences and long run profit considerations. We illustrate this concept in figure 1.

Figure 1: **Conceptual framework**



As can be seen, farm profit increases initially with increasing animal welfare, as predicted by Lusk and Norwood (2011). In our diagram, this is the private benefit part of animal welfare, which is motivated by economic considerations. Up to point A the cost of increasing animal welfare are smaller than the additional revenue gained, hence profit increases. However, once a certain level of animal welfare is reached at the profit maximising point A, further improvements in animal welfare lead to reductions in farm profit. This can be due to lower stocking density than is optimal for profit maximization, or other management strategies that increase farm animal welfare, such as better care for dairy calves that lead to higher labour demand.

Assume a farmer's short-run utility maximising choice is point B. Our diagram suggests that the farmer is willing to forgo some of the short-run farm profit (the vertical part between point A and B) to reach higher animal welfare, and maximize utility. We refer to this as the farmer's WTP. We assume that this part of animal welfare provision is (at least partially) based on altruistic motivation.

The dashed line that connects point A and C is the long run farm profit. This indicates that the farmer's costly choices today (i.e. the vertical difference between A and B) push

farm profit up in the long run, while maintaining animal welfare. This implies that improving animal welfare becomes less costly in the long run.

While animal welfare provision up to point A has a clearly defined economic value[4] (i.e. increases in profit), further increases of animal welfare have public good characteristics and are thus not conventionally priced. This implies that the farmer has to make a choice between competing levels of animal welfare and profit (Lagerkvist et al., 2011), but providing animal welfare beyond the profit maximizing choice A will only be relevant for farmers whose utility function contains animal welfare or who are concerned about the industry. As can be seen in figure 1, WTP for animal welfare increases with increasing altruistic motivations to provide a good for the wider public.

5 Survey Design

Data for this study come from a survey of Irish dairy farmers. The survey was conducted online[5] and we received over 400 completed responses. The survey was implemented by two main means: first, we sent the link directly to dairy farmers through their dairy advisor. In addition, we posted a link in a popular Irish farming press.

The survey consisted of several sections relating farm characteristics focusing on expansion, dairy breeding choices, attitudes toward animal welfare, calf treatment, farmer characteristics, as well as a section using a contingent valuation method to assess farmers' WTP for improved animal welfare and a section eliciting farmers' SVO. The latter two sections are described in more detail below, and the full survey can be found in appendix D.

[4] In practice, it might be difficult to clearly align animal welfare improvements to profit.

[5] Online surveys with farmers have been successfully conducted in other EU countries, see for example Kuhfuss et al. (2016).

5.1 Measuring Willingness to Pay for Improved Animal Welfare

The difficulty to directly assess how farmers' value animal welfare are well known (Johansson-Stenman, 2018; Lusk and Norwood, 2012) and thus, we focus on solutions to improve farm animal welfare. This is a similar concept to previous studies that focused on farm animal welfare programmes (Latacz-Lohmann and Schreiner, 2019) or traceability (Schulz and Tonsor, 2010) when eliciting farmers' preferences.

Specifically, we focus on the establishment of a sexed semen lab in Ireland, which, at the time the study was conducted, was discussed as an important means to reduce surplus dairy calves by facilitating better access to high quality sexed semen. In terms of animal welfare improvement, increased use of sexed semen has the potential to reduce the number of calves that are culled prematurely and can also help to reduce the number of unweaned exported calves. This is based on breeding choices that use sexed semen to breed dairy replacements and using beef bulls on the remaining cows leading to higher quality surplus calves that achieve higher prices through better market outlets.

This scenario was selected based on several focus groups with farmers, as well as discussions with industry experts and farm advisers. In fact, a sexed semen lab has been established in Ireland in November 2021 (which was not known at the time the study was conducted), which shows that our hypothetical scenario was very realistic.

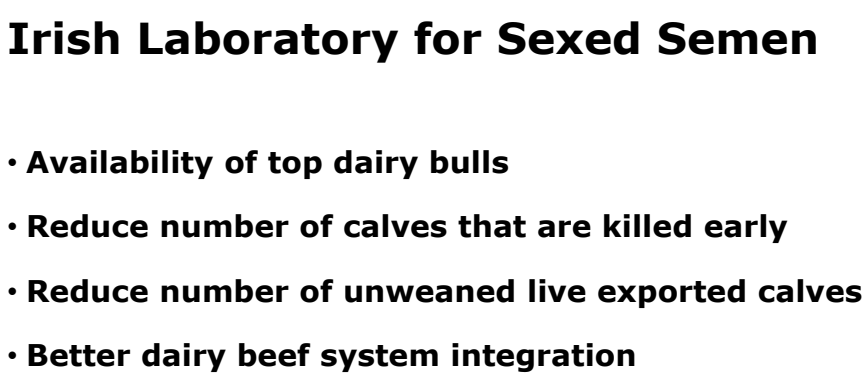
We use a dichotomous choice referendum style double bounded contingent valuation (CV) question that assesses farmers' WTP for the establishment of a sexed semen lab in Ireland. While the dichotomous choice referendum approach is the most common elicitation method, applications in agriculture are sparse. In the referendum approach, the respondent casts a vote. This setup is seen as incentive-compatible if the farmer's best choice from a strategic perspective is to select the choice the farmer most prefers (Phaneuf and Requate, 2016).

First, farmers were presented with background information introducing the problem. Specifically, we informed farmers about the quantity of calves that were culled prematurely or live exported in 2019, and explained how the use of sexed semen can help to alleviate

the problem. Farmers were then asked to imagine that the Department of Agriculture is considering a new scheme aimed at decreasing the number of dairy bull calves. Under this scheme, a sexed semen lab in Ireland would be established in 2020. Please refer to appendix D for the full survey.

In addition, survey participants were presented with the main implications of an Irish sexed semen lab, see figure 2:

Figure 2: **Implications of a sexed semen lab**



This was followed by the main part of the referendum CV question:

Establishing a sexed semen laboratory in Ireland is associated with a significant initial investment and on-going maintenance costs, which requires support from dairy farmers. Imagine establishing this new Irish sexed semen laboratory would be associated with a €3[6] *annual fee per dairy cow for 5 years. This would mean an annual fee of €390 which would be subtracted from your June milk cheque for the next 5 years.*

Suppose the Department of Agriculture is seeking the opinion of dairy farmers whether or not a sexed semen laboratory should be established in Ireland. If a majority of dairy farmers in Ireland support the establishment of an Irish sexed semen laboratory (i.e. vote yes), the

[6]This is an example of a price of €3 for a farmer with a herd size of 130 cows.

new laboratory would be established next year, while it would not be established otherwise.

We then included 'cheap talk' explaining hypothetical bias and reminding farmers that they should answer as if real payments were required. Cheap talk has been found to reduce WTP amounts in some situations (Lusk, 2003). We also made explicit to farmers that this survey and their answers are important for future policy implementation.

The main question was as follows:

If the vote were held today, how would you vote? In your vote, consider that establishing a sexed semen laboratory in Ireland would require an annual fee of €3 per dairy cow for 5 years (i.e. a total annual fee of €390 given your herd size).

