A FIELD EXPERIMENT ON CONSUMER WILLINGNESS TO ACCEPT MILK FROM CLONED COWS

by

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ABSTRACT

With continuous advances in biotechnology, the likelihood of animal cloning being used as a livestock breeding technique has existed. This gained momentum when the sheep, Dolly, was successfully cloned in Scotland in 1996. The possibility for milk and meat from cloned animals entering the food supply has gotten even closer when after a long period of consideration, the Food and Drug Administration (FDA) in 2008 concluded that meat and milk from cloned animals is as safe to eat as food from conventionally bred animals. The FDA does not require mandatory labeling for foods from cloned animals. Even though milk and meat from cloned cows are not yet on the market, if or when they eventually do, there will be some ramifications depending on consumer reaction.

The purpose of the research was thus to investigate consumers' responses and attitudes towards the introduction of an unlabeled food product from cloned animals, in this instance milk from cloned cows. The primary goal was to determine how much compensation consumers would need to be paid to exchange a cup of conventional milk with milk that may or may not have come from cloned cows. Secondary goals included examining consumers' opinions and knowledge of animal cloning, their views on labeling and whether they believe the technology should be used. Also considered were the potential consumer welfare impacts of a future introduction of milk from cloned cows.

The research was accomplished through the use of field experiments in October 2012 with a total of 148 subjects. Subjects were members of the general population and milk consumers approached to participate in a milk survey from four different locations in Delaware.

The experiment began with interested participants been told about the FDA's conclusion of safety regarding food products from cloned animals. Then the Becker-de-Groot Marschak (BDM) mechanism was used to elicit subjects' willingness to accept (WTA) milk that may or may not have come from cloned cows.

The mean WTA was $2.65, which according to the signed rank test was significantly different from zero. Consumers may thus be willing to consume milk that may have come from cloned cows only if they are compensated or, more likely, a price discount is available. To analyze WTA further, a two-limit tobit model, checked for heteroscedasticity, was run using the other collected survey variables. Results from the Tobit model showed that subjects who are likely to accept milk from cloned cows are those who do not consume conventional milk often and who do not have a negative opinion of animal cloning. Other attributes found among consumers who are more accepting of milk from cloned cows included the characteristic of not reading food labels very often, being a principal grocery shopper and not being very considerate of environmental factors when making food choices. On the demographic front, persons more accepting of milk from cloned cows were likely to be males, college graduates, high income earners and persons who did not live with children less than 18 years. The study found that subjects would register a consistent reduction in

their welfare with successively increasing probabilities that the milk that may or may not have come from a cloned cow was actually from a cloned cow. Over 80% of subjects wanted milk from cloned cows labeled and about 65% wanted the product allowed.

Combining these findings suggest that consumers are not necessarily opposed to foods from cloned animals in the marketplace but rather simply want them to be an option that they can identify and then choose whether to consume that version or the conventional one.

Chapter 1

INTRODUCTION

1.1 Background and Motivation

Almost invariably, the introduction of food products from new techniques in agricultural biotechnology is preceded by some degree of consumer apprehension. The introduction of genetically modified (GM) foods is a case in point and this was fraught with debate and different adoption rates among countries. Another landmark achievement in biology and biotechnology is animal cloning.

Cloning is the creation of an organism that is an exact genetic copy of another. This contrasts with genetic engineering which is a laboratory procedure in which scientists alter the genetic material of living organisms in order to produce desired characteristics. Plausible reasons have been proffered in support and against the use of animal cloning technology. Proponents contend that this technology is beneficial to the livelihoods of farmers and consumers alike. Farmers can achieve greater productivity selling high quality milk and meat as they concentrate on replicating superior traits of animals in cloned versions. Consumers also have the benefit of nutritious and wholesome animal products. As expected, there have been anxieties with animal cloning - opponents have cast doubts about the safety of cloned animal products and have also argued on ethical and religious grounds.

Similar to the introduction of GM foods, tolerance for animal cloning technology varies across countries. Europeans for instance have been generally noted to be more sceptical about cloning and cloned animal products. According to the 2008 Flash Eurobarometer survey for example, European Union (EU) citizens were significantly less willing to accept animal cloning for food production purposes: a majority of consumers (58%) said that cloning should never be justified. On the flip side, a study by Sean Fox of Kansas State University indicates that Americans may be more accepting of cloned animal products than Europeans (Torline, 2011).

The possibility of milk or meat from cloned animals entering the food supply has existed since the successful cloning of the sheep, Dolly, in 1996. The potential took a step forward in 2008 when, after a long period of consideration, the Food and Drug Administration (FDA) concluded that meat and milk from clones of cattle, swine and goats and the offspring of clones from any species traditionally consumed as food are as safe to eat as food from conventionally bred animals (FDA 2008). The FDA further announced that there would be no mandatory labeling requirement for foods from cloned animals because they have not been found to be significantly different from that derived from conventionally bred animals. As of now, such products do not exist in the marketplace as companies with cloned animals continue to follow the voluntary moratorium suggested by the United States Department of Agriculture (USDA 2008).

If or when they do, however, the above FDA rulings mean that consumers will be unable to tell if the milk or meat they are purchasing was the product of a cloned animal or not. Consumer reaction to this situation might be varied. For example a Consumers'

Union national poll conducted in mid-2007 found that 89 percent of consumers wanted food from cloned animals labeled. The poll also found that 69 percent of respondents were concerned about eating milk or meat from cloned animals (Consumers' Union 2007).

Different consumer reactions could potentially render markets for these products inefficient and overall welfare could be reduced. The purpose of this research is thus to investigate consumers' responses and attitudes towards the introduction of an unlabeled food product from cloned animals, in this instance milk from cloned cows. The primary goal is to determine how much compensation consumers would need to be paid to exchange milk from conventional cows to milk that may or may not have come from cloned cows. Other goals include examining consumers' opinions and knowledge of animal cloning, their views on labeling and whether they believe the technology should be used. The research also considers the overall welfare impact of a future introduction of unlabeled milk from cloned cows. The study samples milk consumers in the state of Delaware. Their responses and overall research findings are expected to generally agree with the majority of milk consumers in the country.

1.2 Justification of Study

A number of previous studies have examined consumers' acceptance to food products from cloned animals. However, the uniqueness of this research lies in the novelty of its experimental design. This is the first known study requiring consumption of either a cup of conventional milk or milk that may potentially have originated from a

cloned cow to determine consumers' willingness to accept food products from cloned animals. It is thus a step beyond research designs that hypothetically ask consumers whether they are willing to accept food products from cloned animals.

Since cloned animal products are only being withheld from the market because of the USDA's voluntary moratorium to companies and farms that have cloned animals, this study examines consumers' readiness for a future introduction of these products on supermarket shelves and their responses towards this prospect. This is imperative for the reason that public acceptance of animal cloning technology will partly determine how successful cloned animal products fare when they are eventually introduced into the mainstream food supply.

1.3 Organization of Thesis

Subsequent to the introduction section is the review of relevant literature. This section initially focuses on consumer attitudes and responses to animal cloning which is discussed thoroughly. Other consumer related concerns reviewed include consumer welfare impacts of GM foods as well as consumer response to food labels. GM foods are thought to be a close proxy to milk from cloned cows, which is not on the market at present. Some engaging issues that have emerged within animal cloning are also looked at to offer a broad perspective on industry response before and after the FDA announced its rulings on cloned animal products. Ending this section is a discussion on consumers' confidence in food safety agencies, particularly the FDA.

Chapter three begins with an elaboration of the field experimental design. This includes some observations made from the different field locations where the experiments took place. Next is the sub-section that specifies the model, primarily the Tobit model, and this includes a listing of the variables used. The theoretical underpinnings for the consumer welfare and behavior part are also well spelt out and this ends the chapter.

Chapter four contains the entire descriptive information which spans respondents' WTA and their demographics. The descriptive information has graphical and tabular displays starting with respondents' demographic information and other attributes. The econometric specification of the model and the hypothesis underlying the expectation of each variable is examined.

The analysis for the thesis is covered in its entirety in chapter five. This covers the results from the Tobit model. Following the results is a discussion on variables that turned out statistically significant and those that did not. This is followed by a discussion on the variance portion of the model. The results from consumer welfare and behavior section are also deliberated.

The last section of the thesis considers the implications of the results, the conclusions and limitations of the study.

Chapter 2

LITERATURE REVIEW

This chapter reviews literature on a range of interests that centers on consumers and their behavior towards cloned animal products. It starts off with an exposition about consumer attitudes and their willingness to accept (WTA) products from cloned animals. Since cloned animal products are yet to enter the market, consumer welfare impacts from the introduction of genetically modified (GM) foods is considered with the expectation that welfare will be impacted similarly if products from cloned animals enter the market. The chapter concludes with the responses of consumers' to food labeling, some emerging issues in animal cloning and consumer confidence in institutions tasked with ensuring food safety.

2.1 Consumer Attitudes and Purchase Intentions for Cloned Animal Products

A number of studies have focused on consumer reaction to food products from cloned animals. Consistent with the introduction of new food products, consumers' reactions to foods from cloned animals are varied and there still persists an overwhelming skepticism by many.

Different studies and surveys conducted so far have achieved some consensus on the fact that a section of consumers oppose the idea of consuming products from cloned animals. However, the proportion of consumers averse to this concept has varied across

studies, perhaps depending on the type of consumers sampled. Sosin and Richards (2005) for instance reported from their survey that a third of consumers were willing to purchase meat and milk from the offspring of cloned animals, a third were willing to give it consideration if they had more information about it and a third were simply unwilling to buy it. They also found that consumers were more accepting of animal cloning if it improved animal health and led to an improvement in the nutrition of meat and milk.

Brooks and Lusk (2010) examined consumers' demand for milk from cloned cows versus non-cloned cows. They found that consumers showed some aversion to cloning with the willingness to pay (WTP) to avoid milk from cloned cows over three times that for organic and rBST-free milk.

Jones et al (2010) determined consumer willingness to pay for clone-free labels. Using randomly selected subjects from the Sunbelt Agricultural Exposition in 2009, the study employed the logit choice model in determining the relationship between consumer WTP for clone-free labels and their demographic characteristics. Survey results showed that 59.46% of respondents were willing to pay for clone-free label products. Demographic variables like gender and education influenced respondents' WTP for clone-free labels. Females were 22% more likely to pay for a label and respondents who were knowledgeable about cloning and who read labels were 2% less likely to pay for labels.

Brooks and Lusk (2011) used paired comparisons to determine consumers' awareness of and attitudes towards meat and milk from cloned cattle. Although findings showed that consumers were relatively more aware of animal cloning than other assisted

reproductive technologies, approximately 31% of consumers were willing to consume meat and milk products from cloned animals against an unwilling percentage of 43%. Also a little more than 40% of respondents indicated they would alter their consumption of animal products if they learned it came from a cloned animal.

A section of consumers have also been observed to express confidence in government agencies tasked with the responsibility of ensuring food safety such as the Food and Drug Administration (FDA). Such consumers are willing to consume products certified as safe by such agencies. Storey (2006) stated that when asked what they would do if food products regularly purchased included milk from cloned animals, more than 6 out of 10 Americans answered they would continue or at least consider continuing to buy meat and milk products from cloned animals if determined safe by the FDA.

In another survey, the International Food Information Council (IFIC 2007) indicated that 49% of consumers had a likelihood of purchasing foods from the offspring of cloned animals if determined safe by the FDA.

In many instances, education about a product has helped erase initial biases and misapprehensions. This has been suggested by studies that have recorded positive attitudinal changes after consumers received information about certain products they were initially apprehensive about. Using a survey, Butler, Wolf and Bandoni (2008) found that half of consumers who did not obtain initial information about cloning and biotechnology thought that cloning was a bad idea even if it led to cheaper milk products. In contrast, only a third of consumers who obtained initial information thought that cloning was a bad idea for the same benefit of lower milk prices. The conclusion was that

there was the likelihood of a backlash effect if the cloning procedure was adopted without educating consumers, even if it led to milk getting cheaper.

Nonis, Hudson and Hunt (2010) investigated the FDA's conclusion of safety of cloned animal products on purchase intentions at three different price levels. Using university students from the mid-South region in the US, participants were asked their likelihood of purchasing superior quality beef from a cloned offspring at 20% more, 10% more and same price as prime quality conventional beef. This question was asked a second time after participants had been shown a video clip that had an FDA official assert the safety of cloned animal food. Results from the study indicated that the likelihood of purchase was higher after participants watched the video even though the means were still between "probably would not buy" and "neutral".

Americans have been noted to be more open towards new food technologies compared to Europeans and citizens of more conservative countries. The conservatism of Japanese consumers towards animal cloning was suggested by Aizaki, Sawada and Sato (2011) who examined Japanese consumers' attitudes towards consumption of cloned beef. Participants in the study were asked before and after technological information on cloning was provided whether they were uncomfortable consuming beef originating from bovine embryo and somatic cell cloned cattle. The results of the study showed that even though respondents' attitudes toward the consumption of bovine embryo-cloned beef and somatic cell-cloned beef were significantly different after having been provided with cloning information, about 90% of all respondents were equally uncomfortable with the consumption of the two types of cloned beef. The provision of cloning information

generally did not influence respondents' attitudes toward the consumption of the two types of cloned beef.

2.2 Studies that used Willingness to Accept (WTA)

Willingness to pay (WTP) and willingness to accept (WTA) are both welfare measures employed variously in consumer economics to determine premiums or the degree of aversion consumers have towards specific products or attributes. This study and many others have used WTA as a measure of consumers' acceptance to products and attributes by determining the minimum amount of money they are willing to forgo to avoid it. This approach is thought to closely resemble market conditions where consumers make the choice to accept a particular type of food or product if compensated with lower prices (Lusk et al 2004).

The research by Moon, Balasubramanian and Rimal (2006) on WTP and WTA for UK consumers further lends credence to the assertion that WTA shares similarities with real market conditions. They related that whereas WTP a premium has been a proxy to measure consumer's demand for non-GM foods, this approach offered limited insight in giving a prediction for GM foods. From a forecasting perspective, they aver that the more appropriate question to ask is whether consumers are willing to accept GM foods at some or no discount relative to the price of non-GM foods. The WTA according to the study sheds light on both consumers' preference for GM foods and their perceptions regarding the substitutability between GM and non-GM food versions.

Other studies that have used the WTA approach include Kerley et al (2008) who examined the economic impacts of expiry dates on perishable goods by eliciting respondents' willingness to accept (WTA) milk of different ages. They found that compensation increased rapidly with increasing age of the milk and such compensation could imply a negative price for the product to be acceptable.

WTA has also been useful in measuring stigma associated with certain products by determining how much monetary compensation people are willing to forgo to use or consume these products. Hoffman, Messer and Fooks (2012) used WTA to measure stigma attached to products handled by HIV positive persons in a rural community in Kenya by determining the compensation respondents were willing to forfeit in consuming or using the said products or carry out specific tasks using them. The study measured the intensity of stigma as the difference between compensation demanded by participants to perform tasks using goods produced by HIV negative persons and that produced by persons tested positive for HIV.

2.3 Consumer Welfare Impacts of GM Foods

Introduction of food products that have the tendency of stirring public controversy have varied and far reaching consumer welfare implications depending on consumers' perception and response to such products. Some researchers have studied particularly the welfare effects of introducing GM foods in the market without labelling. Although studies on welfare effects of a potential introduction of cloned animal products are scant, primarily because cloned animal food products have not been introduced into the market

yet, studies on the welfare effects of GM foods might provide valuable insights. Conclusions from some of these studies indicate that welfare impacts of such biotechnology products might be country or culture-specific.

Lusk et al (2005) examined consumer welfare effects of introducing and labelling GM food using experimental auction data. Their research findings show that on the average, US consumers have benefited from the introduction of GM foods even without a label whereas conversely, European consumers were generally seen to have on average suffered welfare losses due to the introduction of GM foods. Interestingly, results suggested that a labeling policy in the US would be welfare reducing.

Somewhat similar observations were made by Giannakas and Fulton (2002) in their study that found consumers register welfare losses if imperfections in the market precluded making savings on products from GM technology. Consequently, calls for the ban and label of GM foods are rational if consumers perceive them to be different from conventional products. Plastina and Giannakas (2007) also concluded that for small open economies which export conventional products, the introduction of GM products could be welfare reducing for consumers due to the likelihood of unlabeled products being genetically modified.

2.4 Consumers' Response to Food Labels

Labels on food products provide very useful cues to consumers and inform their choice of food purchase based on nutrition, traceability, country of origin and a host of others factors. Different consumer cohorts have varied attitudes toward food labels as a

result of individual and behavioral idiosyncrasies. This was captured in a study conducted by Nayga (1999) who found that race, gender and income were some factors that shaped consumers' beliefs and perceptions about food label use. Labeling has been a widely contested issue across countries in the wake of the introduction of novel foods from biotechnology, especially GM foods. Whereas the United States' FDA is not mandating the labeling of biotech foods particularly where they have not been proven to be significantly different from their conventional counterparts, Europe has had stricter labeling laws and these scenarios impact consumers in different ways. Many studies have considered the influence of food labeling on consumers.

As regards labeling food products from biotechnology, there seems to be an across the board agreement among a large percentage of consumers worldwide for labels on such products albeit some schools of thought argue that the labels would only serve to reinforce product segregation and consumer avoidance in some cases. Huffman et al (2003) conducted a study to espouse the effects of labeling GM foods on consumers' WTP for them. Sampling adults from two large metropolitan areas in Iowa and Minnesota, the findings showed that the average consumer discounted foods labeled genetically modified by about 14%. The findings also showed that as many as 60% of participants were averse to foods labeled genetically modified as was revealed by their lower bids compared to other foods with standard labels.

Consumer response to GM foods and their labels can also be tied to their countries and cultures as discussed by McCluskey and Loureiro (2003) in their review of empirical research on consumer preferences. McCluskey and Loureiro stated that

relatively conservative and traditional societies like Japan and Norway greatly discounted food products that have been genetically modified. This was not been seen to be the case with China as Chinese consumers have a more positive attitude towards biotechnology in agriculture.

In a related vein, Roosen, Lusk and Fox (2003) used data from mail surveys to analyse the preferences of French, UK and German consumers to beef labels based on brands, origin and mandatory labeling of beef from cattle fed GM feed. The study found that consumers placed greater importance on information about the origin of a product than on private brands. As expected, the findings also revealed that a large section of consumers preferred mandatory labeling for beef from cattle fed GM feed. This has been construed as an indication that European consumers are equally concerned about directly consuming GM foods as they are about indirect consumption.

Another interesting twist to food labeling has been consumer reaction to labels that tout the absence of ingredients or processes perceived contentious in the public eye and how these products so labeled deepen market segmentation. Such was the study conducted by Roe and Teisl (2007) that elicited consumer reaction to different ways of labeling GM foods. Consumers were shown labels that had different information about the presence and potential impact of genetic modification and agencies that certified that information. Participants rated the labels based on a number of indicators such as the credibility of information and health impacts. The study findings showed that GM labels were generally perceived to be more credible than 'No GM' labels. The findings also suggested that respondents found GM labels that explained the use of genetic

modification techniques more adequate, even though too much information also tended to erode the label's credibility ratings. A similar conclusion drawn by Teisl et al (2003) strongly suggests that simply indicating that a product is GM might turn away sections of consumers who are willing to consume GM products if they are apprised of its benefits.

Similarly, Dhar and Foltz (2005) used consumers' revealed preferences to study their valuations and benefits from rBST-free and organic milk. They found that consumers were willing to pay significantly more for rBST-free and organic milk and greatly benefit from the presence of these products on the market.

2.5 Issues with Animal Cloning

The concept of animal cloning has been a contentious one in public discourses anytime it has reared up. Although it no doubt has benefits, there has been mixed reaction by the public towards animal cloning. The underlying concerns have had to do with public apprehension about the safety of products from cloned animals as well as ethical concerns. These said, proponents of animal cloning have advanced some valid arguments in support. Some surveys and journals have captured public sentiments about animal cloning as well as perspectives from the scientific community.

At the height of the FDA's announcement regarding the safety of cloned animal products, various consumer groups slammed the agency for its conclusion. A number of concerns were raised, among them the safety of food products from cloned animals and ethical concerns. The Center for Food Safety (Doering 2007) responded that the FDA had used selectively reported data to fit predetermined conclusions. The group also suspected

heavy industry influence in FDA's decision and was concerned about the safety of cloned animal products. The Consumer Federation of America also voiced similar sentiments.

Studies that have touted the positive contributions of animal cloning have included that of Stice et al (1998) who indicated that the commercial potential from cloning was simply enormous. Apart from increasing the efficiency of meat production in chicken and livestock, cloning was viewed as having large potential impacts for biomedicine and agriculture.