Farmers were asked to vote for or against the new laboratory, followed by a question to assess the degree of certainty respondents have in their answer, measured as 'very certain', 'somewhat certain' and 'not certain at all'.[7]

Next, we elicited the motivation of farmers for voting 'yes' or 'no'. In particular, for 'yes' votes, we were interested whether this motivation stems from private reasons (i.e., availability of top dairy bulls for sexed semen and the expectation of lower prices for sexed semen); animal welfare motivation (i.e., reducing the number of dairy calves that are killed early and reducing live exports of unweaned calves) or dairy industry motivation (i.e., improving beef-dairy integration and improving the dairy industry's reputation). Farmers could select up to three reasons. For 'no' votes, we had similar reasons in a reversed format, as well as reasons that farmers feel they should not have to pay for the establishment of a sexed semen laboratory.

Each participant was randomly allocated a price from €1 to €9 in €2 increments. This was followed by an increase in price in the case of a yes vote and a decrease in price in the case of a 'no' vote. More specifically, the follow-up prices for the second vote were €3, €5, €7, €9 and €11 when the initial response was 'yes', and €0.5, €1, €3, €5 and €7 when the initial vote was 'no'. The number and levels of bids used were set using data obtained from

[7] We found that 4% of participants were very uncertain in the first vote, which increased to 5% in the second vote.

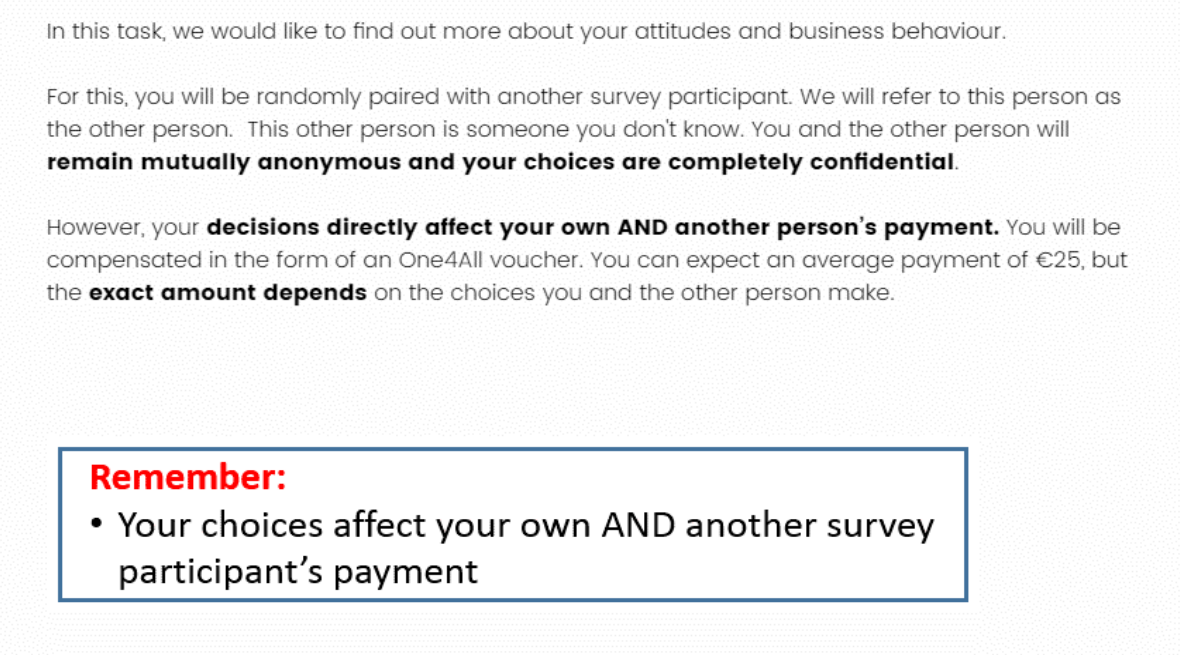
a combination of an open-ended pilot study and focus group discussions with farmers.

5.2 Social Value Orientation

In relation to measuring altruism, we implemented a measure of SVO (Murphy, Ackermann, and Handgraaf, 2011) in our survey. In general, SVO measures the magnitude of concern people have for others.

We followed the standard measure and implemented six items focusing on altruistic, prosocial, individualistic, and competitive behaviour. In practice, this meant participants had to make six choices to allocate money between themselves and another (anonymous) person. The choices were financially incentivised in the sense that we paired each participant with another participant and randomly drew one of the six choices for payoff. Participants then received the average of what they allocated to themselves and what their partner allocated to the other person. Participants were also reminded that their choice had financial implications on their own and someone else's payment. Payment was in the form of gift vouchers as the survey was conducted online.

Figure 3: **Introduction to SVO measurement**



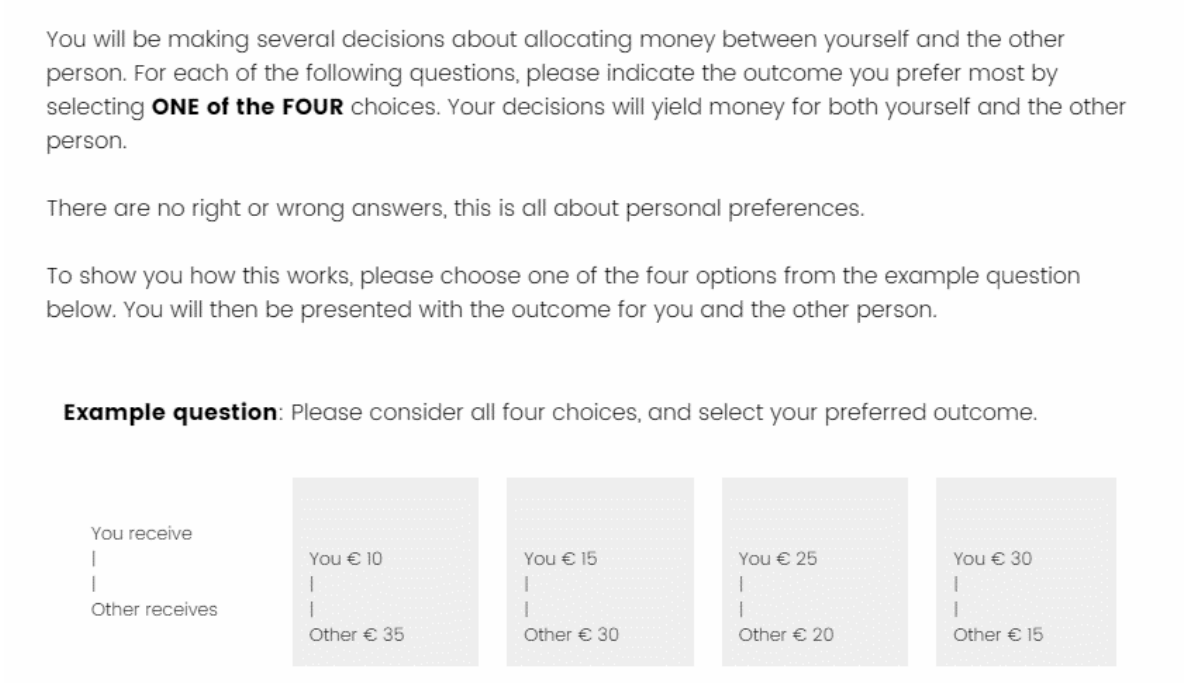
While the original SVO items have nine possible choices each to allocate money, we reduced the set of choices to four. This was based on pilot study results that revealed that participants were not assessing all nine choices, but rather tended to just tick the first available choice. In addition, we divided the original scale by three to receive realistic monetary amounts for payoff. Again, this was informed by pilot tests.