Aside the seeming positives of animal cloning, an over-riding issue that has consistently surfaced is the ethics of it. Genuine fears have been expressed that animal cloning could lead scientist to human cloning. Concerns have further been raised about animal welfare and a possible ecosystem imbalance. Fiester (2005) in his examination of the ethical issues in animal cloning condensed the main ethical arguments into two; consequentialist and deontological. From the consequentialist standpoint, he intimated that animals had to endure suffering in the cloning procedure including obstetrical complications in the surrogate mother and the health of cloned animals. He further argued that there could be an unanticipated environmental impact resulting from the interaction of clones and expressed the fear that the technology once perfected in primates could extend to human cloning which would introduce a new dimension into what is ethically right.

Instead of having outright bans, legislating animal cloning by governments has been advocated as a regulatory measure. Ratner (1999) looked at the legislative approach

to animal cloning for the European Union (EU) and the US. He underscored the importance of legislation for animal cloning given that its benefits outweigh its demerits.

2.6 Consumers' Food Safety Attitudes and Confidence in Agencies

Consumer confidence about the safety of food they purchase is in part influenced by their risk perceptions, behavior, trust in industry and regulating agencies. To this extent, consumers' implied credibility for institutions tasked with regulating food safety is of utmost importance. Violet and Goddard (2012) note that general trust influences consumers' risk perceptions and risk attitudes. More generally, consumer trust in food safety could be engendered by the synergistic interplay of industry and public agencies tasked the responsibility of ensuring food safety. This was captured by Ekici (2004) who inferred that consumers' recognition of food safety involves a number of systematic components that work in tandem. The study also acknowledged that it is possible for a single institution to bolster consumer confidence about safety in the whole food supply.

One interesting dimension about consumers' attitudes is the likelihood of over-confidence due to a positive implementation of food safety which could potentially lead to consumer laxity on safety precautions in the handling of food and thereby enhance risky behaviors. Miljkovic, Nganje and Ndembe (2008) stated that in the face of positive information of food safety policies from various sources, the tendency is for consumers to exhibit an offsetting behavior which can alter their risk perception. This can subsequently increase the possibility of food contamination arising from this very false sense of safety.

Huffman et al (2004) gathered in a study about who consumers trust for information on GM foods that approximately 30% of respondents expressed confidence in independent sources like universities and researchers who did not have ties with biotechnology industries. This contrasted with about 20% of the respondents who had trust in government institutions like the FDA for verifiable information on GM foods.

Brooks and Lusk (2011) noted that less than 30% of their research participants had trust in U.S federal agencies with regard to information about cloning. Roe and Teisl (2007) also noted in a study on consumers' reaction to different labeling approaches that respondents rated the FDA as the highest credible agency in terms of its messages about a 'GM' or 'No-GM' claim in food products. This observation is against the backdrop that only the USDA and private certifying firms can validate 'No-GM' claims, a situation the authors speculate could be attributable to consumers' familiarity with the FDA as a regulatory body with respect to food safety.

Consumers are more likely to trust information on food safety from sources they perceive as unbiased and with little entrenched interests. Shepherd and Saghaian (2008) related a similar response when respondents were hypothetically asked about agencies they trusted the most for information on e-coli in beef and chicken. 47.8% of respondents had complete trust in health authorities and 33% had trust in university scientists. Also, 37.5% had trust in the USDA. Respondents mistrusted political groups the most followed by animal welfare organizations.

2.7 Uniqueness of Study from other literature

This research is set apart from other studies in a number of ways. First, it goes a step further from the survey-type studies where subjects are asked how they would respond if they were offered a product from a cloned animal (Brooks and Lusk 2010, Jones et al 2010, Butler, Wolf and Bandoni 2008, Nonis, Hudson and Hunt 2010). By presenting subjects with two types of milk products: conventional milk and milk that may potentially be from a cloned cow and requiring the consumption of a cup of either milk after the experiment, subjects are presented with a much closer market situation. The second novelty of this study is how the design incorporates an unlabeled milk that may potentially be from a cloned cow, which reflects the future scenario should products from cloned animals be introduced without mandatory labeling. Additionally, by conducting a field experiment with milk consumers, the study has the added impetus of giving a more accurate and objective position of consumers' responses and attitudes towards milk from cloned cows.

Although consumer trust in regulating institutions like the FDA is varied and usually modest (Huffman et al 2004 and Brooks and Lusk 2011), some studies have indicated a higher purchase behavior for products from cloned animals if certified safe by the FDA (Nonis, Hudson and Hunt 2010) and in the study by Storey (2006), up to 60% of subjects indicated they would purchase cloned animal products. By narrating the FDA's position to subjects, the study also assesses consumer reaction to cloned animal products and particularly their confidence in institutions like the FDA.

Chapter 3

METHODOLOGY

This research sought to investigate consumers' responses and attitudes towards an unlabeled food product from cloned animals, with a specific focus on milk from cloned cows. The main objective was to determine how much compensation consumers would need to be paid to exchange a cup of conventional milk for a cup of milk that may potentially have come from cloned cows in a typical willingness to accept (WTA) approach. Other goals included examining consumers' demographics, their opinions and knowledge of animal cloning, their views on labeling and whether they would be comfortable with milk from cloned cows being allowed in the market.

3.1 The Experimental Design

Data for this study were obtained from subjects in a field experiment at four different locations in Delaware in October 2012. Subjects were members of the general adult population and milk consumers. They were pooled from Battery Park in New Castle County, Wilmington Farmer's Market, Newark Natural Foods (which also had a Farmer's Market) and the University of Delaware campus in Newark. Subjects from the University of Delaware were mainly undergraduate students. However, participants interviewed from the other three locations had more background diversity. The reason for a field experiment was to interview real milk consumers and to achieve a diverse sample

from the state of Delaware. The Becker-de-Groot Marschak (1964) mechanism was employed because it has the advantage of flexible adaptability to field settings and also the fact that it is incentive compatible. The BDM mechanism has been previously used in a retail store setting (Lusk et al 2001) and in the field to elicit WTP for clean drinking water technology in Northern Ghana (Berry, Fischer and Guiteras, 2012).

For the field experiment, a session lasted for four hours on the average with an overall sample of 148. Each subject spent about five minutes on the experiment. Typically, each session began with setting a table and having two refrigerated gallons of milk in an ice chest cooler with ice in it to keep the milk wholesome and cool. For the purpose of this experiment, the brand name for one of the gallons of milk was taken off to represent the potential milk from a cloned cow. The second gallon of milk that still had the brand name represented conventional milk. Only milk containing 2% fat was used. People were politely approached and asked whether they were willing to participate in a short research survey on milk where they could earn money between $2 and $7. For an interested participant, the experimenter first asked whether they were milk consumers. If they were, the experimenter proceeded to narrate the FDA's final conclusion on cloned animal products that "meat and milk from clones of adult cattle, pigs, goats, and their offspring are as safe to eat as food from conventionally bred animals. For this reason, the FDA is not mandating labeling for food products from cloned animals". Participants were also told that meat and milk from cloned cows existed and the fact that they were currently not on the market was because of USDA's voluntary moratorium (USDA 2008).

The next stage was to tell and show participants the two different milk types in the cooler, one from a potentially cloned cow and the other conventional milk. Following similar procedures by Rousu and Lusk (2009) and Lusk et al (2005), participants were told that they were being offered a cup of conventional milk and asked how much money they wished to be compensated with, between $0 and $5, to instead exchange and consume a cup of the potentially cloned cow milk, with $0 indicating absolute willingness to accept and drink the potentially cloned cow milk and $5 indicating total aversion. This was to elicit participants' WTA milk from cloned cows. The importance of subjects stating their true values was emphasized as the best approach in the workings of the BDM mechanism. The survey kit also contained an envelope with strips of papers that had amounts between $0 and $5 in $0.25 increments. A participant's stated offer was compared with a randomly drawn number from the envelope. If the participant's offer was less than the random amount, they were paid an amount equal to the random number drawn and offered a cup of the potentially cloned cow milk to drink. Alternatively, if a participant's offer was equal or greater than the randomly drawn number, they were offered a cup of conventional milk to drink but no compensation was paid. Both way, participants were given a cookie to take with the milk and a token of $2 for participating aside any compensation earned. In reality both milk containers were the same and there was no deception as the milk was described as "may or may not be" from a cloned cow, as the market situation would actually be if unlabeled milk from a cloned cow is introduced.

After the experiment with each participant, an anonymous survey questionnaire was administered that requested participants' demographic information, milk purchase attitudes and opinion of animal cloning among others. A total sample size of 155 was collected but 7 were not completed, leaving a total of 148. The following is a short description of the field surveys from each of the four places:

University of Delaware: This was the first survey which also served as the pilot study and was held at the Commons of Townsend Hall, the building that houses the College of Agriculture. Thirteen (13) subjects who were all University of Delaware students participated. The original questionnaire did not ask "how many gallons of milk subjects' purchased in a week" and so the half gallon option was checked for all 13 participants in the final dataset which is the most realistic option for college students. Again, subjects checked different options for household income but this was standardized to less than $25,000.00 for all 13, which again stands as a more realistic choice for college students.

Battery Park (New Castle County): The experimenters set up a tent and a table close to the parking lot and entrance of the park, which was a strategic spot. A total of 42 persons participated in the session. There were interesting observations and comments from participants. For example, a participant who volunteered to partake in the survey and who apparently was oblivious to the existence of milk from cloned cows and the fact that it had been withheld from the market because of the USDA's moratorium showed extreme concern and indicated she would call and verify the information with the FDA the following Monday (the survey was conducted on a Saturday) and also register her gravest

concerns. Another participant remarked that cloned cow milk tasted differently after drinking a cup of the potentially cloned cow milk.

Newark Natural Foods & Farmer's Market: A table was set up close to the entrance of the store to make it easy for the experimenters to approach people about the survey. Forty six (46) persons partook in the session. Interesting comments were recorded as well. A participant who stopped short of participating even after initially agreeing remarked that the FDA is not a trustworthy agency. Another participant left a comment on the questionnaire that the "FDA's safety designation of cloned cow milk was worthless because industry influenced too much of the underlying regulatory and political environment".

Wilmington Farmer's Market: A tent and a table were provided by the organizers of Wilmington Farmer's Market. Overall, 54 subjects participated but 7 questionnaires were improperly completed and were removed from the pool. A participant in Wilmington expressed an opinion that all food products sold must be labeled because consumers have a right to know what they purchase and consume. The same participant also indicated being comfortable with milk from cloned cows provided the cows are raised organically.

3.2 Questionnaire Design

The survey questionnaire (in the Appendix) was designed to capture indices of general consumer behavior, perceptions about animal cloning technology and as well as demographic characteristics. For this reason, all questions were constructed to measure

factors that influenced participants' WTA milk from cloned cows. Questions were framed in accordance with past literature and consistent with surveys conducted in the field of consumer economics. Variables measured included participants' frequency of drinking milk, factors that affect their food purchase behavior, whether they want milk from cloned cows allowed and labeled and finally, demographic characteristics. The variables are described in the ensuing:

3.2.1 Milk Consumption Frequency

This sought to evaluate how often consumers drink either conventional milk or organic milk, capturing the major milk preferences of consumers and was measured with a 1 to 4 point scale, where 1 indicated 'never' and 4 'frequently'. The variable was meant to determine whether consumers' rate of milk intake has significant effects on their willingness to accept milk from cloned cows. The frequency of drinking organic milk turned out to have many missing values, so it was not included in the analysis.

3.2.2 Gallons of Milk purchased weekly

This variable offered an assessment on how often consumers purchased milk in a week and it directly relates to the quantity of milk in gallons. Respondents had four options for answers, respectively 'half gallon', 'one gallon', 'two gallons' and 'more than two gallons' of milk.

3.2.3 Food Purchase Decisions

This section considered some factors that influence consumers' food purchasing decisions and ultimately their food choices. The question was designed to elicit from respondents how often their food purchasing decisions were based on some specific variables. The variables examined were health issues, environmental concerns, religion, ethics or moral concerns, animal welfare concerns and cost of food. These variables were measured with a four-point scale where 1 indicated 'never' and 4 'always'. Albeit there may be several other factors that influence consumers' food purchasing decisions, the considered variables broadly captured the main themes. Health issues are quintessentially the over-riding concern with food decisions. The other variables may exert varying degrees of importance to consumers as they make their food choices. Overall, this section captured the issues that might be of potential concern to consumers in their food decisions.

3.2.4 Knowledge of Animal Cloning

Consumers' self-reported knowledge about animal cloning was also measured on a four-point scale. Respondents were asked how knowledgeable they were about animal cloning with the answers elicited on a four point scale. 1 represented 'Have None', 2. 'Fair', 3. 'Good', and 4. 'Excellent'. Because new techniques in biotechnology have stirred up a considerable wave of controversy among consumer groups, it was important to include respondents knowledge of cloning in the questionnaire to examine how that influences their WTA milk from cloned cows.

3.2.5 Opinion of Animal Cloning

Participants were asked their opinion of animal cloning. This was also measured with a four-point scale with 1 indicating Have None, 2. Negative, 3. Neutral and 4. Positive. Opinions could be great drivers of consumers' purchasing behavior. With respect to opinions on cloning, Hallman and Condry (2006) noted after reviewing public opinion surveys that although many Americans had a fixed position on cloning, these opinions tended to be the first impression of the subject rather than a strongly deliberated position. The 'opinion' variable was included to evaluate whether it made lasting impacts on consumers' acceptance of milk from cloned cows.

3.2.6 Allowing Milk from Cloned Cows

One of the contentious issues about products from cloned cows is whether or not to have them introduced into the mainstream food supply chain. This question was thus included to register the views of respondents' about allowing milk from cloned cows on the market. This was captured with a simple yes/no answer option.

3.2.7 Labelling Milk from Cloned Cows

Among the fiercely debated issues in biotechnology is the labelling of all food products to enable consumers to know what they purchase. By including this item it was possible to determine the preference of respondents on the issue and also determine whether it significantly affects their WTA milk from cloned cows. The question was also elicited with a yes/no option.

3.2.8 Primary Grocery Shopper & Having Children less than 18 years

These variables determine whether respondents do the most grocery shopping for their household and whether they live with children below 18 years. The variables have a yes/no option.

3.2.9 Frequency of Reading Food labels

Reading food labels is another dimension of consumer behavior captured in the questionnaire. Subjects were asked how often they read food labels. The answer options were 1. Never, 2. Occasionally, 3. Frequently and 4. Always.

3.2.10 Personal Disposition

Participants reported their personal dispositions elicited as 1. Liberal, 2. Moderate and 3. Conservative. Attitudes and sometimes beliefs are shaped by whichever spectra of disposition people lie on. For this reason, this was included to determine whether there is a definable relationship between consumers' disposition and their WTA novel food products.

3.3 Model Specification

The research seeks to model respondents' stated compensation required to exchange milk from conventional cows for milk that may or may not have come from cloned cows on selected consumer attributes and social demographic variables. Because the compensation had a $5 ceiling and $0 floor, a two-limit tobit model with upper and

lower censoring was employed. The two limit model is most ideal as it caters to subjects whose true value would have been to rather pay the experimenters to try the milk that may or may not have originated from cloned cows but will have to offer a bid of zero (0) and persons whose true value is above $5. The tobit model was proposed by James Tobin in 1958 to describe relationships between a non-negative dependent variable and independent variables. The tobit model is expressed as:

$y_i^* = \beta X_i + \varepsilon_i$, where i = 1,2,….n

The censored variable y is defined as:

$$y_i = \begin{cases} 5 \ if \ yi^* \geq 5 \\ yi^* \ if \ 0 < yi^* < 5 \\ 0 \ if \ yi^* \ \leq 0 \end{cases}$$

where

n – number of observations

y_i – dependent variable (subjects' WTA offer to exchange conventional milk for the possibly cloned cow milk)

X_i – a vector of independent variables

β – a vector of estimable parameters

ε_i – normally and independently distributed error term with a mean of 0 and constant variance

y* – latent variable that is unobserved for values greater than or equal to 5 and values less than or equal to 0.

Non-demographic variables considered for the Tobit regression model were:

- Frequency of milk purchase (conventional milk)
- Food purchase decisions
- Knowledge of cloning
- Opinion of cloning
- Whether milk from cloned cows should be allowed
- Whether milk from cloned cows should be labeled
- Whether a participant does most of their grocery shopping
- Location variables

Demographic variables considered include gender, ethnicity, income, having children less than 18 years and respondents' age.

3.4 Consumer Behavior and Welfare

Following Giannakas and Fulton (2002) and Lusk et al (2005), a consumer's utility from consuming regular milk is $U - P^R$, where P^R denotes the price of a gallon of regular milk guaranteed not to be from a cloned cow and U denotes the utility from

consuming a unit of a good measurable in monetary terms. Consumer surplus in a situation where cloned cow milk is not on the market is: $CS^R = U - P^R$

The framework being employed determines the change in consumer surplus by simulating a scenario where milk from cloned cows was in the mainstream food supply. If this happened, a consumer who consumes unlabeled milk which may possibly be from a cloned cow will discount their utility by a factor *d*. The term 'unlabeled' is being used to signify milk not specifically labeled as originating from a clone cow or otherwise, which is consistent with the FDA's position on labeling.

Because subjects were informed during the experimental session that the second milk they were bidding may or may not have originated from a cloned cow, a parameter Ψ is introduced to represent different probabilities that the uncertain milk is from a cloned cow. The Ψ parameter is assigned values of 0.01, 0.05 and 0.1 to indicate that the second milk has a 1%, 5% and 10% probability respectively of actually originating from a cloned cow.

It is assumed further that a consumer's utility from consuming the uncertain milk that could possibly be from a cloned cow is U - P^{NL}. The superscript NL denotes milk "not labeled" as originating from a clone cow or otherwise which has some probability of actually coming from a cloned animal. The uncertainty results from the fact that the milk product will not be specifically labeled as originating from a cloned animal. P^{NL} thus denotes the price of a gallon of "unlabeled milk".

Similar to Lusk et al (2005), the auction bid (offers of compensation) equals the discounting factor *d*, essentially because consumers have the dominant strategy to offer

bids such that $U - P^R = U - P^{NL} - d$, which in effect is the price differential of P^{NL} and P^R ($P^{NL} - P^R$).

With this premise, consumer surplus from the introduction of milk from cloned cows (which effectively makes any "unlabeled milk" have some possibility of being from a cloned cow) is: $CS^{NL} = U - P^{NL} - \Psi d$ where Ψd denotes total consumer disutility from consuming milk that may or may not originate from a cloned cow.

It is not anticipated that milk from cloned cows when introduced will be priced any differently from conventional milk not from cloned cows. This framework is thus examining the change in consumer surplus granted milk prices remain the same following the introduction of milk from cloned cows. Both prices of conventional milk not from a cloned cow and the uncertain milk that could potentially be from a cloned cow are being assigned a value equal to the current price of a gallon of conventional milk in the state of Delaware as at May 2013. In other words, if milk from cloned cows were already on the market, consumers would purchase a gallon of "unlabeled milk" at the current price of conventional milk without knowing the milk originated from a clone animal or not.

The total change in consumer surplus resulting from the introduction of milk from cloned cows is thus: $\sum_{k=1}^{n} \Delta CS^{(NL-R)}$

Subsequently, the average change in consumer surplus upon the introduction of milk from cloned cows is computed by dividing the total change by the number of subjects (n) in each survey location.

Chapter 4

STATISTICAL ANALYSIS

4.1 Descriptive Information and Respondents' Demographics

4.1.1 Descriptive Information for WTA

Subjects' WTA the potentially cloned cow milk was measured as the compensation they requested to exchange a cup of conventional milk for the milk that may possibly have originated from cloned cows. Subjects had the choice of exchanging the cup of conventional milk for the possibly cloned cow milk without requesting any compensation, or request compensation up to $5. A low compensation requested is indicative of a high willingness to accept milk from cloned cows and the converse is the case for persons less willing to accept. Table 4.1 highlights descriptive statistics for subject's stated compensation at the different survey locations and the overall dataset.

Table 4.1: Descriptive statistics for subjects' WTA

Survey Location	**Obs**	Min	**Min %**	**Max**	**Max %**	**Mean**	**Std.dev**
University of Delaware	13	0	15.38%	5	7.69%	1.44	1.35
Newark Natural Foods	46	0	23.91%	5	52.17%	3.18	2.14
Wilmington Farmer's Market	47	0	12.77%	5	19.15%	2.86	1.59
Battery Park	42	0	38.10%	5	28.57%	2.19	2.1
Overall	148	0	23.65%	5	31.08%	2.65	1.97

Mean compensation requested by all subjects to drink the possibly cloned cow milk with the $5 ceiling was $2.65. As expected, the mean was greatest at $3.18 for respondents of Newark Natural Foods and lowest among University of Delaware participants at $1.44.

Consistent with past studies which avers that younger consumers are more accepting of biotechnology (Hossain et al 2002), it was not surprising that University of Delaware participants had the lowest mean compensation. As shown in the histogram in Figure 4.1, 53.85% of University of Delaware participants requested compensations between $0 and $1. Approximately 31% of subjects requested compensation between $1.01 and $2 and 7.69% of subjects requested amounts between $4.01 and $5.

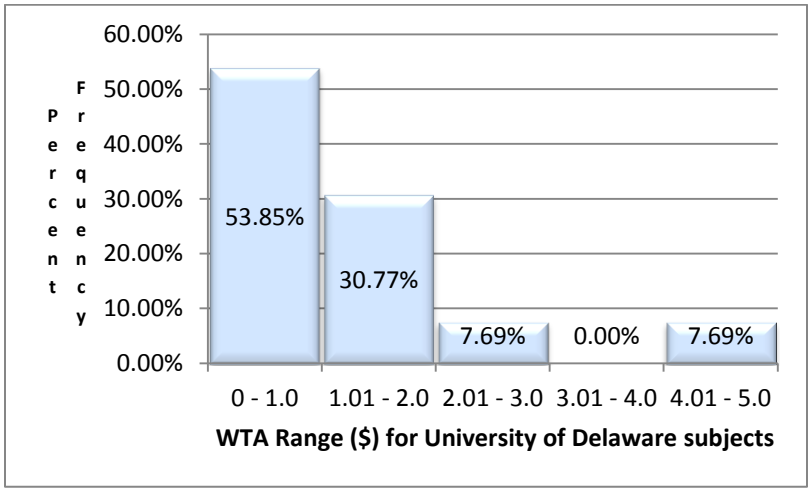


Figure 4.1: WTA distribution for subjects at the University of Delaware

Figure 4.2 shows the WTA distribution for subjects in Newark Natural Foods. It is easy to observe that subjects from this survey location required higher compensations to drink the milk that may or may not have come from cloned cows, compared with

University of Delaware participants. About 52% of Newark Natural Foods' subjects required compensations between $4.01 and $5, and only half that percentage would accept anything between $0 and $1. This trend was not unanticipated at this location because of stronger preferences for natural and organic food alternatives.

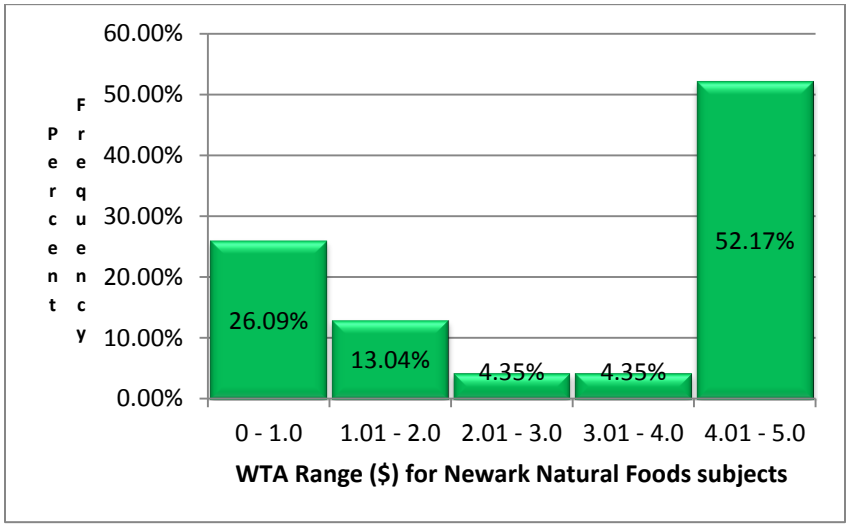


Figure 4.2: WTA distribution for subjects in Newark Natural Foods

The mean compensation of subjects in Wilmington Farmer's Market was $2.86, the second highest after Newark Natural Foods. Figure 4.3 is a histogram for the distribution of the compensations. Over 34% of subjects, representing the majority, requested amounts between $2.01 and $3 as compensation. The percentage variations in the other compensation categories were not very different from each other. About 19% of subjects requested compensation between $4.01 and $5 compared with 17% in the $0 to $1 category. Approximately 15% of subjects requested amounts in the ranges of $1.01 and $2 and then $3.01 and $4.

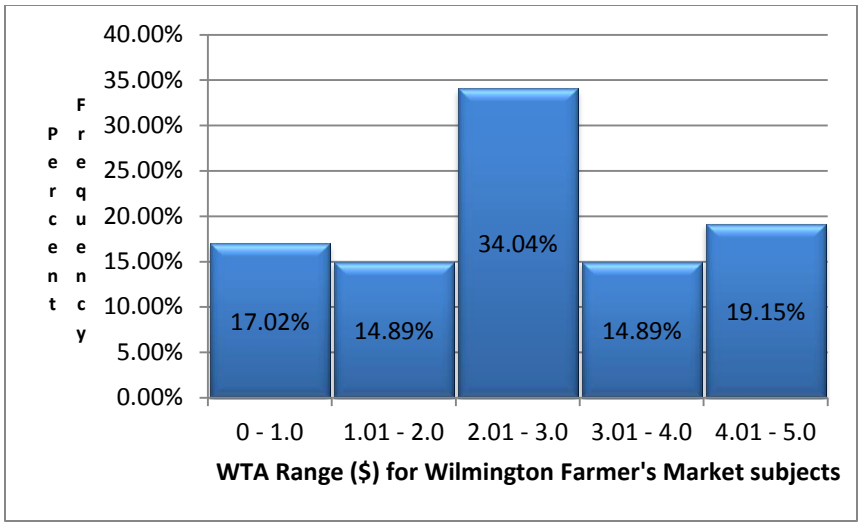


Figure 4.3: WTA distribution for subjects in Wilmington Farmer's Market

Figure 4.4 shows the distribution for subjects in Battery Park. The mean compensation requested was $2.19. The majority of the respondents (about 43%) were willing to accept amounts between $0 and $1 as compensation compared to almost 29% who requested amounts between $4.01 and $5.

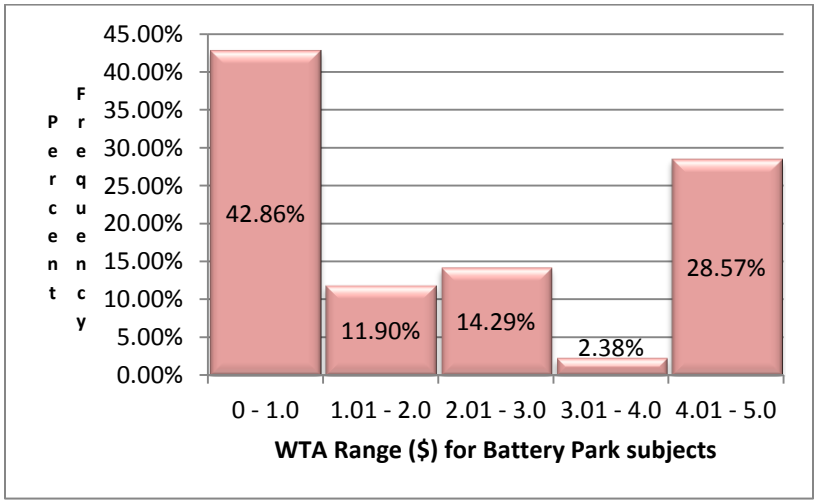


Figure 4.4: WTA distribution for subjects in Battery Park

A little over 14% of subjects offered to accept amounts between $2.01 and $3, and 12% were in the range $1.01 to $2.

The overall distribution of subjects' compensations is graphically displayed in Figure 4.5. As expected, many stated compensations fell in the tail ranges of $0 - $0.5 and $4.51 - $5. In many instances, subjects who were very comfortable drinking the potentially cloned cow milk did not need to be induced with a possible monetary compensation. On the other hand, many subjects who were skeptical about drinking milk from cloned cows requested the highest compensation of $5. The experiment was designed such that persons who requested the highest compensation of $5 had no chance of drinking the milk that may potentially have come from cloned cows.

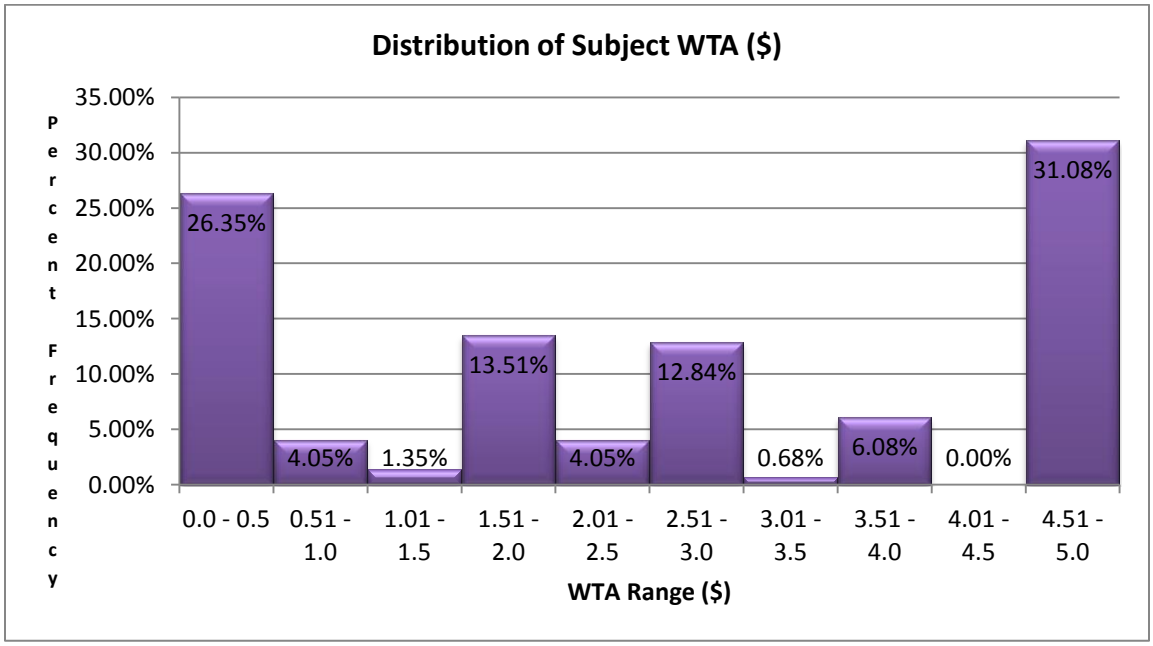


Figure 4.5: Subjects' WTA distribution

Incidentally, subjects who requested compensations in the category of $4.51 to $5 slightly outnumbered those who requested compensation between $0 and $0.5. Close to 31% of subjects were in the $4.51 to $5 category. This is an indication that a good number of subjects were somewhat reluctant to drink the possibly cloned cow milk. Quite closely, 26% of respondents either requested no compensation at all or were willing to be compensated with up to $0.5 to drink the possibly cloned cow milk. Obviously, subjects who were in between the two extreme categories of $0 and $5 were willing to consume milk they knew could have originated from a cloned cow if induced with amounts equal or greater than their stated compensations. About 14% of respondents offered to accept compensation in the range of $1.51 to $2 whilst 12.84% of respondents were willing to accept compensation between $2.51 and $3.0. Also, just about 6% of subjects offered to accept compensation in the range $3.51 to $4.0.

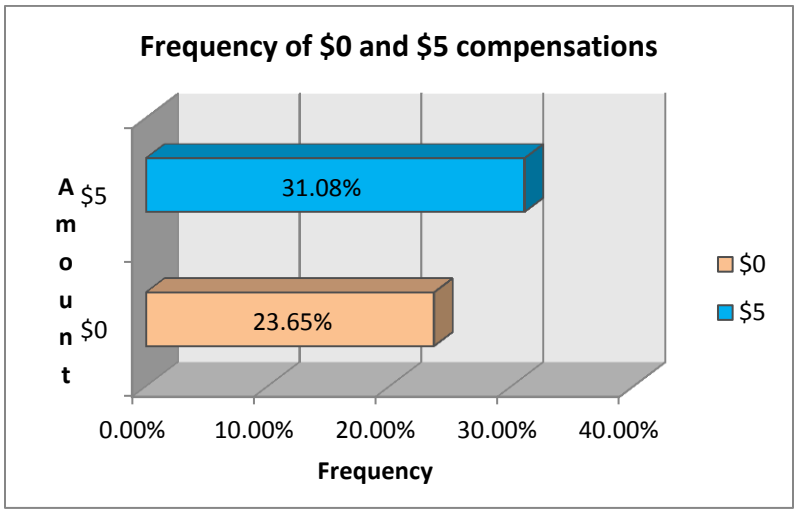


Figure 4.6: Subjects' WTA distribution for $0 and $5

Figure 4.6 shows the proportion of subjects at the two extremes. About 24% of subjects did not request any compensation to consume the possibly cloned cow milk. On the contrary, 31.08% of subjects requested compensation of $5, an indication that they were very unwilling to drink the possibly cloned cow milk.

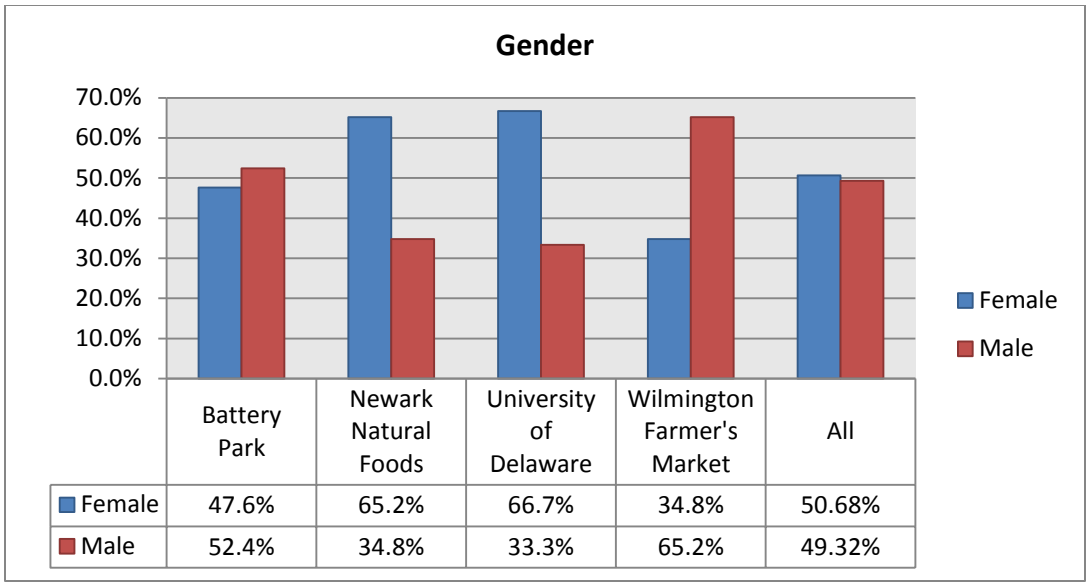
4.1.2 Respondents' Demographic Information

Gender statistics of respondents are summarized in Table 4.2. Females represented 50.68% of total respondents and the remainder (49.32%) represented males. These proportions compare very well with 2010 Delaware census data which reports that females make up 51.56% of the population.

Table 4.2: Respondents' gender statistics

Gender	Number of Respondents	Respondents' Frequency	Census Frequency
Male	74	49.32%	48.44%
Female	72	50.68%	51.56%

Source of census information: http://censusviewer.com/state/DE



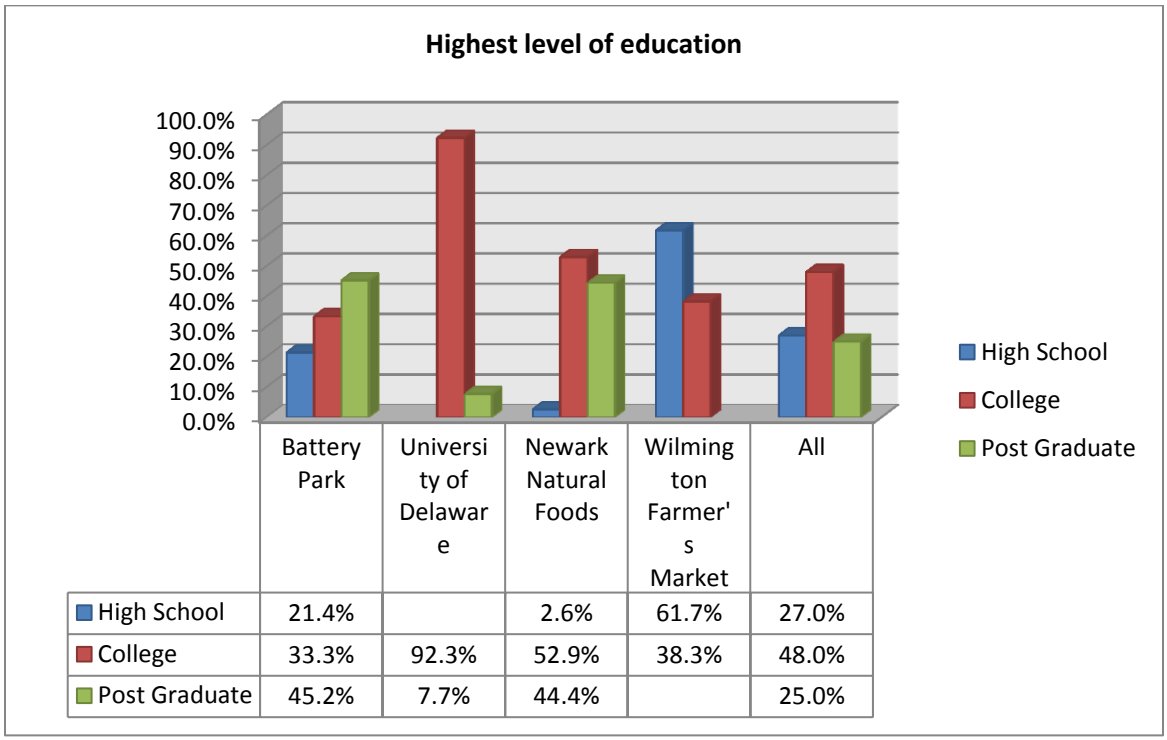
	Battery Park	Newark Natural Foods	University of Delaware	Wilmington Farmer's Market	All
Female	47.6%	65.2%	66.7%	34.8%	50.68%
Male	52.4%	34.8%	33.3%	65.2%	49.32%

Figure 4.7: Gender distributions of respondents

Figure 4.7 is a composition of gender statistics from the various survey locations and as well the entire dataset. Males slightly outnumbered females among Battery Park respondents. This difference was more pronounced for respondents' at Wilmington Farmer's Market where about 65% of respondents were males. The female to male ratio for Newark Natural Foods was very similar to that of the University of Delaware, with females dominating at over 65%. For the overall dataset, the gender proportion was almost one to one, with females marginally outnumbering males.

Subjects' educational background is captured in Figure 4.8. Nearly all subjects from the University of Delaware and Newark Natural Foods have at least been to college. More than 40% of Battery Park and Newark Natural Foods respondents' had post graduate degrees. Battery Park respondents appeared to have had the most diverse educational background. For Wilmington Farmer's Market respondents, 61.7% of them

had high school or less than high school background and no respondent had a post graduate degree. The total dataset showed 48% of respondents having been to college and 73% of respondents at least had a college degree, compared with 27% who had a high school or less than high school background.