Figure 3 and figure 4 show screenshots of the introduction to the SVO part of the survey. This was followed by a screen that explained what the individual choice meant (e.g., this choice means you have allocated €30 to yourself and €15 to the other person), and a reminder to consider all choices. A full description of the SVO part of the survey can be found in appendix B. The SVO measure results in a single score for each participant, computed as follows (Murphy, Ackermann, and Handgraaf, 2011):

$$SVO^{\circ} = arctan\left(\frac{(\bar{A}_O - 16.7)}{(\bar{A}_S - 16.7}\right), \tag{1}$$

where $\bar{A_O}$ is the mean allocation to the other person, while $\bar{A_S}$ is the mean allocation to the own person.

Figure 4: **Introduction to SVO measurement**



6 Data Description

6.1 Farm Characteristics

Table 1 provides summary statistics of our data. On average, farms have a herd size of 133 dairy cows and farm 80 hectares. As such, the sample farms in this survey a considerably larger than the national average of 80 dairy cows with a total farm area of 61 hectares (Dillon, Moran, and Donnellan, 2020). Our sample farmers have a milk yield per cow of 5,475 litres, which is similar to the national average of 5,608 litres of milk produced per cow.

One variables that warrants further explanation is sexed semen. This variable elicits if the farmer has used sexed semen on any cows or heifers in 2019. Almost 20% of farmers indicated that they used sexed semen, but more detailed data exploration revealed that only

Table 1: **Descriptive statistics of sample data**

Variable	Description	Mean	Std. dev.	Min	Max
Herd size	Number of cows	133.44	93.65	5	740
Farm size	Area farmed in hectares	80.47	53.05	3.24	453.23
Stocking rate	Dairy cows / hectare	1.72	0.56	0.22	4.12
Milk yield	Milk produced per cow (in litres)	5,475	1,245	417	12,200
Breed	% of herd that are Jersey Frisian cross	15.58	27.76	0	100
Sexed semen	= 1 if the farmer used sexed semen	0.18	0.39	0	1
SVO	Social value orientation	34.21	12.73	-16.43	88.83
Observations	403				

39% of those farmers used sexed semen on all heifers, while the remaining farmers used sexed semen on selected animals only. Hence, while 20% of farmers used sexed semen in 2019, our data does not suggest that sexed semen is used on 20% of dairy cows.

6.2 Contingent Valuation

Overall, 68% of farmers answered 'yes' to the first vote and 53% said 'yes' to the second vote. When breaking this down into second votes that were presented with a higher value (i.e. initial yes votes), 65% of farmers answered 'yes' to the higher amount, while the group of farmers that answered 'no' to the initial vote, only 27% answered 'yes' to the second vote. The distribution of 'yes, and 'no' votes for the first and second votes is shown in Table 2. As can be seen, the proportion of 'no-no' votes increases with increasing prices, while the proportion of 'yes-yes' votes does not steadily decline with increasing prices. In relation to 'yes-no' votes, some declining pattern is evident (except the first and third bid value), while the 'no-yes' votes do not seem to follow a specific pattern. However, this may be explained by the low number of observations in this category.

We explore response patterns in more detail, and find that participants are responsive to price in the first vote in the sense that 'yes' votes decrease with higher prices. This is generally seen as an indicator of validity (Kling, Phaneuf, and Zhao, 2012). However, when considering price responsiveness in more detail for the second vote, it appears that

Table 2: **Overview of bid levels**

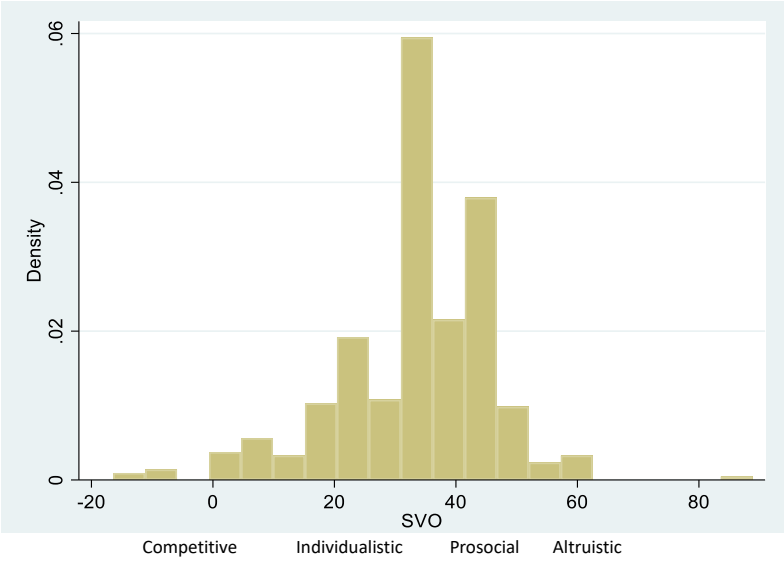
Price of first vote (in €)	**no-no** (%)	**no-yes** (%)	**yes-no** (%)	**yes-yes** (%)	**n**
1	11.70	19.44	23.96	24.86	85
3	13.83	27.78	30.21	19.21	86
5	20.21	22.22	14.58	22.60	81
7	27.66	13.89	18.75	14.12	74
9	26.60	16.67	12.50	19.21	77
Observations (n)	94	36	96	177	403

responsiveness to price is only evident for initial 'no' votes while this is not the case for initial 'yes' votes, i.e. increases in price. One explanation for this pattern is that strategic responses of farmers who voted 'yes' to the initial question are more likely. These farmers may have a stronger interest that the sexed semen lab will be developed compared to farmers who voted 'no' to the initial question. Hence, the latter group is less likely to show strategic behaviour. Please see appendix A for more details. As our data suggests strategic behaviour of participants, we consider this in our empirical approach.

6.3 Social Value Orientation

In relation to altruistic preferences of our sample farmers, the average SVO is 34.11, ranging from -16.43 to 88.83. An overview of the SVO data is provided in figure 5. In line with expectations (Murphy, Ackermann, and Handgraaf, 2011), prosocial is the clear majority type.

Figure 5: **Distribution of SVO**



We divided farmers in three groups based on their SVO scores, as follows: the top 25% of sample farmers were classified as altruists, the middle 50% as prosocials, while the bottom 25% were classified as individualists[8]. Characteristics of the three groups are shown in table 3. Altruists have the largest farms with a herd size of 147 dairy cows and an average farm size of 87 hectares. Their herd consists of 17% Jersey Frisian cross breeds (breed). Only 13% of individualists use sexed semen, while this figure is 21% among prosocials.