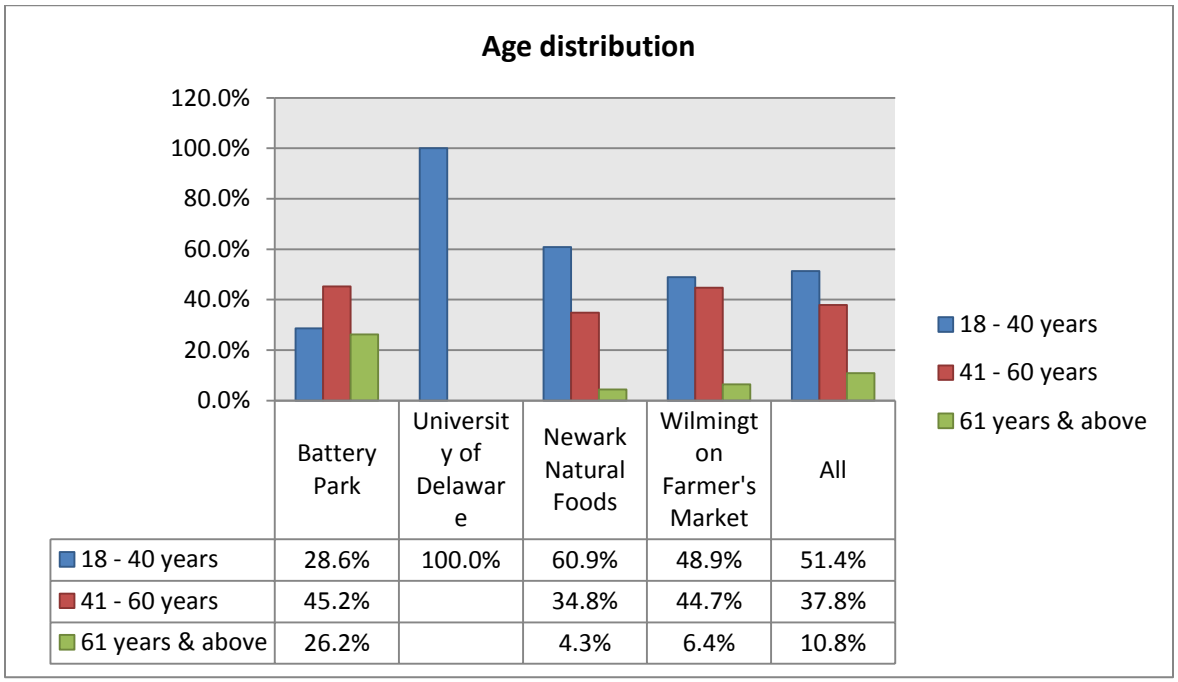


	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
High School	21.4%		2.6%	61.7%	27.0%
College	33.3%	92.3%	52.9%	38.3%	48.0%
Post Graduate	45.2%	7.7%	44.4%		25.0%

Figure 4.8: Highest level of education attained

Age distribution of subjects is shown in Figure 4.9. Subjects from the University of Delaware who were all students were between the ages of 18 years and 40 years. Battery Park had nearly as many respondents who were at most 40 years' as it had for respondents who were at least 61 years. This is reflective of the diverse age groups that visit the recreational park. Less than 10% of subjects from Newark Natural Foods and Wilmington Farmer's Market were 61 years or older and majority of subjects in the two

locations were at most 40 years. Overall, the entire dataset showed a little over half of respondents between 18 years and 40 years with 10.8% of respondents been 61 years or older.



	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
18 - 40 years	28.6%	100.0%	60.9%	48.9%	51.4%
41 - 60 years	45.2%		34.8%	44.7%	37.8%
61 years & above	26.2%		4.3%	6.4%	10.8%

Figure 4.9: Age distribution of respondents

Ethnic demographics of the entire data set compared very similarly with the 2010 census data for Delaware, shown in Table 4.3. There were 70.07% white subjects and 21.09% black or African American subjects, compared with 68.89% whites and 21.36% Black or African American persons from the 2010 census data for Delaware. The Asian population as well as a pooled population of Hispanics and other races was relatively proximal to the census figures of 2010.

Table 4.3: Respondents' ethnic demographics

Race	Number of Respondents	Respondents' Frequency	Census Frequency
White	103	70.07%	68.89%
Black/African American	31	21.09%	21.36%
Asian	3	2.04%	3.18%
Hispanic / Other	10	6.80%	6.57%

Source of census information: http://censusviewer.com/state/DE

Figure 4.10 displays a graphical picture of subjects' ethnicity for all four survey locations. For ease of presentation, all non-white races are grouped together. Wilmington Farmer's Market and Battery Park had about 40% of respondents being non-white. Interestingly, subjects from the University of Delaware and Newark Natural Foods had the same proportion of white subjects versus subjects of other ethnic backgrounds. About 70% of all respondents were whites.

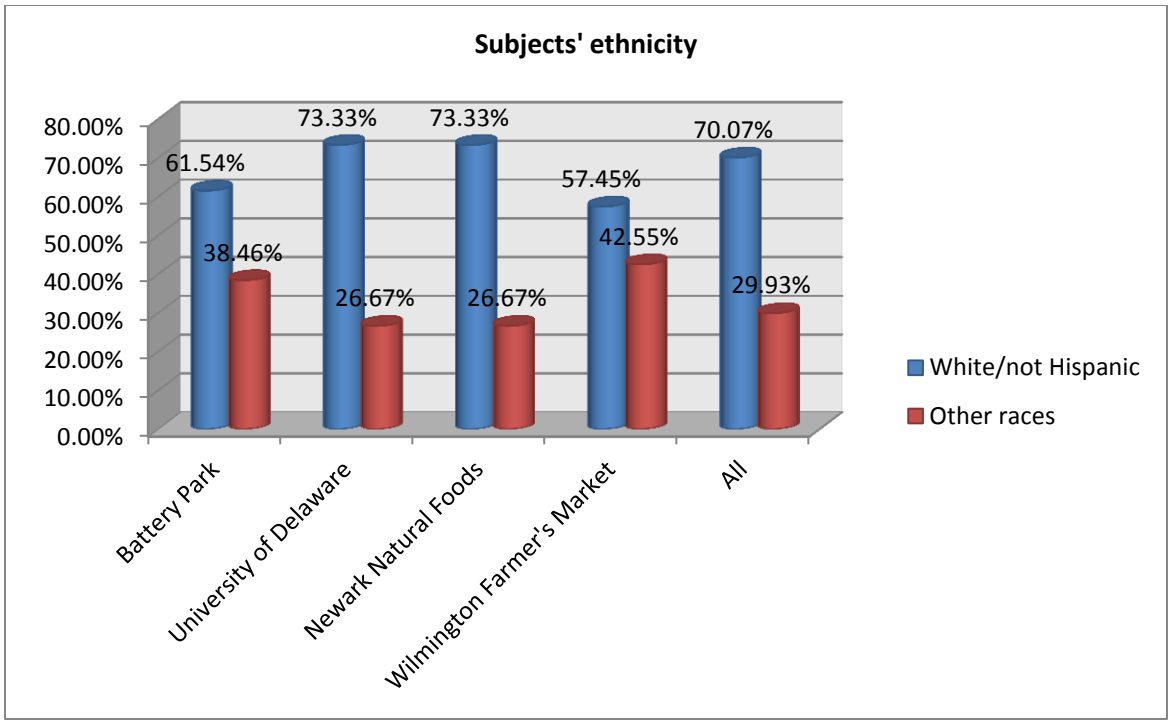


Figure 4.10: Ethnic distribution of respondents

Household income for the entire dataset had a relatively general spread for the different categories ranging from $25,000 to $99,999. About 28% of respondents had income below $25,000 whilst only 2.76% of respondents had income above $200,000. Table 4.4 gives the general summary and descriptive statistics of subjects' demographics across the four survey locations.

Table 4.4: Summary of Respondents' demographics

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Gender										
Male	4	33.33%	22	52.38%	16	34.78%	30	65.22%	72	49.32%
Female	8	66.67%	20	47.62%	30	65.22%	16	34.78%	74	50.68%
Education										
Less than High School	0		0		0		5	10.64%	5	3.38%
High School	0		9	21.43%	2	4.35%	24	51.06%	35	23.65%
College	12	92.31%	14	33.33%	27	58.70%	18	38.30%	71	47.97%
Post Graduate	1	7.69%	19	45.24%	17	36.96%	0		37	25.00%
Ethnicity										
White	11	84.62%	32	76.19%	33	73.33%	27	57.45%	103	70.07%
Black/African American	0		10	23.81%	6	13.33%	15	31.91%	31	21.09%
Hispanic/Latino	0		0		3	6.67%	1	2.13%	4	2.72%
Asian	2	15.38%	0		1	2.22%	0		3	2.04%
Other	0		0		2	4.44%	4	8.51%	6	4.08%
Age										
18 - 40 years	13	100.0%	12	28.6%	28	60.9%	23	48.9%	76	51.4%
41 - 60 years	0	0%	19	45.2%	16	34.8%	21	44.7%	56	37.8%
61 years and above	0	0%	11	26.2%	2	4.3%	3	6.4%	16	10.8%

Table 4.4 continued

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
Income										
Less than $25,000	13	100%	1	2.44%	7	15.56%	19	41.30%	40	27.59%
$25,000 to $49,999			9	21.95%	3	6.67%	14	30.43%	26	17.93%
$50,000 to $74,999			10	24.39%	14	31.11%	4	8.70%	28	19.31%
$75,000 to $99,999			7	17.07%	11	24.44%	3	6.52%	21	14.48%
$100,000 to $149,999			7	17.07%	6	13.33%	5	10.87%	18	12.41%
$150,000 to $199,999			4	9.76%	3	6.67%	1	2.17%	8	5.52%
$200,000 or more			3	7.32%	1	2.22%			4	2.76%

4.1.3 Descriptive Information for Respondents on other Attributes

Apart from demographics, responses to other variables of interest were elicited from respondents in the survey questionnaire. These included how often respondents' drink milk, the volume of milk purchased per week, their rated knowledge of animal cloning and their opinion of the technology. Other attributes included respondents' views on the possible entry of milk from cloned cows into the mainstream food supply, having them labeled or otherwise, their frequency of reading food labels as well as their personal disposition.

With respect to how often subjects drink milk, responses were elicited separately for both conventional and organic milk. However, there were so many missing values for respondents' frequency of drinking organic milk that the variable was omitted from the analysis.

How often subjects drink conventional milk is displayed in Table 4.5 and Figure 4.10. Apart from respondents from Newark Natural Foods, more than 70% of respondents in the other three locations had indicated drinking conventional milk sometimes or frequently, as shown in Table 4.5. More than half of Newark Natural Foods respondents never or rarely consumed conventional milk. Apart from Newark Natural Foods respondents where close to 30% of respondents had indicated never drinking conventional milk, less than 10% of respondents in the other three survey locations reported never drinking conventional milk.

For the entire dataset, the majority of all respondents, constituting a little over 43% indicated drinking conventional milk frequently and this is shown in Figure 4.11. Respondents who reported never drinking conventional milk were about 14%. Considering that all subjects had affirmed prior to their participation in the survey to be milk drinkers, the proportion of subjects who responded never drinking conventional milk are anticipated to be consumers of organic milk or other close milk substitutes.

Table 4.5: Frequency of taking conventional milk from survey locations

	University of Delaware		**Battery Park**		**Newark Natural Foods**		**Wilmington Farmer's Market**	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Never	1	8.33%	3	7.50%	12	29.27%	3	6.52%
Rarely	2	16.67%	6	15.00%	13	31.71%	9	19.57%
Sometimes	3	25.00%	14	35.00%	3	7.32%	10	21.74%
Frequently	6	50.00%	17	42.50%	13	31.71%	24	52.17%

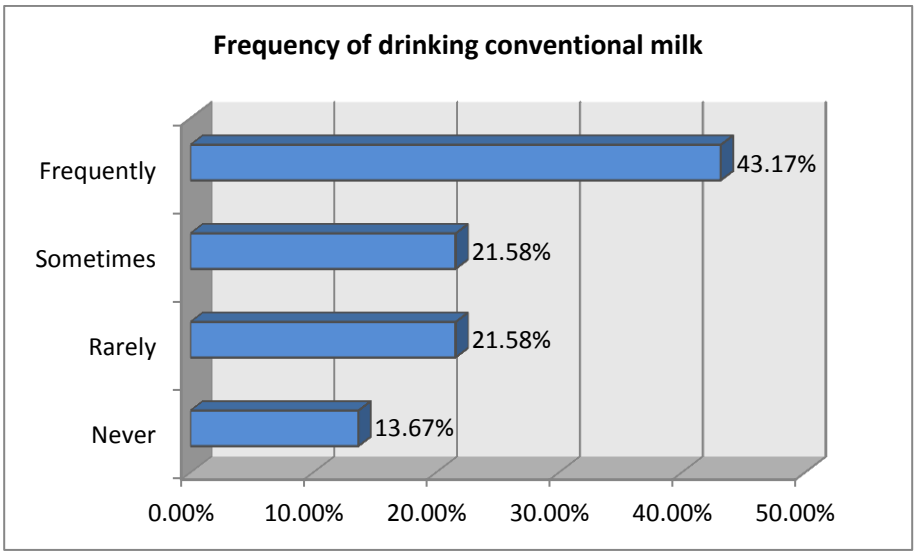


Figure 4.11: Frequency of drinking conventional milk for all subjects

The number of gallons of milk that subjects' indicated purchasing in a week is shown in Table 4.6 and Figure 4.11. This category had not been included in the questionnaire at the time of the first experiment at the University of Delaware. However, since all respondents in this group are college students, it was concluded that they would consume at most half a gallon of milk weekly, explaining why Table 4.6 shows 100% of all University of Delaware respondents purchasing half a gallon of milk weekly. More than 70% of respondents in Battery Park and Newark Natural Foods stated they purchased at most one gallon of milk weekly, as presented in Table 4.6. Approximately 13% of Wilmington Farmer's Market respondents purchased half a gallon of milk per week, and about 30% purchased two gallons weekly.

Overall, close to 43% of all subjects, which constitutes the majority, responded purchasing half a gallon of milk every week compared to 27.89% who purchased one

gallon per week as displayed in Figure 4.12. Almost 13% of subjects reported purchasing more than two gallons of milk weekly. It is obvious that the number of consumers decrease for higher volumes of milk purchased weekly.

Table 4.6: Gallons of milk purchased weekly across the survey locations

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market	
	N	Freq.	N	Freq.	N	Freq.	N	Freq.
Half	13	100.00%	19	46.34%	25	54.35%	6	12.77%
One			13	31.71%	10	21.74%	18	38.30%
Two			4	9.76%	6	13.04%	14	29.79%
More than two			5	12.20%	5	10.87%	9	19.15%

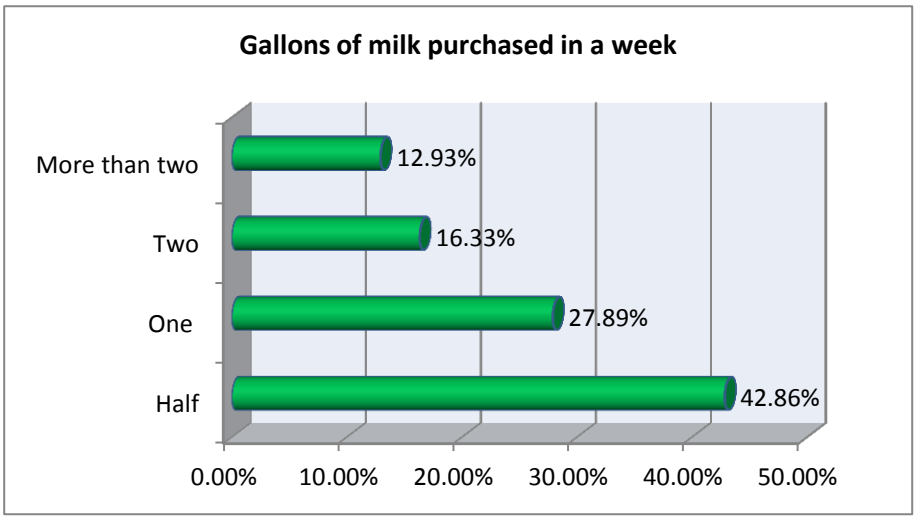


Figure 4.12: Gallons of milk purchased weekly

Table 4.7 gives summary statistics across the four survey locations regarding how often health issues dominate respondents' food purchase decisions. Across the

various locations, Newark Natural Foods respondents were the highest rated for always considering health issues when making food purchase decisions, with a frequency of 47.83%. With the exception of Wilmington Farmer's Market, health issues were very important for more than 70% of respondents from the other survey locations, often or always influencing their food choices. In total, 75.17% of respondents would often or always consider health issues when making food choices.

Table 4.7: How often purchase decisions are based on health reasons

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Health										
Never	0		1	2.56%	1	2.17%	11	23.40%	13	8.97%
Sometimes	3	23.08%	4	10.26%	5	10.87%	11	23.40%	23	15.86%
Often	8	61.54%	19	48.72%	18	39.13%	13	27.66%	58	40.00%
Always	2	15.38%	15	38.46%	22	47.83%	12	25.53%	51	35.17%

Subjects' food purchase decisions as influenced by environmental concerns are captured in Table 4.8. Newark Natural Foods had the most respondents (28.26%) always consider the environment when making their food choices. More than 60% of all respondents were sometimes or often environmentally conscious about their food choices. Only 21.53% of all respondents however reported always making food purchase decisions based on the environment, compared to only 9.72% who never considered the environment in their food choices.

Table 4.8: How often purchase decisions are based on environmental concerns

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	Freq.	N	Freq.	N	Freq.	N	Freq.	N	Freq.
Environmental Concerns										
Never	0	0%	3	7.50%	3	6.52%	8	17.78%	14	9.72%
Sometimes	4	30.77%	11	27.50%	9	19.57%	20	44.44%	44	30.56%
Often	8	61.54%	17	42.50%	21	45.65%	9	20.00%	55	38.19%
Always	1	7.69%	9	22.50%	13	28.26%	8	17.78%	31	21.53%

Respondents' food purchase decisions based on religion is summarized in Table 4.9. It is obvious that religion is not a significantly considered factor for many respondents with regards to their food choices. With respondents from Wilmington Farmer's Market as the exception, at least 80% of respondents in the other three locations stated that religion never influenced the foods they purchased. Approximately 16% of Wilmington Farmer's Market respondents indicated that religion was always considered in their food choices. The entire dataset shows 79% of respondents never being influenced by religion in their food purchase decisions, contrasted with about 7% for whom religion was a significant influence.

Table 4.9: How often purchase decisions are based on religious reasons

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	Freq.	N	Freq.	N	Freq.	N	Freq.	N	Freq.
Religion										
Never	12	92.31%	34	85.00%	36	80.00%	31	68.89%	113	79.02%
Sometimes	1	7.69%	4	10.00%	3	6.67%	6	13.33%	14	9.79%
Often	0		2	5.00%	3	6.67%	1	2.22%	6	4.20%
Always	0		0		3	6.67%	7	15.56%	10	6.99%

How frequent food purchase decisions revolve around ethics and morality was another variable for which responses were elicited from subjects and summarized in Table 4.10. The entire dataset shows a relatively even proportion for the four categories. More than 60% of respondents in Newark Natural Foods stated that ethics was often or always a principal consideration in their food purchases, compared to only 4.44% who never considered ethics in their food choices. Just about 15% of respondents at the University of Delaware, Battery Park and Wilmington Farmer's Market always made food choices based on ethics. Overall, less than half of all respondents often or always made food choices based on ethical or moral concerns.

Table 4.10: How often purchase decisions are based on ethical concerns

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	Freq.	N	Freq.	N	Freq.	N	Freq.	N	Freq.
Ethical concerns										
Never	3	23.08%	12	30.77%	2	4.44%	23	51.11%	40	28.17%
Sometimes	4	30.77%	12	30.77%	12	26.67%	12	26.67%	40	28.17%
Often	4	30.77%	9	23.08%	15	33.33%	3	6.67%	31	21.83%
Always	2	15.38%	6	15.38%	16	35.56%	7	15.56%	31	21.83%

Respondents were also asked how often animal welfare concerns featured in their food purchase decisions. Their responses are captured in Table 4.11. Almost 40% of Newark Natural Foods respondents indicated they always considered the welfare of animals when making food choices and only 6.5% never gave consideration to animal welfare issues. More than half of University of Delaware and Battery Park respondents often or always considered animal welfare issues as a significant factor when making food choices. For Wilmington Farmer's Market respondents, less than 40% of them often or always considered the environment in their food choices. For the entire dataset, nearly half of all respondents (51.39%) often or always considered the welfare of animals in their food choices, compared with 15.28% who never did.

Table 4.11: How often purchase decisions are based on animal welfare

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market		Total	
	N	Freq.	N	Freq.	N	Freq.	N	Freq.	N	Freq.
Animal welfare										
Never	1	7.69%	5	12.50%	3	6.52%	13	28.89%	22	15.28%
Sometimes	4	30.77%	15	37.50%	14	30.43%	15	33.33%	48	33.33%
Often	6	46.15%	13	32.50%	11	23.91%	10	22.22%	40	27.78%
Always	2	15.38%	7	17.50%	18	39.13%	7	15.56%	34	23.61%

Table 4.12 presents a synoptic picture of how often respondents in the various survey locations decidedly considered food cost in their purchase choices. With the exception of Newark Natural Foods, more than 40% of respondents in the other three locations always considered the cost of food. More than 70% of respondents in these three locations often or always considered the cost of food in their choices. For respondents from Newark Natural Foods, just about a quarter of them indicated they always made food purchase decisions based on its cost. Overall, 37.5% of respondents always considered the cost of food in their purchase decisions and just about 7% of respondents never did.