7 Methodology

Our contingent valuation question was based on a double-bounded referendum question where farmers voted 'yes' or 'no' on the implementation of a sexed semen lab that was associated with a specific price per cow. Double-bounded models provide more information about the participant's WTP as they provide an additional data point. Specifically, if the

[8]Following Murphy, Ackermann, and Handgraaf (2011) altruists have an SVO score greater than 57.15; prosocials have values between 22.45 and 57.15, individualists are between -12.04 and 22.45, while competitive people have scores smaller than -12.04. When dividing our sample following this classification, we find that the vast majority of farmers fall into the prosocial scale (82%), while the proportions of altruists and competitive people in our sample are very small. Therefore, following the categorisation by Murphy, Ackermann, and Handgraaf (2011) did not provide sufficient observations in each group. Hence, we decided to create groups based on sample size.

Table 3: Descriptive statistics by SVO group

Variable	**Altruists**	**Prosocials**	**Individualists**
Herd size	147.47 (95.35)	128.57 (93.48)	128.75 (91.66)
Farm size	87.18 (51.19)	80.17 (57.44)	74.02 (44.48)
Stocking rate	1.74 (0.57)	1.68 (0.53)	1.79 (0.61)
Milk yield	5,569.14 (1,095.20)	5,483.62 (1,303.46)	5,359.27 (1,273.64)
Breed	17.39 (31.34)	15.05 (25.80)	14.57 (27.64)
Sexed semen	17.48 (38.16)	21.18 (40.96)	13.26 (34.09)
SVO	47.42 (6.15)	36.05 (3.45)	16.53 (9.93)
Observations	103	202	98

Table 4: WTP

Scenario	**WTP**
'yes' - 'yes'	$(P_{j1} + a) \leq WTP$
'yes' - 'no'	$P_{j1} \leq WTP < (P_{j1} + a)$
'no' - 'yes'	$(P_{j1} - a) \leq WTP < P_{j1}$
'no' - 'no'	$WTP < (P_{j1} - a)$

participant answers 'yes' to the initial question with price P_{j1}, the participant receives a follow up question with price $P_{j1} + a$ with a being the change in price for j randomly assigned prices. If the participant answers 'no' to the first question with P_{j1}, the participant receives a follow up question with a lower price $P_{j1} - a$. This leads to the four scenarios shown in table 4.

Initially, Hanemann, Loomis, and Kanninen (1991) suggested a double-bounded (interval data) model to analyse such data. But, double-bounded models have been found to provide biased results, as they rely on the assumption that the participant's answers to both votes is based on the same WTP value (Alberini, Kanninen, and Carson, 1997), i.e. $WTP_1 = WTP_2$. Cameron and Quiggin (1994) suggest a bivariate probit model to analyse double-bounded questions. This model accounts for the fact that the second offered price is not independent of the participant's first vote. A general problem with double-bounded approaches is that participants have strategic reasons to misreport their true value in the second vote, leading to incentive incompatibility (Phaneuf and Requate, 2016). Our previous discussion of the

data indicates that this may be the case with our data.

Therefore, following Whitehead (2002), we test for incentive incompatibility by using a random-effects probit models to estimate WTP. Specifically, we estimate a series of models, where the 'yes-no' response to the referendum question depends on whether the WTP is greater than the respective price given to the respondent:

$$Y_{it} = \begin{cases} 1 & \text{if } WTP_{it} > P_{jt} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

We begin to model the probability of a 'yes' response by farmer i over both votes t with a random-effects probit model (Whitehead, 2002),

$$Pr(Y_{it} = 1) = Pr(\beta X_i + e_{it} \geq P_{jt}) = Pr\left(\frac{\beta X_i - P_{jt}}{\sigma_v} \geq -\frac{e_{it}}{\sigma_v}\right) = \Phi\left(\frac{\beta X_i - P_{jt}}{\sigma_v}\right) \tag{3}$$

where $e_{it} = \alpha_i + v_{it}$. α_i is an individual-specific random effect, while v_{it} is the random error term, assumed to be distributed $N(0, \sigma_v^2)$. The correlation coefficient ρ between both votes of farmer i is measured as $\rho = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_v^2}$. In the random-effects probit model from equation 3, the WTP amount used by each participant is subject to a random error, but is based on the same WTP amount (Alberini, Kanninen, and Carson, 1997).

Specifically, we estimate the following equation

$$Pr(Y_{it} = 1) = \Phi\left(\frac{\beta_0 - \beta_1 P_{it} + \beta_2 SVO_i + \beta' X_i + \alpha_i + v_{it}}{\sigma_v}\right) \tag{4}$$

where β are coefficients to be estimated, SVO is our measure of altruistic preferences, X_i is a vector of covariates, P_{jt} is the price respondents voted on (included as log values). The vector of covariates X_i consists of farm characteristics expected to be related to the decision of whether or not to contribute to the establishment of the sexed semen lab. Specifically, we include herd size, stocking rate and milk yield, which control for farm size and intensity and

also serve as a proxy for farm income[9]. We also control for whether the farmer used sexed semen, and the percentage of the herd that are Jersey Frisian cross breeds[10].

Given the reasons outlined above, assuming that both votes of the participant are based on the same WTP amount may not be realistic. Hence, we test for incentive incompatibility by including a dummy variable S that equals 0 if $t = 1$ and 1 if $t = 2$, leading to the following model:

$$Pr(Y_{it} = 1) = \Phi\left(\frac{\beta_0 - \beta_1 P_{it} + \delta S + \beta_2 SVO_i + \beta' X_i + \alpha_i + v_{it}}{\sigma_v}\right) \tag{5}$$

The coefficient δ will be negative and statistically significant if the follow up question is incentive incompatible (Whitehead, 2002).

For comparison purposes, we also estimate a bivariate probit model and a probit model with only the first vote, with both models including the same covariates (except the shift effect).

We estimate median WTP for the overall sample as follows:

$$E(WTP) = exp(\beta_0 + \beta \bar{X}) \tag{6}$$

where $\bar{X}$ are the mean values of the covariates for the full sample and standard errors are obtained by the delta method.

When $S = 1$ median WTP is calculated as,

$$E(WTP) = exp(\beta_0 + \beta \bar{X} + \delta). \tag{7}$$

We then calculate WTP for the three altruistic groups separately by replacing the sample mean values with mean values from each respective group.

[9]Due to the difficulty of eliciting farm income in a survey, we asked for milk price instead and calculated revenue by multiplying milk output with price. This control variable (on a per cow basis) was not significantly associated with WTP. Therefore, due to the associated uncertainty of the accuracy of this income variable, we decided to proceed with farm characteristics as control variables instead.

[10]In general, Jersey breeds have poor beef characteristics and surplus calves have a lower value.

8 Results and Discussion

8.1 Estimation Results

We begin our results by presenting a number of different probit specifications that are used to calculate WTP, see table 5. Model 1 is a random effects probit model that constrains WTP of the first and second vote to be equal. Model 2 is random effects probit models that test for incentive incompatibility by including a shift effect, following the method outlined in Whitehead (2002). The shift effect, which is negative and statistically significant, suggests incentive incompatibility. This means that WTP values from the first and second vote differ significantly. This is not surprising given the initial inspection of our data. Model 3 is a probit model that only includes the first stage votes, i.e. it serves as a robustness test given that our data show incentive incompatibility on the second vote; while model 4 is a bivariate probit model that is frequently used for double-bounded CV approaches (Cameron and Quiggin, 1994).[11]

All models reported in table 5 indicate that survey participants responded rationally to increases in the contribution they were asked to pay as the coefficient of the logged price is negative and statistically significant in all models. In relation to control variables, we find that higher stocking rate is positively associated with the probability to vote 'yes'. This suggests that farm intensity plays an important role in initiatives to improve animal welfare. However, the proportion of Jersey Frisian cross breeds in the herd (breed) and whether or not the farmer used sexed semen are not statistically significantly related to a 'yes' or 'no' vote[12].