Table 4.12: How often purchase decisions are based on cost of food

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington farmer's market		Total	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Food Cost										
Never	1	7.69%	1	2.50%	2	4.44%	6	13.04%	10	6.94%
Sometimes	0		7	17.50%	17	37.78%	5	10.87%	29	20.14%
Often	6	46.15%	15	37.50%	15	33.33%	15	32.61%	51	35.42%
Always	6	46.15%	17	42.50%	11	24.44%	20	43.48%	54	37.50%

A correlation table showing the strength of linear relationships among variables that influence respondents' food purchase decisions is shown in Table 4.13. The highest correlation coefficient of 0.7305 is between purchase decisions based on animal welfare and ethical concerns which is an indication of a fairly strong positive relationship. Persons who strongly considered the welfare of animals in their food decisions were also strongly influenced by ethics. There is also a moderately strong positive relationship between food decisions based on animal welfare and environmental concerns, and as well ethical and environmental reasons with statistically significant correlation coefficients of 0.68 and 0.57 respectively. It could be reasonably anticipated that people who show concern for animal welfare in their food purchase decisions might also be concerned about the environment

Table 4.13: Correlations among food purchasing decision variables

Pearson Correlation Coefficients

Prob > |r| under H0: Rho=0

	health	***environment***	***ethical***	***animal***	***cost***
health	1				
Purchase decisions based on health					
environment	0.5945	1			
Purchase decisions on environment	<.0001				
ethical	0.4547	0.5687	1		
Purchase decisions based on ethics	<.0001	<.0001			
animal	0.5168	0.6846	0.7305	1	
Purchase decisions on animal welfare	<.0001	<.0001	<.0001		
cost	0.0927	0.0854	-0.0254	0.0449	1
Purchase decisions based on food cost	0.2723	0.3121	0.7649	0.5961	

Subjects self-rated their knowledge of animal cloning, as summarized in Table 4.14 and graphically in Figure 4.13. Over 60% of University of Delaware's respondents rated their knowledge of animal cloning as good with the remainder rating their knowledge as fair. Almost 31% of Battery Park respondents indicated they had no knowledge of animal cloning, the highest across all the survey locations. Exactly half of Newark Natural Foods respondents rated their knowledge as fair, and 15.22% indicated having excellent knowledge about the technology, the highest across the four survey locations. More than half of respondents in Wilmington Farmer's Market reported having a fair knowledge about animal cloning.

Overall, about 46% of all subjects reportedly had a fair knowledge of animal cloning as displayed in Figure 4.13. Roughly 10% of all subjects rated their knowledge of animal cloning to be excellent whilst about 21% thought their knowledge of the technology was good. Quite surprisingly, about 22% of all subjects reported they did not have any knowledge about animal cloning.

Table 4.14: Knowledge of animal cloning across the survey locations

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Have None			13	30.95%	9	19.57%	11	23.40%
Fair	5	38.46%	16	38.10%	23	50.00%	25	53.19%
Good	8	61.54%	10	23.81%	7	15.22%	6	12.77%
Excellent			3	7.14%	7	15.22%	5	10.64%

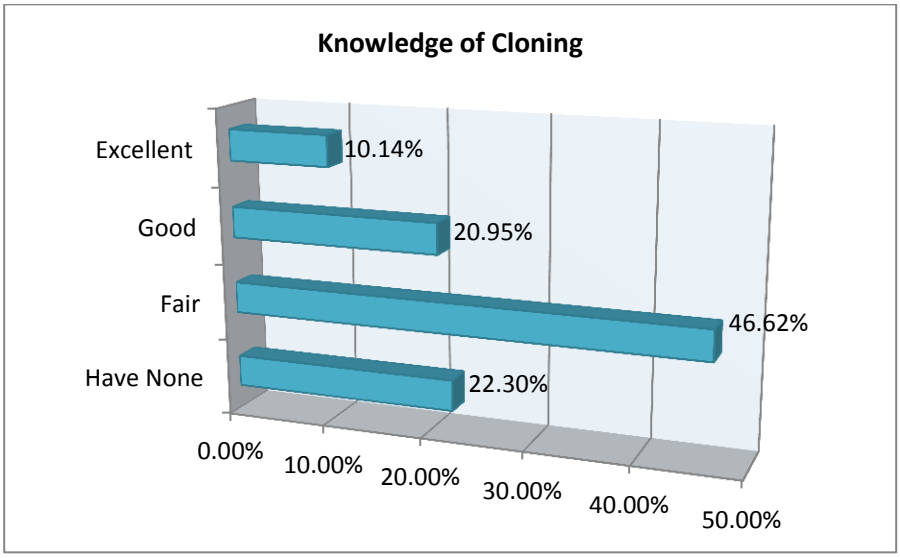


Figure 4.13: Self-rated knowledge of animal cloning by all subjects

Subjects also rated their opinion of animal cloning which is displayed in Table 4.15 and Figure 4.14. Over 75% of University of Delaware respondents had a neutral opinion of cloning, compared to a little more than 50% for Battery Park and Wilmington Farmer's Market respondents. Approximately 58% of Newark Natural Foods' respondents indicated they held negative views about animal cloning, the highest across all survey locations. About 17% of Wilmington Farmer's Market respondents had no opinion of animal cloning, and 6.38% held a positive opinion.

From Figure 4.14 which captures responses from all subjects, barely 7% of subjects saw cloning in a positive light. In contrast, about 36% of respondents held a negative view of animal cloning. A little over 57% of respondents indicated either a neutral or no opinion of animal cloning.

Table 4.15: Opinion of animal cloning across the survey locations

	University of Delaware		**Battery Park**		**Newark Natural Foods**		**Wilmington Farmer's Market**	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Have None			3	7.14%	3	6.67%	8	17.02%
Negative	2	15.38%	13	30.95%	26	57.78%	12	25.53%
Neutral	10	76.92%	23	54.76%	13	28.89%	24	51.06%
Positive	1	7.69%	3	7.14%	3	6.67%	3	6.38%

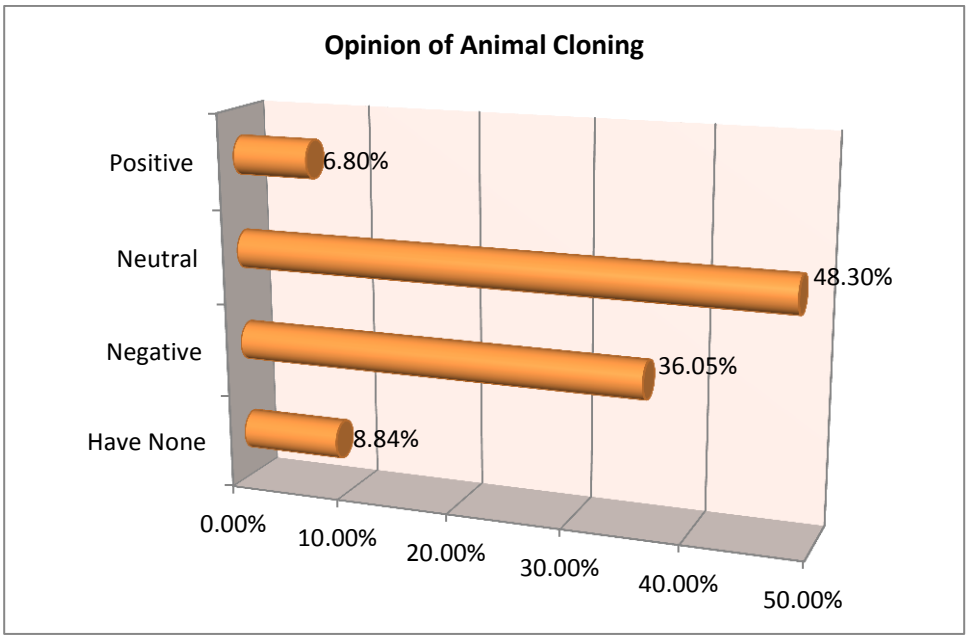
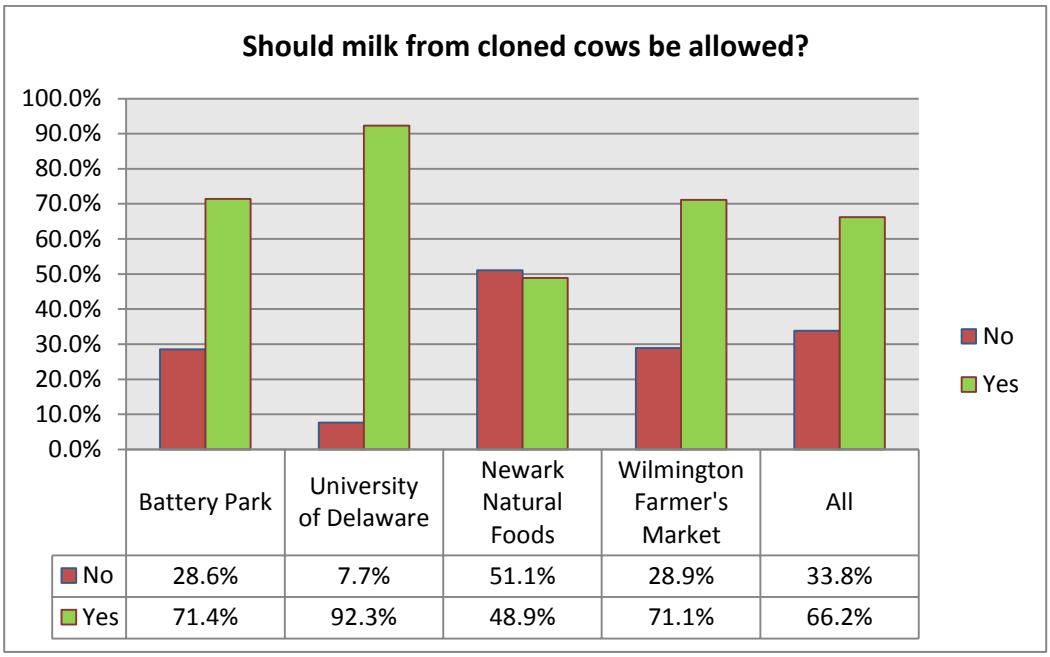


Figure 4.14: Respondents' opinion of animal cloning

Subjects' responses to whether milk from cloned cows should be allowed to enter the mainstream food supply are captured in Figure 4.15. About 90% of University of Delaware respondents wanted milk from cloned cows allowed into the market. Also, a little over 70% of respondents from Battery Park and Wilmington Farmer's Market wanted milk from cloned cows allowed. Not surprisingly, 51.1% of respondents from Newark Natural Foods answered 'no' when asked whether they wanted milk from cloned cows allowed, in other words they were uncomfortable with milk from cloned cows entering the market. From the pooled response however, more than 60% of respondents were comfortable with milk from cloned cows being allowed into the market, in contrast with 33.38% who opposed.



	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
No	28.6%	7.7%	51.1%	28.9%	33.8%
Yes	71.4%	92.3%	48.9%	71.1%	66.2%

Figure 4.15: Responses to whether milk from cloned cows should be allowed

Respondents gave their responses on whether they preferred labels on milk from cloned cows, in the event it entered the market. As displayed in Figure 4.16, responses from the four survey locations were overwhelmingly skewed in favor of labeling milk from cloned cows. As expected, 93.5% of respondents from Newark Natural Foods wanted milk from cloned cows labeled, which happened to be the highest response in favor of labels. 77% of respondents from the University of Delaware favored labels. Over 80% of subjects from Battery Park and Wilmington Farmer's Market also wanted labels on cloned animal milk. In general, subjects were unanimous about having milk from cloned animals labeled; 87% of all subjects favored a labeling policy.

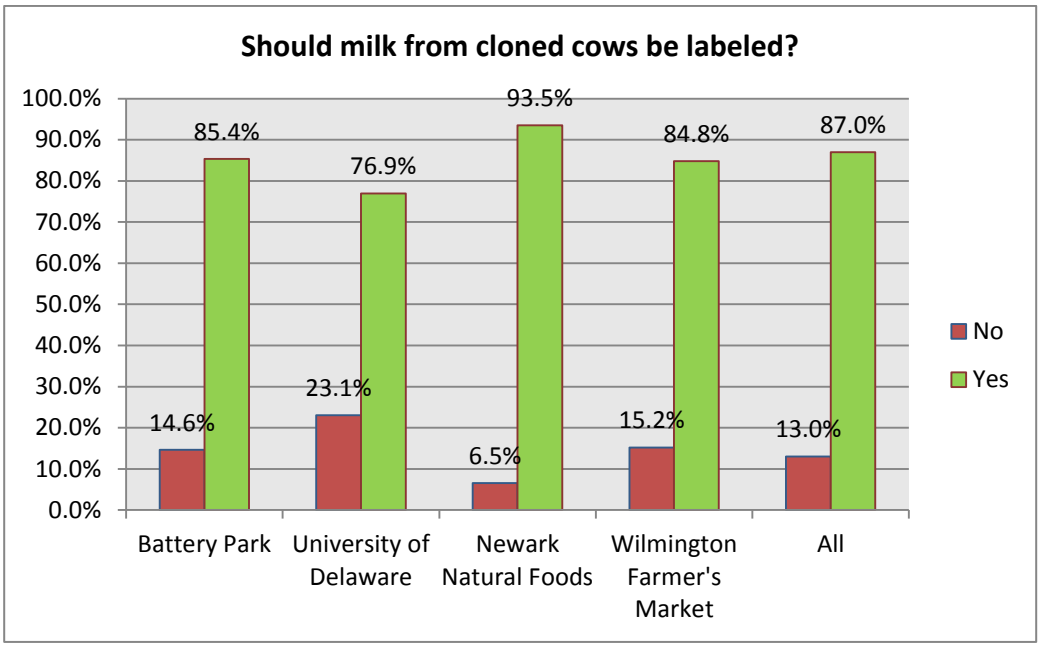
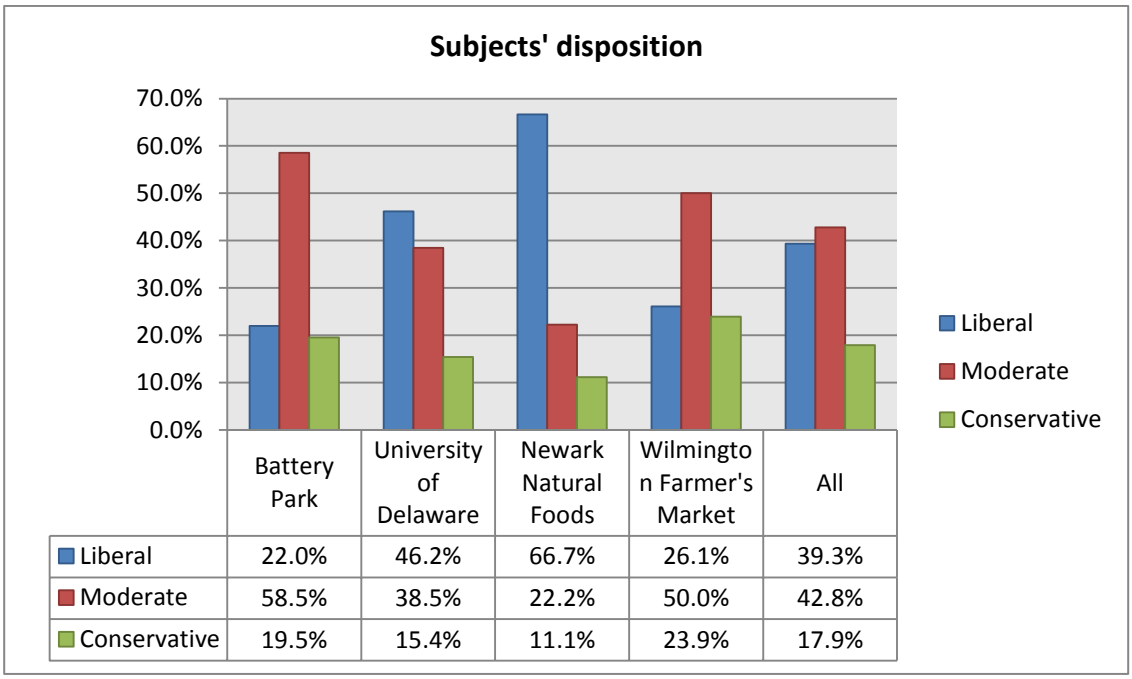


Figure 4.16: Responses to whether milk from cloned cows should be labeled

Figure 4.17 indicates the composition of subjects' disposition. The responses across the different survey groups depict an interesting picture. About 67% of Newark Natural Foods respondents identified themselves as liberals, contrasted with 11.1% who viewed themselves as conservatives. Half the respondents of Wilmington Farmer's Market and a little more than half of Battery Park respondents viewed themselves as moderates. More than 80% of University of Delaware respondents identified themselves as liberals or moderates. In total, there was about an equal proportion of 40% for subjects who indicated having liberal leanings as were those who viewed themselves as moderates. A little less than 20% of subjects indicated they were conservatives in the total dataset.



	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
Liberal	22.0%	46.2%	66.7%	26.1%	39.3%
Moderate	58.5%	38.5%	22.2%	50.0%	42.8%
Conservative	19.5%	15.4%	11.1%	23.9%	17.9%

Figure 4.17: Disposition of subjects

Another variable of interest is how frequently food labels are read and this is presented in Table 4.16 and Figure 4.18. Almost 70% of University of Delaware respondents indicated they frequently or always read food labels. For Battery Park respondents, more than 70% reportedly read food labels frequently or always, with just about 5% never reading labels. Approximately 59% of Newark Natural Foods respondents indicated they always read food labels, and nobody within that group was in the category of never reading food labels. About 67% of respondents from Wilmington Farmer's Market frequently or always read food labels, and about 6.5% of them never did.

The entire picture of all responses is illustrated in Figure 4.18. A very small fraction of all subjects (3.4%) responded not reading food labels at all and over 20%

of subjects indicated reading labels occasionally. On the flip side, close to 40% of all subjects responded always reading food labels and more than 75% of subjects interviewed frequently or always read food labels.

Table 4.16: Frequency of reading food labels across survey locations

	University of Delaware		Battery Park		Newark Natural Foods		Wilmington Farmer's Market	
	N	**Freq.**	**N**	**Freq.**	**N**	**Freq.**	**N**	**Freq.**
Never			2	4.76%			3	6.52%
Occasionally	4	30.77%	10	23.81%	3	6.52%	12	26.09%
Frequently	6	46.15%	15	35.71%	16	34.78%	16	34.78%
Always	3	23.08%	15	35.71%	27	58.70%	15	32.61%

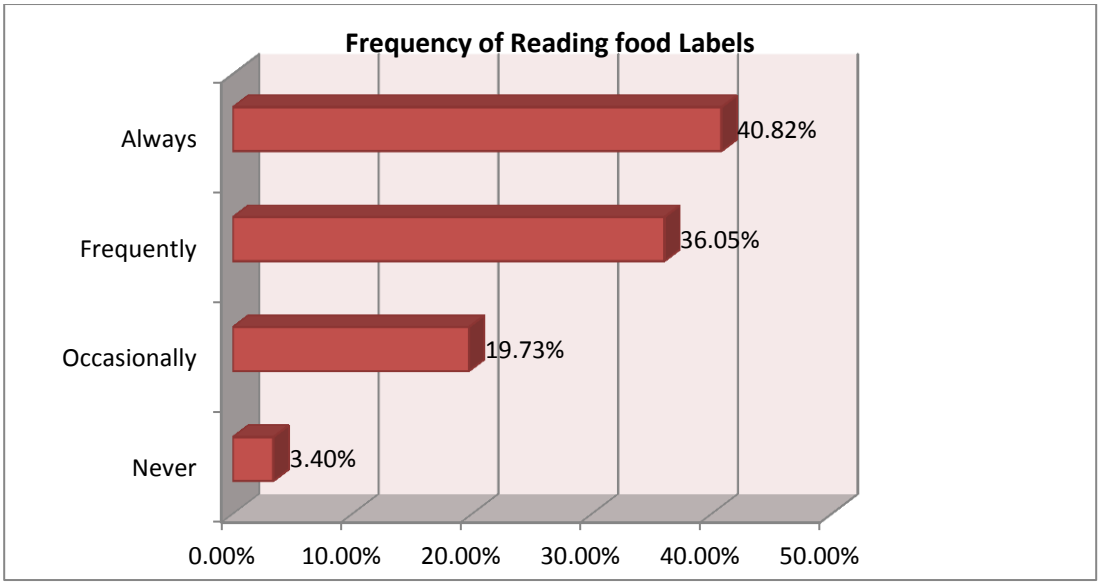
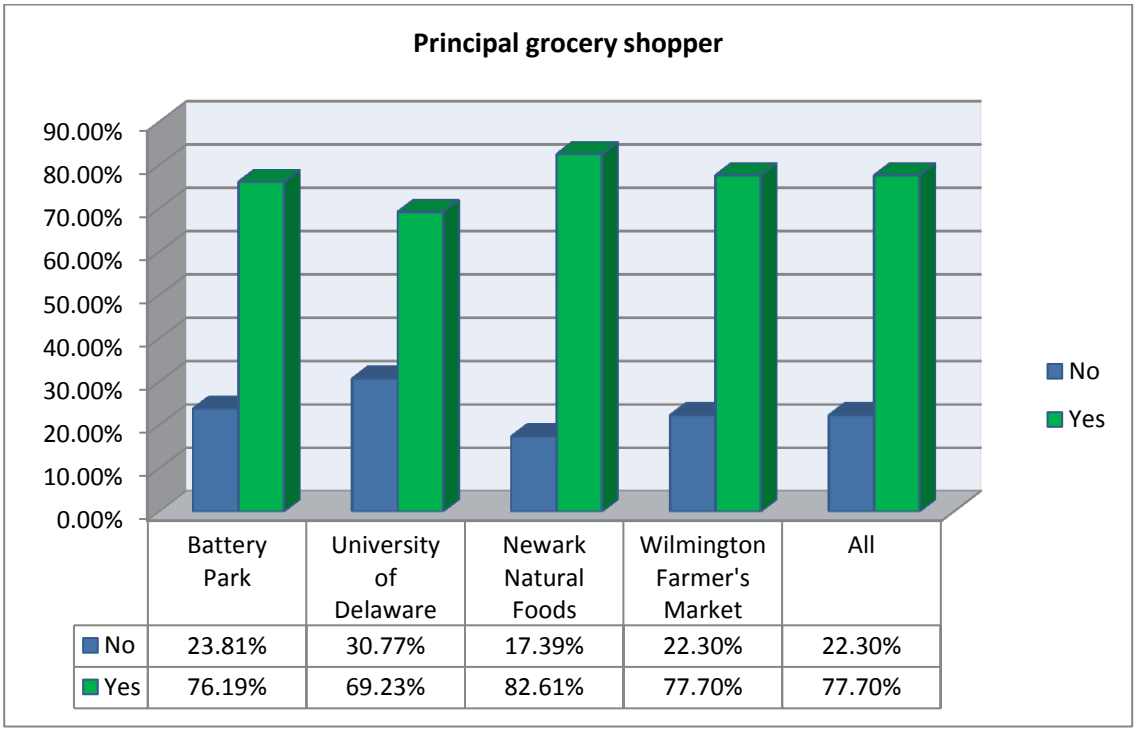


Figure 4.18: Respondents' frequency of reading food labels

Figure 4.19 shows the composition of subjects who act as the principal grocery shoppers for their households. More than 75% of respondents in three survey locations did most of the grocery shopping for their households except University of Delaware respondents, where 69.23% acted as the principal grocery shoppers. In total, 77.7% of respondents indicated doing most of the household grocery shopping.

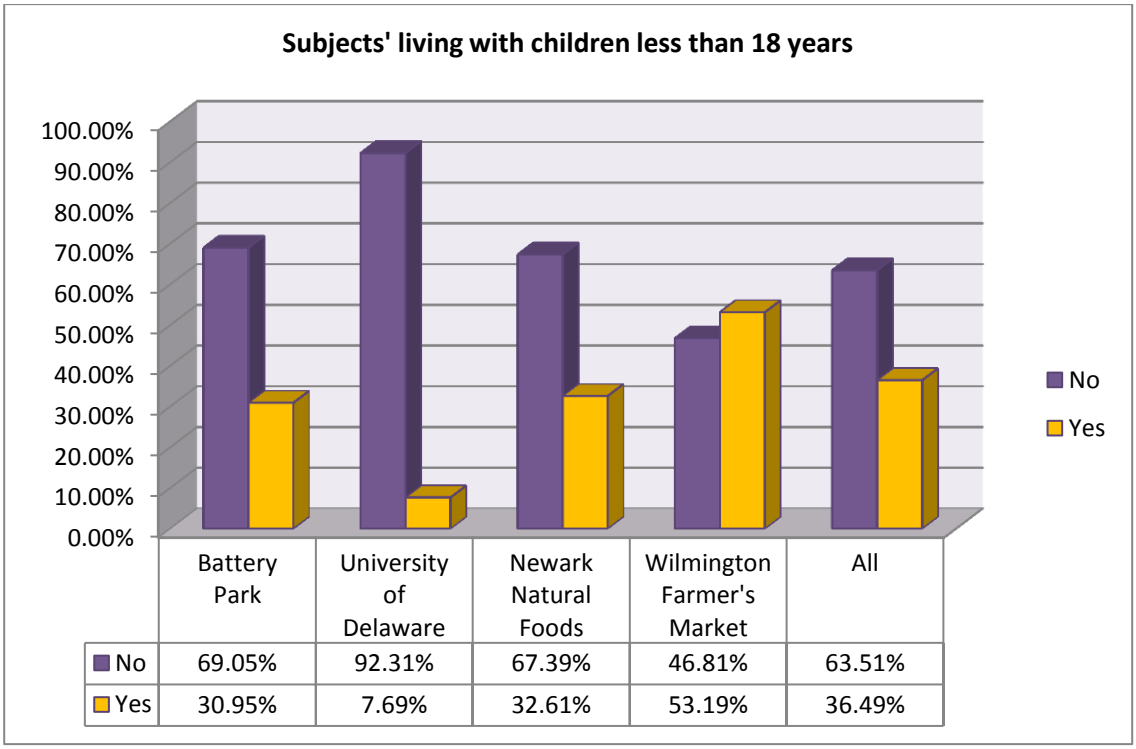


	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
No	23.81%	30.77%	17.39%	22.30%	22.30%
Yes	76.19%	69.23%	82.61%	77.70%	77.70%

Figure 4.19: Principal grocery shoppers for household

Subjects' responses to whether they lived with children less than 18 years are captured in Figure 4.20. For respondents of Wilmington Farmer's Market, more than half of them lived with children under 18 years of age. More than 65% of respondents in the other three locations did not live with children below 18 years. In total, 63.51%

of respondents did not live with children below 18 years, compared with 36.49% who did.



	Battery Park	University of Delaware	Newark Natural Foods	Wilmington Farmer's Market	All
No	69.05%	92.31%	67.39%	46.81%	63.51%
Yes	30.95%	7.69%	32.61%	53.19%	36.49%

Figure 4.20: Respondents' who live with children less than 18 years

4.1.4 Description of Data and Statistics

Table 4.17 details the descriptive statistics of all the variables included in the questionnaire.

Table 4.17: Definition of variables and descriptive statistics

Variable	Description	Mean	Std Dev
conventional	Frequency of taking conventional milk, 1=never to 4=frequently	2.94	1.10
gallons	Gallons of milk purchased in a week, 1=half to 4=more than two	1.97	1.04
health	Milk purchase decisions based on health, 1=never to 4=always	3.01	0.94
environment	Milk purchase decisions based on environment, 1=never to 4=always	2.75	0.90
ethical	Milk purchase decisions based on ethics, 1=never to 4=always	2.37	1.12
animal	Purchase decisions on based animal welfare, 1=never to 4=always	2.60	1.02
cost	Milk purchase decisions based on food cost, 1=never to 4=always	3.04	0.91
knowledge	Knowledge of cloning, scale from 1=have none to 4=excellent	2.19	0.91
opinion	Opinion of cloning, 1=negative 0= have none/neutral/positive	0.36	0.62
allow	1 if subject wants milk from cloned cows allowed; 0 otherwise	0.66	0.48
label	1 if subject wants milk from cloned cows labeled; 0 otherwise	0.88	0.33
grocery	1 if subject does most of household grocery shopping; 0 otherwise	0.78	0.41
child	1 if subject lives with children less than 18 years ; 0 otherwise	0.36	0.48
read	Frequency of reading food labels, scale from 1=never to 4=always	3.16	0.83
liberal	Personal disposition, 1 if liberal, 0 if moderate or conservative	0.39	0.49
male	1 if subject is male; 0 otherwise	0.49	0.50
white	1 if subject's ethnicity is white; 0 if nonwhite	0.70	0.46
college	1 if subject had some college education or more; 0 otherwise	0.73	0.45
income	Household income, in thousands	66.90	55.19
age	Age, in years	41.88	15.78

4.2 Regression Analysis

The Tobit regression model was used to determine the relationship between respondents' WTA (compensations requested) and other independent variables. Specifically, respondents' WTA was regressed on their frequency of drinking conventional milk, quantity of milk purchased weekly, factors that influenced their food purchasing decisions, and their knowledge and opinion of cloning. Other independent variables also included respondents' opinion on whether milk from cloned cows should be allowed and labeled, whether they were the principal grocery shoppers, frequency of reading food labels, personal disposition and demographic variables.

The amounts respondents' were willing to take as compensation to exchange a cup of conventional milk for the milk that may or may not have originated from cloned cows were between $0 and $5. These WTA values give an indication of respondents' degree of acceptance or aversion to milk from cloned cows. The WTA variable was thus censored in the regression model to take into account potential lower bound below $0 and upper bound beyond $5. The variance portion of the model was considered and checked for heteroscedasticity as in Bernard and Berarnd (2009), the existence of which would render the estimates inefficient (Haefele and Loomis, 2001). The model was estimated using maximum likelihood with the QLIM procedure in SAS.

4.3 Model and Hypothesis for WTA

4.3.1 Econometric Model

The final econometric model to determine the relationship between subjects' stated offer of compensation and the independent variables was:

$$y_i^* = \beta_0 + \beta_1 conventional_i + \beta_2 gallons_i + \beta_3 health_i + \beta_4 environment_i + \beta_5 religion_i + \beta_6 ethical_i + \beta_7 animal_i + \beta_8 cost_i + \beta_9 knowledge_i + \beta_{10} opinion_i + \beta_{11} allow_i + \beta_{12} label_i + \beta_{13} grocery_i + \beta_{14} child_i + \beta_{15} read_i + \beta_{16} disposition_i + \beta_{17} male_i + \beta_{18} white_i + \beta_{19} college_i + \beta_{20} income_i + \beta_{21} age_i + \beta_{21} loc1_i + \beta_{21} loc2_i + \beta_{21} loc3_i + \varepsilon_i$$

where

loc1, *loc2* and *loc3* are location variables for Wilmington Farmers' Market, Newark Natural Foods and University of Delaware respectively.

$\varepsilon_i \sim N(0, \sigma^2(\exp(z_i \gamma))$.

and where z_i represents a second vector of relevant independent variables, γ is a second vector of coefficients and σ^2 is the variance when $z_i \gamma$ is zero.

$z_i \gamma = \gamma_1 \text{gallons} + \gamma_2 \text{grocery} + \gamma_3 \text{child} + \gamma_4 \text{read} + \gamma_5 \text{liberal} + \gamma_6 \text{animal}$

4.3.2 Hypothesis

Expectations *a priori* of all regressors were hypothesized and are detailed in Table 4.18, together with the expected signs. The signs are the anticipated direction of the outcomes of each of the independent variables.

Table 4.18: A priori parameter expectations hypothesized for all covariates

Variable	Parameter	Hypothesized sign	Variable	Parameter	Hypothesized sign
conventional	β_1	+/−	label	β_{12}	+/−
gallons	β_2	+	grocery	β_{13}	+
health	β_3	+	child	β_{14}	+
environment	β_4	+	read	β_{15}	+
ethical	β_6	+	disposition	β_{16}	+
animal	β_7	+	male	β_{17}	−
cost	β_8	−	white	β_{18}	−
knowledge	β_9	−	college	β_{19}	−
opinion	β_{10}	−	income	β_{20}	−
allow	β_{11}	−	age	β_{21}	+

It has been noted that consumers who take organic milk very often are less willing to consume milk from cloned animals compared with others who take less organic milk (Lusk 2008). In the case of conventional milk however, establishing a definitive relationship between regular consumers and their attitudes toward cloned animal products may not come across very lucidly. It is thus hypothesized that the sign could be either positive or negative. More specifically, regular drinkers of conventional milk could have demanded little compensation to make the exchange for the potentially cloned cow milk, or may have demanded more.

Regarding the volume or quantity of milk purchased weekly, it is intuitive to suggest that consumers who purchase more gallons weekly will show a stronger

concern about their consumption of milk from cloned cows. The explanation could be the rather high likelihood that large volumes of milk purchased weekly are not consumed by just the individual purchasing it, but most probably the entire family or household. This might demand a greater caution about the type of milk purchased for consumption. Therefore, the expectation is that the more gallons of milk consumers' purchase weekly, the less likely they are to accept milk from cloned cows. The expected sign is positive, signifying a greater compensation for such consumers.

It is expected that consumers for whom health concerns take precedence in their food choices will in all likelihood be more concerned about milk from cloned cows, even though it is acknowledged that their reaction will depend on the extent to which they deem food products from biotechnology as safe. It is still expected, regardless, that consumers who are very conscious about health in their food options will have a low willingness to accept milk from cloned cows, with the anticipated sign being positive to signify more compensation needed.

Animal cloning may not directly pose identifiable challenges to the environment although there are concerns of unanticipated environmental impacts (Fiester 2005). Consumers mindful of the environment when making food purchases might be concerned about the overall impact of animal cloning on the ecosystem. Such persons are not expected to support the technology and will therefore be more unwilling to accept food products from cloned animals. The anticipation is that of a positive relationship between persons who are strongly influenced by the environment

in their food purchasing choices and the expected compensation they required to drink the possibly cloned cow milk.

Consumers strictly guided by ethics in their food choices tend to take very firm positions on issues they perceive to be right or wrong. People who have a negative moral opinion of animal cloning are unlikely to patronize products from cloned animals. This was confirmed by Brooks and Lusk (2012) who found that consumers who believe animal cloning is morally wrong were willing to pay much more for products from non-cloned animals. It is thus tenable to expect consumers who are especially concerned about ethics and morality to have a lower likelihood to accept milk from cloned cows. The expected sign is positive to signify a higher compensation for such category of consumers.

Persons concerned with animal welfare issues will no doubt be strongly opposed to the concept of animal cloning. Animal welfare lobbyists have cited the poor health of cloned animals, high incidence of abnormalities and the high mortality rate associated with cloned animals to back their stance. The Humane Society of the United States (2010) report that in addition to the challenges that plague surrogate mothers and their cloned babies, there is not enough regulation that targets the welfare of such animals. Animal rights and welfare proponents are thus expected to be very unwilling to consume food products from cloned animals. The anticipation is thus a positive relationship between persons who regularly make food purchase decision with a strong consideration for animal welfare concerns and a higher compensation to accept milk from a cloned cow.

Consumers whose food purchase decision is strongly influenced by the cost of food are generally not expected to fuss about technology or production process provided it guarantees a reasonable price and it is certified safe. It is thus expected that this cohort of consumers will be more accepting of milk from cloned cows especially if it commands a lower price. The expected sign is thus negative to indicate relatively low compensation demanded and consequently a higher willingness to accept.

Knowledge or information about food products and its processing exerts a great influence on consumer purchasing behavior. Only a third of consumers who obtained initial information about animal cloning thought of it as a bad idea in a study by Butler, Wolf and Bandoni (2008), in contrast with half of consumers concluding it was a bad idea and who had not received prior information on cloning. Consumers who have a broader familiarity about biotechnology tend to see it in a more positive light (Faass & Lahr 2007, Govindasamy et al 2008 and Jones et al 2010). The expectation therefore is that consumers who are knowledgeable about animal cloning might not have a problem accepting food products from cloned animals. It is thus expected that an increased level of knowledge of animal cloning will be negatively related to the required compensation to drink the possibly cloned cow milk.

It is intuitive to propose that consumers who view cloning positively will readily accept milk from cloned cows. Conversely, consumers whose opinion is negative towards animal cloning are unlikely to accept products from cloned animals. Consumers with a neutral opinion may be willing to accept products from cloned animals since they may not have formed a strongly negative view about such products.

The opinion variable is modelled with a '1' for respondents who view cloning negatively and '0' for all the other categories. The sign is consequently anticipated to be positive to indicate that consumers who view cloning negatively required higher compensations compared to those who had no views or held other opinions.

Americans have been noted to be more open towards food products from cloned animals. About 60% of consumers have been noted to have the likelihood of purchasing food products from cloned animals (Storey 2006). It is thus expected that at least half of respondents will affirm the introduction of milk from cloned cows into the market. It is also expected that consumers who are comfortable with the introduction of milk from cloned cows in the mainstream food supply will be more willing to accept the product. Consequently, the expectation is that the variable *allow* will have a negative sign to indicate that respondents who wanted milk from cloned cows allowed were willing to accept lower compensations than those who opposed its introduction in the market.

Lusk (2008) noted that the majority of people supported a mandatory labeling for products from cloned animals even if it led to increases in price by as much as 30%. With many consumers thinking it a right to be apprised of what they purchase and consume, the expectation is that the majority of subjects will prefer that milk from cloned cows is labeled. It is a challenge however predicting whether respondents who favor a labeling policy for cloned animal products are willing to accept and consume them or, would rather wish to identify these products just to avoid them altogether (Huffman et al, 2003). The expected sign could either be positive or negative.

It has been noted that consumers who are primary shoppers for their household are more likely to disagree that animal cloning is unacceptable (Brooks and Lusk, 2011). Perhaps familiarity with food products on grocery shelves makes primary shoppers less suspicious and more confident about the safety of food products they purchase. In the instance of milk from cloned cows, they are expected to be more willing to accept it than non-regular shoppers. The sign for its coefficient is expected to be negative indicative of the willingness of people in this category to accept less compensation than non-primary shoppers.

Naturally, adults who live with children are anticipated to be more cautious about the types of food they consume at home. Brooks and Lusk (2011) have noted that people who live with children less than 12 years in their household have a lower likelihood of believing that meat from cloned animals are safe. It is thus expected that people who live with children less than 18 years will be less willing to accept milk from cloned animals. The sign is hypothesized to be positive to signify a greater compensation requested by respondents living with children rather than those who do not.

For consumers who constantly read food labels, nutritional and processing facts of what is consumed might be details of interest. Reading nutritional information in this case is helpful especially for consumers in this category to identifying food products that suit their particular nutritional preferences. Concerning novel food products from biotechnology, a majority of consumers have been observed to avoid genetically modified products where the product is labeled as such (Huffman et al

2003). The FDA is not mandating the labeling of food products from cloned animals if they eventually enter the market. However, should there have been a mandatory labelling regime for cloned animal products, it can be intuitively suggested that consumers who habitually read food labels will be less likely to purchase them. Such consumer cohorts are thus expected to have a low willingness to accept milk from cloned cows. The expected sign was consequently hypothesized to be positive.

Liberals and conservatives have tended to be on opposite sides of the spectrum on a range of social issues. Undoubtedly, these two extremes might exercise different views about food products from biotechnology. Govindasamy et al (2008) found that South Koreans who had more liberal leanings tended to be more accepting of animal based genetic modifications. Puduri et al (2005) reported that liberals were 15% more likely to approve animal-based genetic modification compared to centrists and conservatives. However, Faass and Lahr (2007) noted from their study that Republicans seemed more accepting of genetically modified products than people of other political affiliation. In the United States, the Republican Party garners widespread support from conservatives. In spite of the divergence in findings, conservatives are expected to be more accepting of milk from cloned animals than liberals. The variable was modeled as '1' for liberals and '0' for conservatives and moderates. The sign is thus expected to be positive to indicate that liberals are less accepting of milk from cloned cows and therefore require a greater compensation compared to conservatives and moderates.

A number of previous studies have observed females to be less supportive of products from cloned animals (Jones et al 2010, Lusk 2008 and Butler, Wolf & Bandoni 2008). Brooks and Lusk (2012) also found that females were willing to pay $0.32 more to avoid beef from cloned animals compared to males. Following the observations of previous research, females are expected to be the more unwilling party to accept milk from cloned animals rather than males. The sign is hypothesized to be negative suggesting that males requested less compensation to exchange for the milk that could possibly have originated from cloned cows, than females.