Our main control variable of interest is the farmer's SVO score, which is statistically significant in all models. The positive coefficient indicates that with increasing altruistic

[11] We also estimated the same models with certainty adjustment, i.e. we recoded all 'very uncertain' values. Results are reported in table A4 in appendix C.

[12] We tested whether the survey was conducted on a mobile phone or computer, and whether it was completed through a link from an advisor or an online farming media is significantly related to the 'yes' or 'no' vote. Neither of the variables were statistically significant and a LR test revealed that the inclusion of these variables did not improve the models.

tendency the propensity to vote 'yes' increases. This is in line with findings in the animal welfare literature that altruism plays an important role in animal welfare provision (Cowen, 2006), but it also coincides with the wider literature on WTP that finds that feelings of 'warm glow' can motivate increased WTP amounts (Kahneman and Knetsch, 1992; Nunes and Schokkaert, 2003).

8.2 WTP

Median WTP is reported at the bottom of table 5 for all models. Models 2 to 4 result in very similar WTP estimates of around €2.3 per cow, while Model 1 results in a higher WTP of €2.78. However, as previously outlined, this estimate is likely biased upwards. A likelihood ratio test confirms that model 2 is improvement over model 1. Therefore, we proceed with model 2 for our WTP estimates by altruistic groups[13], see table 6.

As previously outlined, we are interested how WTP differs depending on SVO. To this end, we calculate median WTP for the full sample, and for three altruism groups.

The results in table 6 indicate that altruists have the highest WTP estimate with €2.9 per cow, equating to €429 per annum based on the group's average herd size of 147 dairy cows. In contrast, farmers that fall into the prosocial category have an estimated WTP of €2.36 per cow, which is €303 per farm (average herd size 128), while farmers that fall into the individualist category have the lowest estimated WTP with €1.72 resulting in a farm WTP of €220 based on their average herd size of 127 dairy cows.

8.3 Motivation for WTP

In line with our conceptual framework, we explore farmers' motivations to support the new policy scheme to improve calf welfare. Recall that once the profit maximizing level of animal welfare is reached, we expect the support of a policy to improve animal welfare is motivated by the aim to improve animal welfare on the own farm or to help reduce bad practices on

[13]Model 3 and 4 produce similar results.

Table 5: **Estimation results**

	Model 1 RE probit	Model 2 RE probit Shift	Model 3 Probit vote 1	Model 4 Bivariate probit vote 1	Model 4 Bivariate probit vote 2
$\ln P_t$	-0.440***	-0.468***	-0.269***	-0.288***	-0.252**
	(0.147)	(0.168)	(0.088)	(0.091)	(0.103)
Herd	-0.001	-0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Stocking rate	0.383**	0.414**	0.253*	0.237*	0.249**
	(0.165)	(0.180)	(0.129)	(0.142)	(0.116)
Yield	-0.000*	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Breed	0.003	0.004	0.003	0.004	0.001
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Sexed semen	0.291	0.318	0.083	0.094	0.261
	(0.223)	(0.245)	(0.174)	(0.172)	(0.162)
SVO	0.017**	0.018**	0.012**	0.011**	0.010**
	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)
Shift effect		-0.603***			
		(0.124)			
σ_u^2	0.405	0.639*			
	(0.320)	(0.328)			
ρ					0.770***
					(0.141)
Constant	0.478	0.826	0.497	0.522	0.084
	(0.536)	(0.601)	(0.414)	(0.417)	(0.409)
Median WTP	2.84	2.30	2.32	2.37	
Std. err.	1.37	1.23	0.78	0.78	
Observations	806	806	403	806	806
Number of ID	403	403			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

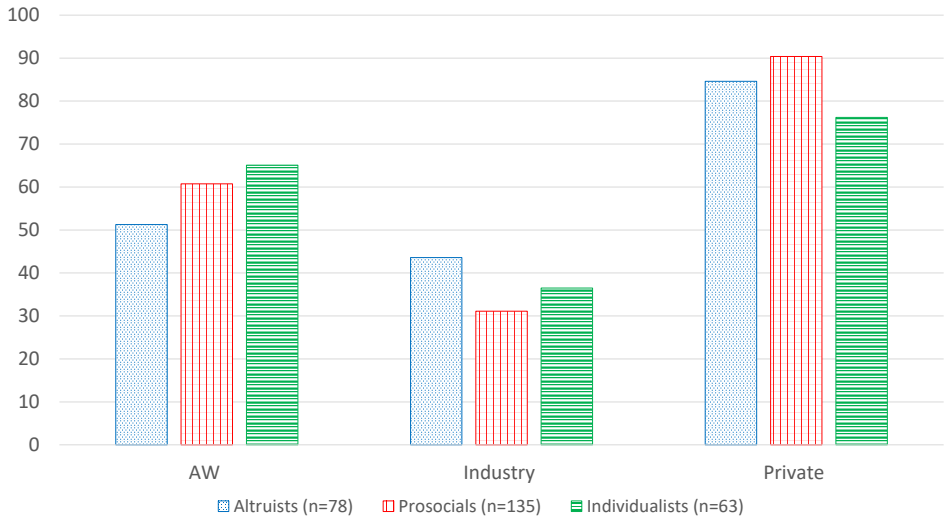
Table 6: **WTP for altruism groups**

	Median WTP	Std. err.
Full sample	2.304	1.234
Altruists	2.909	1.683
Prosocials	2.361	1.269
Individualists	1.722	0.915

other farms. We see altruism as a main motivator to provide a public good, but recognise that long run profit consideration may also play a role, especially when industry reputation is of concern.

We presented farmers with six reasons: two reasons related to animal welfare (i.e. help to reduce the number of dairy calves that are killed early and reduce live exports of unweaned calves), two reasons related to the dairy industry (i.e. improve dairy beef system integration and help the Irish dairy industry reputation) and two private reasons (i.e. availability of sexed semen from top dairy bulls and lower prices for sexed semen). Each farmer could select up to three reasons. The proportion of how often each reason was selected separated by altruism group is shown in figure 6.

Figure 6: **Reasons to support a sexed semen lab by SVO group**



The first observation is that private reasons are the most frequently mentioned reason to

support the establishment of a sexed semen lab by all groups. A Kruskal Wallis test confirms that there is a significant difference between the three groups. A direct group comparison based on a chi^2 test reveals that the answers from individualists differ significantly from the prosocial group. Initially, it appears counterintuitive that a lower proportion of individualists selected private reasons when compared to prosocials. However, the fact that only 11% of individualists (who voted 'yes') use sexed semen (when compared to 20% use of sexed semen in the other groups) may explain this finding.

In relation to industry related reasons, it appears that altruists were more likely to be motivated by industry concerns than prosocials, while there is no significant difference between altruists and individualists. This may suggest that altruists are motivated by negative externalities created by others, as suggested by our conceptual framework.

Finally, in relation to animal welfare reasons, we do not find significant differences between the three groups. However, it is important to remember that these are the reasons of farmers who are willing to pay for the sexed semen lab, hence there is a bias towards those who do care for their animals and, in general, altruists are more likely to vote 'yes' than the remaining two groups. Overall, it appears that there are no distinct differences between the three groups to support an animal welfare policy, and a combination of different reasons facilitates support for animal welfare.

9 Conclusion

Animal welfare has attracted increasing attention over the last number of years, and the fact that an overwhelming majority of Europeans feel it is important to protect the welfare of farmed animals (Eurobarometer, 2016), shows that this topic is of general interest. While the majority of economic studies on animal welfare focus on consumer views, in this paper we explore dairy farmers' willingness to pay (WTP) for a new policy scheme to improve animal welfare. We focus on the establishment of a sexed semen lab in Ireland that has

the potential to improve dairy calf markets, which have become under pressure due to a major expansion of Ireland's dairy industry. Specifically, live exports of unweaned calves and premature culling have attracted consumer disapproval. This caused reputation damage to the industry fuelled by animal welfare concerns in relation to the treatment of those calves.

We developed a conceptual framework that divides the provision of animal welfare into private benefits and public good motivations. Public good motivations can be targeted at the provision of better animal welfare on the own farm or the aim to reduce bad practices on other farms. These can be driven by genuine concern about animal welfare, or concerns about industry reputation, which are both connected to altruism. Empirically, we link farmers' WTP to their altruistic preferences and find that more altruistically minded farmers are willing to contribute more to support a policy to improve animal welfare. In line with our conceptual framework, we find that farmers are motivated by private reasons, industry and animal welfare concerns, with no clear differences depending on altruistic preferences.

Our findings have important policy implications. First, our results show that the majority of farmers are willing to financially support the implementation of a new policy to improve farming practices. While we focused on animal welfare, it is likely that these findings also hold for other policies aimed at the prevention of public bads that have the potential to cause harm to the reputation of the entire industry. One obvious example are policies to reduce GHG emissions from dairy farming, as similar to animal welfare, negative actions by individual farmers (or ignorance of the problem in this case) cause significant harm to the entire industry. Importantly, the use of sexed semen is also an important GHG mitigation measure. Thus, supporting the uptake of sexed semen will likely bring considerable public good benefits.

Second, we find that altruistically minded farmers have a higher WTP for the animal welfare friendly policy. However, in contrast to previous literature on animal welfare that suggest altruism is important in its provision (Bennett and Blaney, 2003), we do not find that altruists are more motivated by animal welfare considerations when compared to less

altruistically minded farmers. If anything, it appears that reducing negative actions of others are of higher importance to altruists.

Finally, we make an important contribution to the animal welfare literature in economics as we show that farmers are motivated by a number of reasons including private benefits, public good and bads. Importantly, we find that private reasons are the main motivating factor to support a public policy aimed at improving animal welfare. This may suggest that there is still room to simultaneously improve animal welfare and increase farm profit. While this suggests further improvements in animal welfare will provide economic gains to farmers, it also raises cause for concern about the general industry level of animal welfare. Considering that Norwood and Lusk (2011) show that maximizing animal welfare is not equivalent to maximizing profit, indicates that further animal welfare improvements are required. An increased focus on farmers' animal welfare decisions will be important to help achieve this target.

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Appendix

Appendix A: Overview of responses to votes

Table A1: Responses to first vote

Price €	1	3	5	7	9	All
yes (%)	78.82	73.26	66.67	58.11	59.74	67.74
Frequency (yes)	67	63	54	43	49	276
Frequency (all)	85	86	81	74	80	406

Table A2: Responses to second vote - initial 'yes'

Price €	3	5	7	9	11	All
yes (%)	65.67	53.97	74.07	58.14	73.91	64.84
Frequency (yes)	44	34	40	25	34	177
Frequency (all)	67	63	54	43	46	273

Table A3: Responses to second vote - initial 'no'

Price €	0.5	1	3	5	7	All
yes (%)	38.89	43.48	29.63	16.13	19.35	27.69
Frequency (yes)	7	10	8	5	6	36
Frequency (all)	18	23	27	31	31	130

Appendix B: Social Value Orientation Measurement (SVO)

The following are screen shots of the SVO measurement. The SVO measurement began with a general introduction and motivation to complete this section.

In this task, we would like to find out more about your attitudes and business behaviour.

For this, you will be randomly paired with another survey participant. We will refer to this person as the other person. This other person is someone you don't know. You and the other person will **remain mutually anonymous and your choices are completely confidential**.

However, your **decisions directly affect your own AND another person's payment.** You will be compensated in the form of an One4All voucher. You can expect an average payment of €25, but the **exact amount depends** on the choices you and the other person make.

Remember:

- Your choices affect your own AND another survey participant's payment

You will be making several decisions about allocating money between yourself and the other person. For each of the following questions, please indicate the outcome you prefer most by selecting **ONE of the FOUR** choices. Your decisions will yield money for both yourself and the other person.

There are no right or wrong answers, this is all about personal preferences.

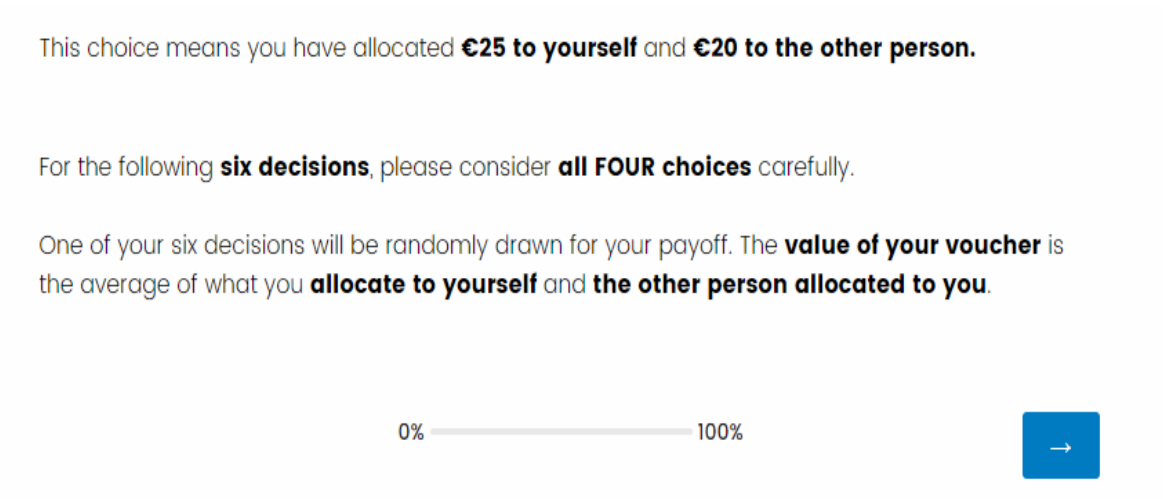
To show you how this works, please choose one of the four options from the example question below. You will then be presented with the outcome for you and the other person.