With regard to how different ethnic groupings perceive products from biotechnology, Hossain et al (2002) found that Caucasians were 30% more likely to approve of plant-based genetic modifications than other ethnicities. Following this, whites are expected to be more embracing of products from cloned animals than people of other races. The sign is hypothesized to be negative to indicate that whites required less compensation than other ethnicities.

Jones et al (2010) found that respondents who did not have very strong educational backgrounds were 33% more likely to pay for clone-free labeled milk compared to those who had a higher level of education. Faass and Lahr (2007) also noted a similar trend that highly educated people and those who had some familiarity with biotechnology have a more positive opinion of it than relatively less educated people and those who are not very knowledgeable about biotechnology. Higher education thus tends to be more positively correlated with greater willingness to accept products from biotechnology, and in this case milk from cloned cows. It is thus

hypothesized that the sign for this variable will be negative, suggesting that persons with college backgrounds required less compensation to exchange for the possibly cloned cow milk than those with high school backgrounds.

Hossain et al (2002) observed that household income differences did not appear to strongly influence acceptance of food products from biotechnology. Nevertheless, they found that consumers within the middle income bracket were more willing to accept GM vegetables than those in the lowest and highest income groups. Another study also found high household income to be associated with a high approval of biotechnology (Puduri et al, 2005). If household income has any significant effect on consumers' willingness to accept milk from cloned cows, then the expectation is that people with relatively high income would be more inclined to accepting it than those in a lower household income bracket. The sign is hypothesized to be negative.

In terms of age, younger people may be generally more accepting of products from biotechnology than relatively older people. This supposition is consistent with a study by Hossain et al (2002) who found that younger consumers were more willing to purchase GM food products. It is thus expected that people within lower age groups will more readily accept milk from cloned cows compared with people in higher age groups. The sign is thus hypothesized to be positive to indicate older respondents requesting greater compensation for the possibly cloned cow milk.

Chapter 5

RESULTS

5.1 Sign ranked test for Dependent Variable

The output from the signed rank test is displayed in Table 5.1.

Table 5.1: Signed ranked test for dependent variable

Survey Location	Mean	Statistic (S)	p Value
University of Delaware	1.44	33	0.001
Battery Park	2.19	175.5	<.0001
Newark Natural Foods	3.18	315	<.0001
Wilmington Farmer's Market	2.86	430.5	<.0001
All	2.65	3220.5	<.0001

The signed rank test is a non-parametric alternative to the t-test for observations that are not normally distributed, as is the case of the dependent variable *offer*. According to the signed rank test statistics in Table 5.1, the dependent variable in all four survey locations was significantly different from zero, evidenced by the highly significant p-values. For the pooled dataset, the mean of $2.65 was also significantly different from zero ($p<.0001$). This depicts that in the general sense, subjects were not willing to consume the possibly cloned cow milk unless they were compensated. From a more

practical market situation, consumers might be willing to consume milk from cloned cows if a price discount is available. Overall, the observation was that when presented with the milk that may have originated from a cloned cow with the possibility of consumption, consumers differentiated between that and conventional milk in spite of the FDA's conclusion that the milk from cloned cows is as safe as milk from conventionally bred cows. In light of this, issues such as consumer trust and confidence in regulatory institutions mandated with ensuring food safety are brought to the fore.

5.2 Results of WTA Model

Parameter estimates for subjects' WTA from the Tobit Regression model was presented in Table 5.3.

Table 5.2: Tobit Regression results of subjects' WTA and predictor variables

Parameter Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**
Intercept	1	-0.427351	1.901888	-0.22	0.8222
conventional	1	**0.445827**	0.097856	4.56	<.0001
gallons	1	-0.252582	0.196423	-1.29	0.1985
health	1	0.167041	0.193774	0.86	0.3887
environment	1	**2.537054**	0.236862	10.71	<.0001
ethical	1	-0.220943	0.220704	-1	0.3168
animal	1	**-1.270205**	0.275998	-4.6	<.0001
cost	1	**-0.504468**	0.074031	-6.81	<.0001

Table 5.3 continued

Parameter Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**
knowledge	1	**-0.758178**	0.267311	-2.84	0.0046
opinion	1	**3.81155**	0.51214	7.44	<.0001
allow	1	**-0.452507**	0.147158	-3.07	0.0021
label	1	**1.333006**	0.36062	3.7	0.0002
grocery	1	**-2.725972**	0.305587	-8.92	<.0001
child	1	**1.116971**	0.348075	3.21	0.0013
read	1	**1.174203**	0.269019	4.36	<.0001
liberal	1	**-1.313844**	0.557349	-2.36	0.0184
male	1	**-1.453446**	0.23391	-6.21	<.0001
white	1	-0.230587	0.18945	-1.22	0.2236
college	1	**-1.156798**	0.281403	-4.11	<.0001
income	1	**-0.019044**	0.002185	-8.72	<.0001
age	1	0.007431	0.009084	0.82	0.4133
loc1	1	**0.896495**	0.294266	3.05	0.0023
loc2	1	**2.087386**	0.723207	2.89	0.0039
loc3	1	**-0.948042**	0.500046	-1.9	0.058
_Sigma	1	8.267754	6.006351	1.38	0.1687
_H.gallons	1	3.17713	0.616591	5.15	<.0001
_H.grocery	1	5.573989	1.203119	4.63	<.0001
_H.child	1	-7.661712	1.284642	-5.96	<.0001
_H.read	1	-2.895938	0.702442	-4.12	<.0001
_H.liberal	1	5.621476	0.940861	5.97	<.0001
_H.animal	1	-1.44398	0.42965	-3.36	0.0008

Note: Bold estimates are significant at the 10% level or lower.

5.2.1 Variables significant in the model

A number of variables emerged as having a strong association with subject's willingness to accept the potentially cloned cow milk, and this gives a general picture of consumer characteristics that influence their acceptance of milk from cloned cows.

How often subjects consume conventional milk (*conventional*) was found to be significant at the 1% level. The variable was hypothesized to be either positive or negative, an indication that a higher frequency of consuming conventional milk would be associated with either a low or high willingness to accept milk from cloned cows. The resulting estimate of 0.45 was positive, and showed that as the frequency of consuming conventional milk increased by each level, subjects' requested $0.45 more compensation. Thus, the more frequently a person consumed conventional milk, the less willing they were to accept the potentially cloned cow milk.

The variable *environment* turned out significant at the 1% level. As expected, the coefficient has the hypothesized positive sign, an indication that subjects who strongly consider the environment in their food choices are less willing to accept milk from cloned cows. From the estimate, it can be interpreted that as the frequency of environmental concerns in food choices increased by each level, the compensation requested by subjects to consume the potentially cloned cow milk increased by $2.54.

The variable *animal* considered how often consumers' food purchasing decisions are based on animal welfare concerns. The sign was hypothesized to be positive. Surprisingly, the estimate has a negative sign and was significant at the 1% level. This outcome is incongruent with the logical intuition that consumers who are

concerned about animal welfare issues will be averse to the technology of animal cloning, especially following reported compromises to the health of cloned animals. The negative coefficient of 1.27 associates the variable *animal* with a high willingness to accept, indicating that as the frequency of consumers' food choices based on animal welfare concerns increased by each level, consumers' compensation to drink the potentially cloned cow milk decreased by $1.27. In attempting to explain this, consideration can be given to the possibility that consumers who rate animal welfare issues highly in their food choices may view the level of concern about animal cloning differently once it is for milk purposes rather than for beef. Also, there is some likelihood that consumers concerned with animal welfare issues do not view a healthy cloned cow any differently from a healthy conventionally bred cow.

The variable *cost* considered how subjects' food choices were influenced by the cost of food. The resulting coefficient has a negative sign and is consistent with the hypothesis. As the frequency of food choices based on cost concerns increased by each level, subjects requested $0.50 less compensation to consume the potentially cloned cow milk. Consumers who often consider food cost are therefore more likely to accept milk from cloned cows.

The variable *knowledge* was also significant at the 1% level. The sign was negative as hypothesized. As subjects' knowledge on animal cloning increased at each level, they demanded 0.76 less compensation. This confirms that consumers familiar with biotechnology tend to view it more positively (Faass & Lahr 2007, Govindasamy

et al 2008 and Jones et al 2010). The more knowledgeable consumers are about animal cloning, the more willing they would be to accept milk from cloned cows.

Consumers' opinion of animal cloning was transformed as a dummy variable with the value '1' assigned as 'having a negative opinion', and '0' for all other opinions (have none, neutral and positive). The variable *opinion* was significant at the 1% level. The coefficient has the anticipated positive sign. With the relatively high estimate of 3.81, consumers who held a negative opinion of animal cloning requested $3.81 additional compensation to consume the possibly cloned cow milk compared to those who held other opinions. The fact that the *opinion* estimate recorded the highest absolute value in the model amplifies how strongly consumers' opinion on animal cloning exerts a tremendous influence on their acceptance for the technology.

One of the very significant concerns of consumers regarding animal cloning is whether products from cloned animals should be allowed into the mainstream food supply. The variable *allow* captured consumers' responses in this regard. The sign was expected to be negative; an indication that subjects who wanted milk from cloned cows allowed would have a greater willingness to accept than those who did not. With an estimate of -0.45, the sign was consistent with the hypothesis and suggested that consumers who thought milk from cloned cows should be allowed requested $0.45 less compensation. The variable *allow* is thus associated with a higher willingness to accept milk from cloned cows.

Arguably, one of the very contentious issues regarding products from biotechnology has been the issue of labeling. Consumers gave their views on whether

milk from cloned cows should be labeled, which was captured as the variable *label*. The coefficient turned out positive. Consequently, it can be inferred that the variable *label* has a negative relationship with consumers' willingness to accept milk from cloned cows, suggested by its positive estimate of 1.33. Thus, consumers who wanted milk from cloned cows labeled accepted $1.33 more compensation to consume the milk that may have originated from cloned cows. This may be an indication that those who clamor for a labeling regime for milk from cloned cows might want to see the labels in order to avoid taking such products altogether, an assertion which syncs with previous research findings (Lusk 2008, Huffman et al, 2003). Alternatively, consumers who do not insist that milk from cloned cows should be labeled are obviously open to the product.

The behavior of principal grocery shoppers was also captured in the model as *grocery*. The variable was hypothesized to have a negative sign to signify a higher willingness to accept milk from cloned cows by principal grocery shoppers. The variable *grocery* was found to be highly significant at the 1% level. The negative estimate from the model shows that consumers who did much of the household grocery shopping requested $2.73 less compensation to consume the possibly cloned cow milk. Thus, the characteristic of frequently doing household groceries is associated with a higher willingness to accept milk from cloned animals.

Consumers were asked whether they lived with children less than 18 years and this was included in the model as *child*. The variable was found to be significant at the 1% level. According to the estimate from the model, consumers who lived with

children under 18 years offered to accept $1.12 more compensation before drinking the potentially cloned cow milk. The finding suggests that consumers with children have lower willingness to accept milk from cloned cows. This is consistent with the hypothesis and past studies that associate living with children in the same household with a lower likelihood of accepting products from cloned animals.

Factored in the model was how often consumers read food labels. The variable was found to be significant at the 1% level. The estimate of *read* was 1.17, and this suggests that as the frequency of reading food labels increased by each level, the compensation requested by consumers to drink the possibly cloned cow milk increased by $1.17. This is an indication that a high frequency of reading food labels is associated with a lower willingness to accept milk from cloned cows and is consistent with the hypothesis.

Subjects' disposition which was captured by the variable *liberal* turned out significant. The negative estimate was contrary to the hypothesis that suggested that persons who identified themselves as liberals were less willing to accept milk from cloned animals compared to moderates and conservatives. The estimate however indicates that liberals accepted $1.31 less compensation compared to moderates and conservatives. Consumers who identify themselves as liberals are thus more willing to accept milk from cloned cows.

One of the demographic variables found significant was respondents' gender, which was represented by the variable *male*. The estimate of the variable turned out to be significant at the 1% level, with the expected negative sign. It can thus be deduced

that males offered to accept $1.45 less compensation to consume the possibly cloned cow milk compared to females. The implication is that males have a higher willingness to accept milk from cows, concurring with the hypothesis and findings from previous researches.

Another demographic variable found significant was *college*. Significant at the 1% level, the variable *college* had the expected negative sign. The absolute value of the estimate was 1.16, and this signifies that subjects who at least had a college education were willing to accept $1.16 less compensation to consume the possibly cloned cow milk compared with subjects who had at most a high school level education. This is consistent with the hypothesis and confirms that consumers who have at least a college background are more accepting of milk from cloned cows.

Income was found to be significant at the 1% level. The variable *income* was measured in a thousand dollars, and the estimate from the model was -0.019 which has the expected negative sign as hypothesized. This means that with a $10,000 increase in income, the compensation required by subjects to consume the possibly cloned cow milk decreased by 19 cents. This confirms findings from previous literature that consumers within a higher income bracket have a greater willingness to accept milk from cloned cows.

Location variables were included in the model to check location effects on WTA. Battery Park was used as the reference location. Compared with Battery Park, Wilmington Farmer's Market respondents accepted 89.65 cents more in compensation, represented by the variable *loc1*. As expected, Newark Natural Foods' respondents

had $2.09 more compensation than Battery Park respondents, represented by the variable *loc2*. The variable *loc3*, which represents the University of Delaware, suggests that University of Delaware respondents requested 94.8 cents less in compensation than Battery Park respondents. These results were expected and give an indication of the relative differences in subjects' compensation by location.

5.2.2 Variables not significant in the model and variances

A few variables did not turn out statistically significant in the model and they are *gallons, health, ethical, white* and *age*. There was little statistical evidence that these variables exerted significant influence on consumers' compensation demanded to drink the possibly cloned cow milk. Rather surprising was the insignificance of the variable *health* which considered how often consumers' made food purchasing decision based on health reasons. This is against the backdrop that health concerns command some paramountcy for many consumers in their food choices.

Adjustments were made for heteroscedasticity for some of the variables, specifically *gallons, grocery, child, read, liberal* and *animal*. All six variables had concerns with heteroscedasticity, as evidenced from their significance in the variance portion of the model.

The variable *gallons* in the variance portion was positive and significant, suggesting that a wider variability in subjects' compensation at each level of the variable.

The variable *grocery* was also found significant and had a positive effect on variance. This is an indication that subjects who were principal grocery shoppers for their households exhibited a wider variance in the compensations they demanded to take the possibly cloned cow milk. Therefore, some subjects who were also principal grocery shoppers for their households demanded high compensations, whilst some others demanded a low compensation. A plausible explanation is the likelihood that some principal grocery shoppers may be apprehensive with milk from cloned cows especially if they shop for an entire family, whereas others may not differentiate much between that and regular milk.

Variables *child*, *read* and *animal* all had negative signs in the variance portion of the model. Subjects who live with children less than 18 years and those who often read food labels were found to have a rather limited distribution with regard to compensation demanded to drink the possibly cloned cow milk. Put another way, subjects who lived with children less than 18 years and those who often read food labels showed a narrower variability with the compensations they demanded to consume the possibly cloned cow milk. It can be inferred thus that consumers who live with children and those who read food labels frequently may have a more homogeneous position on animal cloning than those who do not live with children and infrequently read food labels. Similarly, subjects who often considered animal welfare in their food choices had a much narrower variability.

Another variable which also turned out significant in the variance portion of the model was *liberal*. The significant positive coefficient of *liberal* shows that

subjects who thought of themselves as liberal exhibited a wider variability in the compensation they requested to consume the possibly cloned cow milk compared with subjects who identified their disposition as moderate and conservative. This suggests that among subjects who viewed themselves as liberal, some were willing to accept very high compensation, whereas others would demand very little compensation to take the milk that may or may not have come from cloned cows. This shows that moderates and conservatives generally have a more fixed opinion of animal cloning than liberals do.

5.3 Results from Consumer Welfare

This section presents results of changes in consumer welfare if milk from cloned cows is introduced. The values used in the implementation of this framework are detailed in Table 5.3.

Table 5.3: Variables in welfare model and their assigned values

Variable	Value
P^{NL}	\$4.40
P^{R}	\$4.40
d	Subject's offer / compensation amount in dollars
Ψ	0.01, 0.05 & 0.10

Existing average milk prices for Delaware in May 2013 were used, as indicated in Table 5.3. Milk from cloned cows is not expected to command a different price

from conventional milk, since consumers cannot tell the difference. This explains why the price of the two types of milk is both given as $4.40. The parameter Ψ represents the probability that the unlabeled milk actually originates from a cloned cow. The proportion of cloned cattle vis-à-vis conventionally bred cattle is anticipated to be very small especially at the inception stages following the introduction of milk from cloned cows. Table 5.4 summarizes the mean change in consumer surplus in that instance with the different probabilities (1%, 5% and 10%) that the milk actually originated from a cloned cow.

Table 5.4: Mean changes in consumer surplus

	Average change in consumer surplus $\Delta CS(NL\text{-}R) / n$		
Survey Location	**Probability = 0.01**	**Probability = 0.05**	**Probability = 0.10**
University of Delaware	-0.014	-0.072	-0.144
Battery Park	-0.022	-0.109	-0.219
Newark Natural Foods	-0.032	-0.159	-0.318
Wilmington Farmer's Market	-0.029	-0.143	-0.286

Mean changes in consumer surplus are detailed in Table 5.4. Across all four survey locations, mean changes in consumer surplus were negative, and the values decreased with an increasing probability that the unlabeled milk is actually from a cloned cow. This suggests that consumers will generally experience losses in their welfare if milk from cloned cows is introduced.

Average change in consumer surplus was lowest among subjects from the University of Delaware compared with the other three locations and at all the different probabilities. This is an indication that University of Delaware respondents did not differentiate much between conventional milk and the uncertain milk which could potentially be from a cloned cow. On the flip side, Newark Natural Foods registered the highest negative change in consumer surplus for all the different probabilities. The trend observed is that progressively higher probabilities that the uncertain milk is from a cloned cow is associated with greater negative mean changes in consumer surplus. For instance, when the probability increased from 1% to 5% that uncertain milk could actually have originated from a cloned cow, mean change in consumer surplus decreased from -0.029 to -0.143. Welfare losses will thus vary across different consumer cohorts. Consumers who are more averse to milk from cloned cows will experience greater welfare losses as would be the case if they strongly believe there is a high possibility that milk not labeled as originating from a clone cow could actually have come from one.

Chapter 6

CONCLUSION AND RECOMMENDATION

This final section gives the conclusion to the study and considers the implication of the results. It ends with a sub-section on the study's limitations and recommendations.

6.1 Conclusion

Similar to the advent of genetically modified foods in the marketplace, consumers will be unable to tell whether the milk they purchase is from a cloned cow or simply regular milk from a conventionally bred cow whenever milk from cloned cows eventually enter the food supply. This follows the FDA's ruling on products from cloned animals subsequent to its risk assessment, which revealed that food products from cloned animals are as safe as that from conventionally bred ones and for which reason mandatory labeling is not required. This ruling effectively puts a future introduction of food products from cloned animals in a rather contentious position that has potential ramifications including ineffective markets and welfare reduction depending on consumer reaction.

This study therefore sought to determine consumer response to products from cloned animals, more specifically milk from cloned cows. In greater detail, the study investigated consumers' acceptance of milk from cloned cows, examined consumers'

opinions and knowledge of cloning, their views on labeling and whether milk from cloned cows should be allowed. Additional research interests included examining consumer attributes that influence their acceptance of milk from cloned cows as well as consumer welfare impacts from a future introduction of milk from cloned cows. Findings to these objectives were expected to mesh into a big picture showing consumers' perspectives to milk from cloned cows.

Simulating a real market scenario, a field experiment was conducted which employed the Becker-de-Groot Marschak mechanism to determine consumers' willingness to accept (WTA) milk from cloned cows. The WTA approach has been thought to mimic market conditions because it affords consumers the option of accepting products if they are compensated with lower prices (Lusk et al 2004). Subjects were asked the minimum compensation between $0 and $5 they were willing to accept to exchange a cup of conventional milk for milk that may or may not have originated from cloned cows. The novelty of this design is its close similitude to the real market environment when milk from cloned cows eventually enter the market, since consumers cannot tell a regular milk product from one that may have originated from a cloned cow. The minimum compensations requested by subjects offer a broad overview of consumers' acceptance of milk from cloned cows. Additionally, regressing the WTA values (compensations) on variables related to cloning and demographics gives an indication of consumer attributes and characteristics that influence their acceptance of milk from cloned cows.