Example question: Please consider all four choices, and select your preferred outcome.

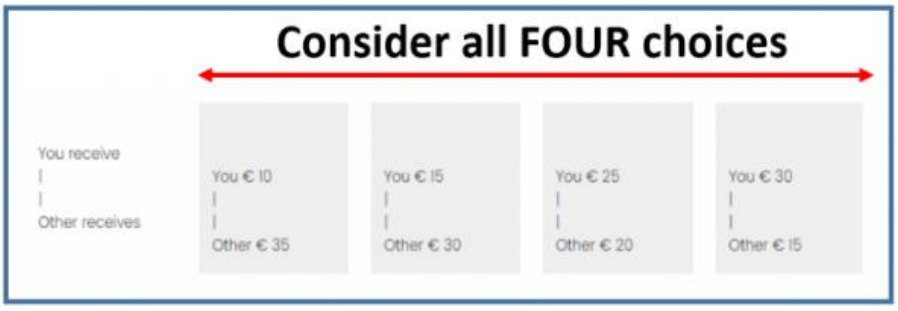
You receive | | Other receives	You € 10 | | Other € 35	You € 15 | | Other € 30	You € 25 | | Other € 20	You € 30 | | Other € 15

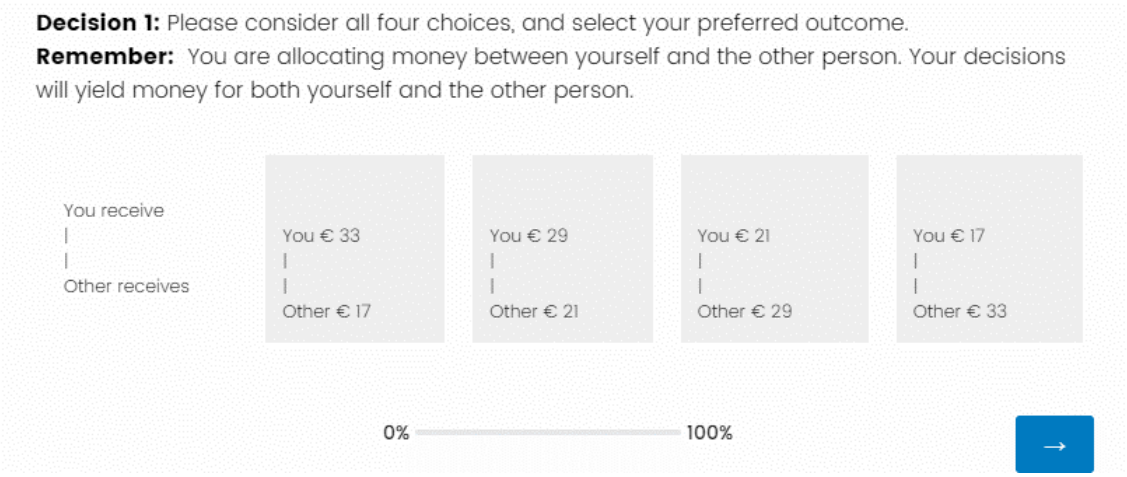
0% 100%

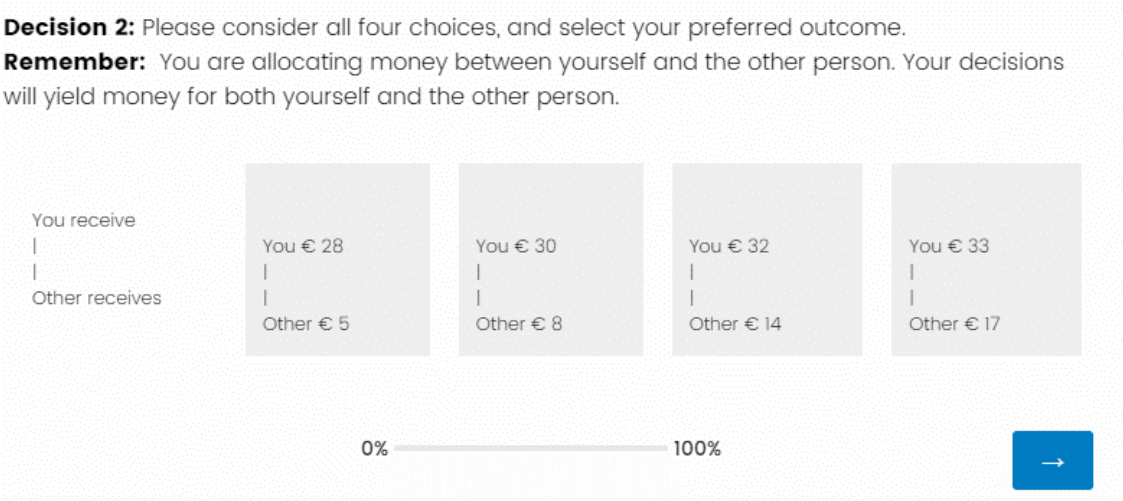
→

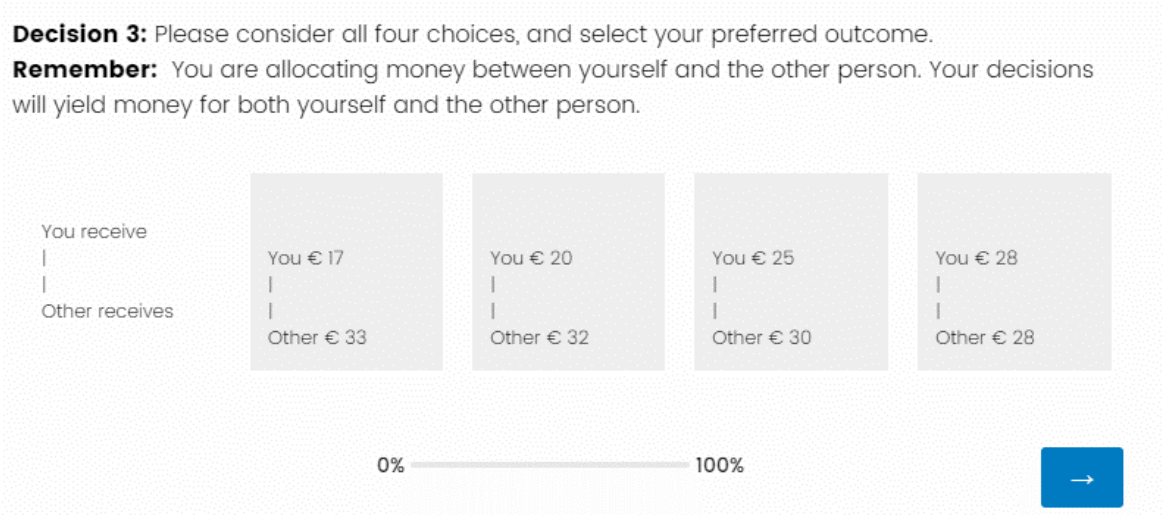


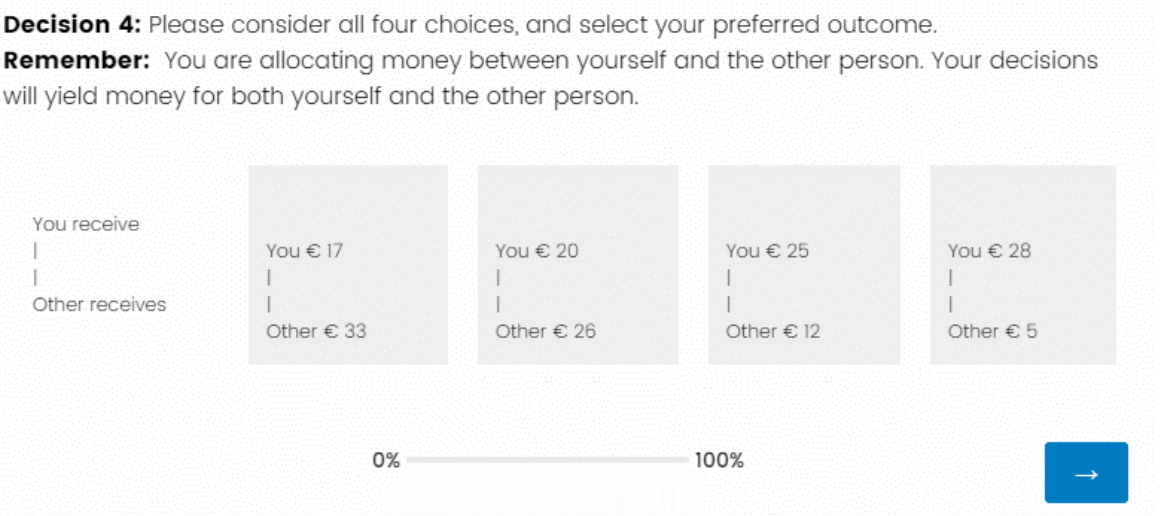
We specifically included a picture to remind participants to consider all choices. This figure was vertical if the survey was answered on a mobile phone.



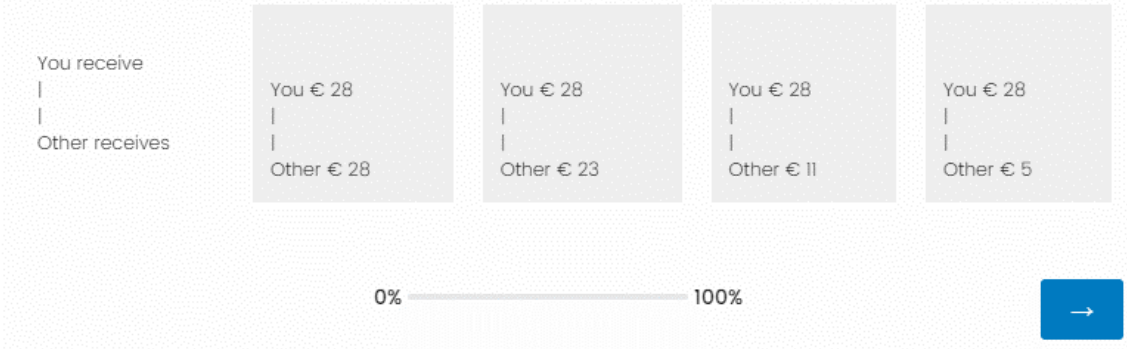

Decision 1: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.
You receive
|
|
Other receives
You € 33
|
|
Other € 17
You € 29
|
|
Other € 21
You € 21
|
|
Other € 29
You € 17
|
|
Other € 33
0%
100%
→


Decision 2: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.
You receive
|
|
Other receives
You € 28
|
|
Other € 5
You € 30
|
|
Other € 8
You € 32
|
|
Other € 14
You € 33
|
|
Other € 17
0%
100%
→

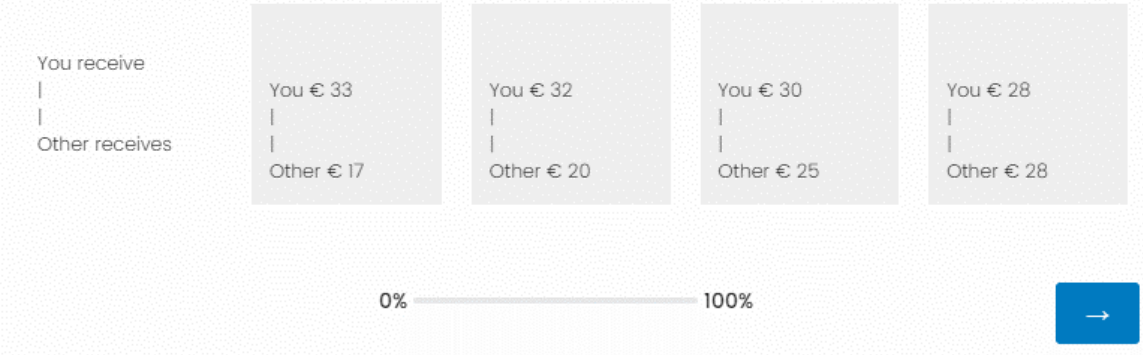

Decision 3: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.
You receive
|
|
Other receives
You € 17
|
|
Other € 33
You € 20
|
|
Other € 32
You € 25
|
|
Other € 30
You € 28
|
|
Other € 28
0%
100%
→


Decision 4: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.
You receive
|
|
Other receives
You € 17
|
|
Other € 33
You € 20
|
|
Other € 26
You € 25
|
|
Other € 12
You € 28
|
|
Other € 5
0%
100%
→