6.1.1 Results and Implications

The mean compensation requested by subjects was found to be significantly different from zero, implying that subjects were willing to consume the milk that may have originated from cloned cows if they were compensated. It is obvious that subjects differentiated between conventional milk and the possibly cloned cow milk regardless of the FDA's conclusion of safety. This was the case even though the experimenters narrated to each subject prior to the experiment the conclusion arrived at by the FDA, that meat and milk from cloned animals are as safe to eat as that from conventionally bred animals.

Analysis of some variables related to cloning indicated that subjects generally did not have a positive opinion of animal cloning. Less than 10% of all respondents held a positive view of cloning, whereas 36% of respondents thought the technology was negative. More than half of respondents however had no opinion at all about animal cloning or held a neutral opinion. The largest group of consumers indicated having fair knowledge of animal cloning; less than a quarter of respondents stated they had no prior knowledge of the technology. Regardless of opinions about animal cloning, respondents showed great flexibility about allowing milk from cloned cows into the marketplace. A little over 65% of all respondents wanted milk from cloned cows allowed. This is ample demonstration that consumers are more open to other options in food supply. An overwhelming proportion preferred having milk products from cloned animals labeled as such.

The tobit regression output shows consumer characteristics and demographic attributes that influence their acceptance of milk from cloned cows. Subjects who often purchased conventional milk were found to be less accepting of milk from cloned cows. Subjects who often made food purchase decisions based on environmental concerns as well those who were influenced by ethics in their food choices were less likely to consume milk from cloned cows. For consumers mindful of the environment, long term impacts of animal cloning on the ecosystem might be a deciding factor in explaining why they might be less willing to accept cloned cow milk. Subjects who often made food decisions based on animal welfare concerns were surprisingly found to be more accepting of milk from cloned cows. It was noted in the discussion that such subjects may view animal cloning more favourably if it is intended for milk purposes rather than for beef. Other consumer attributes which were associated with a greater willingness to accept milk from cloned cows included making food decision based on the cost of food and the characteristic of being knowledgeable about animal cloning. Naturally, subjects who held a negative opinion of animal cloning were less likely to consume milk from cloned cows. The magnitude of the opinion variable was the highest in the model; an indication that consumers' opinions exert a great deal of influence on their willingness to accept cloned animal products. Subjects who often read food labels also had a lower likelihood of taking milk from cloned cows. On the flip side, subjects who wanted milk from cloned cows allowed as well as principal grocery shoppers were more accepting of milk from cloned cows. Liberals were found to be more accepting of milk from cloned cows

compared with moderates or conservatives, even though there was evidence of a much wider variability in compensation requested among subjects who considered themselves liberals.

Some demographic characteristics of subjects also influenced their willingness to accept. Consumers who lived with children less than 18 years were less accepting of cloned cow milk. Males and persons who had at least a college education however were observed to be more accepting of milk from cloned cows. Subjects with higher household incomes also had a greater tendency to consume milk from cloned cows.

From the consumer welfare perspective, findings showed that consumers will experience losses in their welfare if milk from cloned cows were introduced. These welfare losses will vary across different consumer cohorts. Consumers who greatly differentiate between conventional milk and milk from cloned cows would register greater welfare losses, in comparison to those who do not.

Merging these threads of findings, it is evident that in spite of the registered aversion to products from cloned animals by some consumers, the majority are not necessarily opposed to having them in the marketplace. Consumers are however clamouring for labels on milk from cloned cows which will afford them the option of identifying and choosing between milk from cloned cows or the conventional version.

6.1.2 Limitations and Recommendations

An observable drawback to the study is the sampling of subjects from just one state, Delaware. Albeit the sample is considered relatively diverse, it might be a slight overstretch extrapolating study findings to be the case for the entire country.

The experimental design in spite of its novelty had some inherent weaknesses. There were occasions where experimenters were simply overwhelmed by the number of people who showed up at the table wanting to participate. Ultimately, some questionnaires were not fully completed leading to missing observations in the datasets. Looking over 'completed' questionnaires at such times was an arduous task if so many interested persons showed up at a time. In other instances, some participants showed interest because of the modest tokens given for participation. For these participants, their interests laid more in how they could make the most money from the auction process even though that could not be pre-determined aforehand. This might call into doubt whether the stated compensations by such respondents was an actual reflection of their true values. This challenge was isolated to Wilmington Farmer's Market which had a disproportionate number of low income subjects.

A few recommendations from the studies can be proffered. The majority of respondents who partook in the experiment were oblivious to the FDA's conclusion of safety for milk from cloned cows. Consumer education prior to the eventual introduction of milk from cloned cows in the marketplace will come in very helpful. The overwhelming proportion of respondents that preferred labels on milk from cloned cows clearly indicates that consumers are at odds with the FDA's policy on

labeling. Although labeling remains one of the most contentious issues in the cloning debate, the FDA could revisit its decision based on the strong consumer response about labeling food products.

REFERENCES

Aizaki, H., Sawada, M. and Sato, K. (2011). "Consumers' Attitudes toward Consumption of Cloned Beef". The Impact of Exposure to Technological Information about Animal Cloining. Appetite 57 : 459–466.

Becker, G.M., M.H. DeGroot, and J. Marschak. 1964. "Measuring Utility by a Single-Response Sequential Method." *Behavioral Science* 9(3):226-232.

Bernard, J. C., and Bernard D. J. (2009). "What is it about Organic Milk? An Experimental Analysis". American Journal of Agricultural Economics 91(3):826-836.

Berry, J., Fischer, G. and Guiteras, R. (2012). "Eliciting and Utilizing Willingness to Pay: Evidence from Field Trials in Northern Ghana". University of Maryland Working Paper, University of Maryland, 63 pp.

Brooks, K. R. and Lusk, J. L. (2010). "Stated and Revealed Preferences for Organic and Cloned Milk: Combining Choice Experiment and Scanner Data". American Journal of Agricultural Economics 92(4):1229-1241.

Brooks, K. R. and Lusk, J. L. (2011). "U.S. Consumers Attitudes toward Farm Animal Cloning". Appetite 57:483–492.

Brooks, K. R. and Lusk, J. L.(2012). "Public and Private Preferences for Animal Cloning Policies". Journal of Agricultural and Resource Economics 37(3):485–501.

Butler, L. J., Wolf, M. M. and Bandoni, S. (2008). "Consumer Attitudes toward Milk Products Produced from Cloned Cows". Journal of Food Distribution Research. 39(1): 31-35.

Consumers' Union, 2007
http://www.consumersunion.org/pub/core_food_safety/004657.html (accessed in February 1, 2013).

Dhar T. and Foltz J.D. (2005). "Milk by Any Other Name... Consumer Benefits from Labeled Milk". American Journal of Agricultural Economics, 87(1): 214-228.

Doering C. (2007). "Group blasts FDA Plan to Allow Food from Clones". Reuters (US Edition), March 21, 2007.

Ekici A. (2004). "Consumer Trust and Distrust in the Food System: Some Implications for the Debates on Food Biotechnologies". Advances in Consumer Research 31: 555-563.

Faass J. and Lahr M. (2007). "Towards a More Holistic Understanding of American Support for Genetically Modified Crops: An Examination of Influential Factors Using a Binomial Dependent Variable". Munich Personal RePEc Archive (MPRA) Paper No. 6124. Available online at: http://mpra.ub.uni-muenchen.de/6124/

Fiester A. (2005). "Ethical Issues in Animal Cloning". Perspectives in Biology and Medicine, 48(3): 328–43

Flash Eurobarometer # 238 (2008) "Europeans' attitudes towards animal cloning". Conducted by The Gallup Organization, Hungary upon the request of Directorate General Health and Consumers, European Commission.
Food and Drug Administration (FDA). 2008. Press Release, January 15. Available online at: http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/2008/ucm116836.htm

Giannakas, G., Fulton, M., 2002. Consumption Effects of Genetic Modification: What if Consumers are Right? Agricultural Economics 27:97–109.

Govindasamy R., Onyango B., Hallman W. K., Jang H. and Puduri V. (2008). "Public Approval of Plant and Animal Biotechnology in South Korea: An Ordered Probit Analysis". Agribusiness, 24 (1) 102–118.

Hallman, W. K., & Condry, S. C., (2006). "Public Opinion and Media Coverage of Animal Cloning and the Food Supply: Executive Summary".
Food Policy Institute. Rutgers University, FPI Research Report: RR-1106-011.

Haefele, M.A., and J.B. Loomis. ''Improving the Connection between Theory and Empirical Analysis of Stated Preference and Conjoint Data: Improving Statistical Efficiency and Testing Robustness of Conjoint Marginal Valuations.'' American Journal of Agricultural Economics 83(2001):1321–27.

Hoffman, Messer and Fooks (2012). "Measuring and Mitigating HIV Stigma: A Framed Field Experiment". Maryland Population Research Center, Working Paper (PWP-MPRC-2012-003).

Hossain F., Onyango B., Adelaja A., Schilling B. and Hallman W. (2002). "Consumer Acceptance of Food Biotechnology:Willingness to Buy Genetically Modified Food

Products". Rutgers University, Food Policy Institute Working Papers Series, Number 18169.

Huffman W. E., Shogren J.F., Rousu M. and Tegene A. (2003). "Consumer Willingness to Pay for Genetically Modified Food Labels in a Market with Diverse Information: Evidence from Experimental Auctions". Journal of Agricultural and Resource Economics 28(3):48 1-502

Huffman W. E., Rousu M., Shogren J.F. and Tegene A. (2004). "Who do Consumers' Trust for Information: The Case of Genetically Modified Foods"? American Journal of Agricultural Economics 86 (5): 1222–1229

International Food Information Council. Food Biotechnology: A Study of U.S. Consumer Trends, 2007 Report.

Jones, G., Jennings, S., Ibrahim, M. and Whitehead, J. (2010). "Will Consumers Pay a Premium for Clone-free labeled Meat products? Evidence from the 2009 Sunbelt Agricultural Exposition". Paper Prepared for Presentation at the Southern Agricultural Economics Association Annual Meeting, Orlando, Florida, February 6-9, 2010.

Kerley, D., Messer, K. D., Wansink, B. K., Kaiser, H. M. and Shulze W. D. (2008). "Expiration Dates and Stigma: Why don't we Observe Hedonic Markets for Perishable Products?" Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008.

Lusk, J. L, House, L. O., Valli, C., Joeger, S. R., Moore, M., Morrow, J. L. and Traill, W. B. (2004). "Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food: Evidence from Experimental Auctions in the United States, England and France". European Review of Agricultural Economics 31(2): 179-204.
Lusk, J. L, House, L. O., Valli C., Jaeger S. R., Moore M., Morrow J. L. and Traill W. B. (2005). "Consumer Welfare Effects of Introducing and Labelling Genetically Modified Food". Economics Letters 88: 382–388.

Lusk, J. L. (2008). "Final Report on Consumer Preferences for Cloning". Report submitted to USDA Economic Research Service, Washington D.C.

McCluskey, J.J. and Loureiro M.L. (2003). "Consumer Preferences and Willingness to Pay for Food Labeling: A Discussion of Empirical Studies". Journal of Food Distribution Research 34(3): 95-102.

Miljkovic D., Nganje W. and Ndembe E. (2008). "Offsetting Behavior: Consumers' Response

to Food Safety Policies". Choices, 23(3):49-52.
Moon, W., Balasubramanian, S. K. and Rimal, A. (2006). "WTP and WTA for Non-GM and GM Food: UK Consumers". Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26 2006.

Nayga (Jr.) R. M. (1999). "Toward an Understanding of Consumers' Perceptions of Food Labels". International Food and Agribusiness Management Review, 2(1): 29–45

Nonis, S. A., Hudson, G. I. and Hunt, S. C. (2010). "Should We Label Products from Clones? An Exploratory Study of Beliefs, Attitudes and Food Safety Information on Consumer Purchase Intentions". Journal of Marketing Development and Competitiveness 5(1): 95 – 106.

Plastina A. and Giannakas (2007). "Market and Welfare Effects of GMO Introduction in Small Open Economies". AgBioForum, 10(2): 104-123.

Puduri, V., Govindasamy, R., Lang, J. T. and Onyango, B. (2005). "I Will Not Eat It with a Fox; I Will Not Eat It in a Box: What Determines Acceptance of GM Food for American Consumers?" Choices, 20: 257-261

Ratner S. J. (1999). "Baa, Baa Cloned Sheep, Have You Any Law? Legislative Responses to Animal Cloning in the European Union and the United States". Boston College International and Comparative Law Review, 22(1): 141-157.

Roe B. and Teisl M. F. (2007). "Genetically modified food labeling: The impacts of message and messenger on consumer perceptions of labels and products". Food Policy 32: 49-66

Rousu M.C. and Lusk J. L. (2009). "Valuing Information on GM Foods in a WTA Market: What Information is Most Valuable"? AgBioForum, 12(2): 226-231.

Roosen J., Lusk J. L., and Fox J. A. (2003). "Consumer Demand for and Attitudes Toward
Alternative Beef Labeling Strategies in France, Germany, and the UK". Agribusiness 19 (1) 77–90.

Saad L. (2010). "Four Moral Issues Sharply Divide Americans". Gallup Politics, May 26, 2010. Available online at http://www.gallup.com/poll/137357/four-moral-issues-sharply-divide-americans.aspx.

Shepherd J. and Saghaian S. (2008). "Consumer Response to and Trust of Information about Food-Safety Events in the Chicken and Beef Markets in Kentucky". Journal of Food Distribution Research, 39(1): 123-129.

Stice S. L., Robl J. M., Ponce de Leon F. A., Jerry J., Golueke P.G., Cibelli J.B., and Kane J. J.(1998). "Cloning: New Breakthroughs leading to Commercial Opportunities". Theriogenology 49.129-138.

Sosin, J. and Richards, M. D. (2005). "What Will Consumers Do? Understanding Consumer Response When Meat and Milk from Cloned Animals Reach Supermarkets". Survey Report. KRC Research 2005.

Storey, M. (2006) "Consumers' Knowledge, Attitudes, Beliefs, and Purchase Intent regarding Foods from the Offspring of Cloned Animals". Final Topline Report 2006. Center for Food, Nutrition and Agriculture Policy. University of Maryland College Park.

Teisl M. F., Garner L., Roe B. and Vayda M. E. (2003). "Labeling Genetically Modified Foods: How Do US Consumers Want to See It Done?" AgBioForum, 6 (1&2): 48-54.

Torline J. (2011). "In Europe and the U.S., Consumer Views on Cloned Products Breed different Results". Kansas State University News Release. Accessed on http://www.k-state.edu/media/newsreleases/jun11/cloning62111.html.

The Humane Society of the United States (HSUS) Report (2010). "Welfare Issues with Genetic Engineering and Cloning of Farm Animals".

USDA Statement on FDA Risk Assessment on Animal Clone (2008). Release No. 0012.08. January 15, 2008.

Violet M. and Goddard E. (2012). "The Effect of Consumers' Trust on Stated Responses to Food Safety Incidents: Case of Meat in Canada and the U.S." Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012.

Appendix A

QUESTIONNAIRE

Session # _____ **Offer Amount _____**

1) How often do you drink:

	Never	Rarely	Sometimes	Frequently
Conventional Milk	1	2	3	4
Organic milk	1	2	3	4

2) How many gallons of milk do you purchase in a week?

Half One Two More than two

3) How often do you make food purchasing decisions based on the following?

	Never	Sometimes	Often	Always
Health issues	1	2	3	4
Environmental concerns	1	2	3	4
Religion	1	2	3	4
Ethical/Moral concerns	1	2	3	4
Animal welfare concerns	1	2	3	4
Cost of food	1	2	3	4

4) How would you rate your **knowledge** of animal cloning?

Have None Fair Good Excellent

5) How would you rate your **opinion** of animal cloning?

Have None Negative Neutral Positive

6) Should milk from cloned cows be allowed in the market? Yes No

7) Should milk from cloned cows be labeled? Yes No

8) Do you do most of the grocery shopping for your household? Yes No

9) Do you have any children less than 18 years old in your household? Yes No

10) How often do you read food labels?

Never Occasionally Frequently Always

11) Do you consider yourself:

Liberal Moderate Conservative

12) What is your gender? Male Female

13) What is your ethnicity?

_____ White, not of Hispanic origin
_____ Black or African American
_____ Hispanic or Latino
_____ Asian
_____ Other

14) What is the highest level of education you have completed?

_____ Less than High School
_____ High School
_____ College
_____ Post Graduate

15) What is your total household income?

_____ Less than $25,000
_____ $25,000 to $49,999
_____ $50,000 to $74,999
_____ $75,000 to $99,999
_____ $100,000 to $149,999
_____ $150,000 to $199,999
_____ $200,000 or more

16) In which age group do you belong?

_____ 18 to 30
_____ 31 to 40
_____ 41 to 50
_____ 51 to 60
_____ 61 to 75
_____ Over 75

17) If a gallon of milk that could have come from a cloned cow costs $3, how much would you be willing to pay for a gallon of milk guaranteed **not** to come from a cloned cow?

Appendix B

SCRIPT

Hi, I'm _____ and this is _____ and we are graduate students at the University of Delaware.

We are conducting an economic study looking at possible consumer acceptance of milk from cloned cows. Participating includes telling us your value for milk, having a small cup of milk to drink and answering a few survey questions. It should take no more than five minutes of your time. You need to be a consumer of milk and over 18 to participate. Your responses will be anonymous and kept confidential. Are you willing to help us with our study?

If No:

Have a nice day.

If Yes:

The FDA has decided there is no significant difference between conventional milk and milk from a cloned cow. Due to this, if milk from cloned cows enters the market, it will not need to be labeled and you will not be able to tell if you are drinking it or not. While milk from cloned cows is not currently in stores, it does exist and we have been in contact with farms with cloned cows.

Small empty cup on table.

We are trying to determine your value for conventional milk compared to milk that may have come from a cloned cow. To do this, we are offering you a cup of conventional milk, but would like to know how much money you'd require to instead be given a cup of milk that may have come from a cloned cow. Your amount needs to be between 0 and $5.

We will use the number you give us in a two person auction, where I will be the other person and my amount will be randomly drawn. The person with the lowest offer gets the milk that may have come from a cloned cow to drink. So, if the number I draw is higher than your number, I will pay you the amount I drew, in cash, and pour you a cup of milk to drink that may be from a cloned cow. If the number I draw is lower

than your number, than I will pour you a cup of conventional milk to drink and you will not receive any payment.

The best approach in this auction is for you to give the true amount you would want to switch from conventional milk to milk that may have come from a cloned cow. Please think carefully about the amount you require as it is very important to our study.

What is the minimum amount of money, between 0 and $5, you'd want to be paid to have a cup of milk that may have come from a cloned cow instead of a cup of conventional milk?

Get their offer / Conduct random draw / Compare values

<u>If random draw > offer:</u>

You were the low offer in the auction so we will pay you (*random draw amount*). Here is your cup of milk that may have come from a cloned cow. **Pour cup from hidden label milk container.** Feel free to have a cookie to go with your milk. While we count out your money and you have your milk, please fill out our short survey.

Hand person survey on a clipboard (make sure they see it is front and back).
Have money and receipt ready for when the survey is completed.

Lastly, since we need to account for our funds, we need you to sign a receipt for your payment.

Hand over money once you have the signed receipt.

Thank you very much for participating in our study and enjoy the rest of your day.

Make any notes needed on the survey (e.g. person did not drink the milk).

<u>If random draw < offer:</u>

Yours was not the lowest offer in the auction so we will just be giving you a cup of conventional milk. **Pour cup from store brand labeled milk container.** Feel free to have a cookie to go with your milk. While you have your milk, please fill out our short survey.

Hand person survey on a clipboard (make sure they see it is front and back).
Collect survey.

Thank you very much for participating in our study and enjoy the rest of your day.

Make any notes needed on the survey (e.g. person did not drink the milk).
<u>If random draw = offer:</u>

Both offers were the same. Since the auction requires a higher number to determine payment we will just be giving you a cup of conventional milk. **Pour cup from store brand labeled milk container.** Feel free to have a cookie to go with your milk. While you have your milk, please fill out our short survey.

Hand person survey on a clipboard (make sure they see it is front and back). Collect survey.

Thank you very much for participating in our study and enjoy the rest of your day.

Make any notes needed on the survey (e.g. person did not drink the milk).

Appendix C

IRB EXEMPT LETTER

RESEARCH OFFICE

210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE: September 5, 2012

TO: Kofi Britwum, MS
FROM: University of Delaware IRB

STUDY TITLE: [373397-1] Abstract of Experimental Design

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: September 5, 2012

REVIEW CATEGORY: Exemption category # 2, 6

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Jody-Lynn Berg at (302) 831-1119 or jlberg@udel.edu. Please include your study title and reference number in all correspondence with this office.