Nearly there!
Decision 5: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.



Last one!
Decision 6: Please consider all four choices, and select your preferred outcome.
Remember: You are allocating money between yourself and the other person. Your decisions will yield money for both yourself and the other person.



Appendix C: Estimation Results with Certainty Adjustments

Table A4: **Estimation results with certainty adjustments**

	Model 1 RE probit	Model 2 RE probit Shift	Model 3 Probit Vote 1	Model 4 Bivariate probit Vote 1	Model 4 Bivariate probit Vote 2
$\ln P_t$	-0.490***	-0.519***	-0.270***	-0.299***	-0.279***
	(0.156)	(0.179)	(0.087)	(0.091)	(0.100)
Herd	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SR	0.421**	0.460**	0.286**	0.266*	0.247**
	(0.175)	(0.193)	(0.129)	(0.141)	(0.114)
Yield	-0.000*	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Breed	0.004	0.004	0.003	0.003	0.001
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Sexed semen	0.183	0.204	0.015	0.014	0.175
	(0.233)	(0.257)	(0.173)	(0.168)	(0.160)
SVO	0.016**	0.018**	0.012**	0.011*	0.009*
	(0.007)	(0.008)	(0.005)	(0.006)	(0.005)
Shift		-0.653***			
		(0.129)			
σ_v	0.568*	0.815**			
	(0.314)	(0.324)			
ρ					0.856***
					(0.144)
Constant	0.396	0.771	0.391	0.432	0.004
	(0.565)	(0.638)	(0.415)	(0.412)	(0.405)
Median WTP	2.77	2.20	2.19	2.26	
Std. err.	1.42	1.26	0.74	0.74	
Observations	801	801	398	398	398
Number of ID	403	403			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1