PREFERENCES OF US, EU, HONDURAN, AND CHINESE UNDERGRADUATES FOR CLONING

by

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Abstract

The concept of animal cloning was first introduced to the public's attention in 1996 with the birth of "Dolly the Sheep," the first mammal to be cloned. Now, after more than a decade the technology has reached a point of feasibility on a commercial scale. With the publication of the U.S. Food and Drug Administration risk assessment on animal cloning in 2008, a report that concluded that the technology was safe and posed no risk to consumers, the issue has received renewed attention.

In this thesis I use survey data to examine attitudes to the use of cloning in animal food production among samples of college students in the U.S., Ireland, France, Honduras, and China. Stated likelihood of consuming meat products from cloned animals is correlated with individual characteristics including socio-demographic variables (gender, and farming background) and attitudinal variables measuring concern about various food technologies. In addition, using ordered logit modeling, we examine how respondents might change their probability of consuming cloned products after being provided with information about scientific assessments about the safety of cloning and possible price reductions for cloned products.

The analysis shows that: a) respondents in the U.S. and Honduras were more likely than those in other countries to indicate that they would consume cloned products, b) on average, respondents in all countries increased their stated likelihood of consuming cloned products when informed that the U.S. Food and Drug Administration and the European Food Safety Authority had assessed cloned foods as safe for human consumption, and c) individuals who were opposed to cloning on moral grounds were significantly less likely to consume cloned product and furthermore were less likely to respond positively to information about the safety of cloning.

Key Words: animal cloning, cloned products, biotechnology, food safety, consumer perception, food issues.

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1 Introduction

In the years since the birth of the first cloned mammal, "Dolly the Sheep", in 1996, the technology of animal cloning has made significant progress to the point where its use is becoming viable in commercial livestock production. The potential for using cloned animals in food production was further enhanced with assessments by the U.S. Food and Drug Administration (FDA) and European Food Safety Administration (EFSA) that foods derived from cloned animals or their progeny were safe for human consumption. Uncertainty remains however, about how consumers in domestic and international markets will react to the availability of foods from cloned animals, and about how their reactions will be influenced by media coverage and other information about cloning.

The primary advantage cloning offers for food production is the ability to exactly replicate animals with superior production characteristics. By duplicating a superior bull for example, cloning effectively extends the longevity of a genetically high-quality animal. Replicating superior animals in this way has the potential to significantly enhance, or at least accelerate the ongoing enhancement of overall herd genetics and productivity. The resulting increase in animal productivity has the potential to benefit both producers – through lower production costs – and consumers – either through lower retail prices or improved product quality and uniformity. Given the United Nations (2009) estimate that "food production will need to double by mid-century to meet demand from a growing world population" the production enhancing benefits of cloning become more appealing.

At about the same time that cloning technology was being developed, the world saw the introduction and widespread commercial adoption, particularly in the U.S. but also in many other countries, of genetic modification of plants in commercial agriculture, and to a lesser extent the adoption of bovine somatotropin (rBST) in commercial milk production. Concurrently however, active and well-organized consumer groups helped to implement stringent labeling laws on GM ingredients in both food for human consumption and animal feed in Europe, Japan and other countries. In the US, consumers still appear to be broadly unconcerned about GM ingredients but consumer opposition has resulted in a shift away from the use of rBST .

The objective of this thesis is to assess the likelihood of consuming products derived from cloned animals or from the progeny of cloned animals. Attitudes toward the use of cloning

in animal food production among samples of US, European, Asian, and Central American college students are examined. We compare expressed levels of concern about cloning to concerns about other food production technologies, issues, and production practices (genetic modification, bacterial contamination, packaging, etc). Furthermore we attempt to correlate attitudes toward cloning and willingness to purchase cloned products to individual characteristics including not only socio-demographic variables (gender, household income, farming background) but also attitudinal variables measuring political disposition – such as whether the individual tends to lean conservative or liberal on social and economic issues. While the data collection is restricted to undergraduate student samples, we believe the comparison across locations will provide interesting findings about this global issue.

2 Literature Review

Since the early 1990's, the topic of genetically modified (GM) foods has received considerable attention in the media. And while cloning is distinctly different from genetic modification – in that it involves replication of existing genotypes and not the modification thereof - the technology is often part of the same public debate. Indeed, some studies have found the media is at fault for confusing the two topics when discussing agro-biotechnology (Marks et al. 2003). And Storey (2006) reported that 59% of survey respondents believed that cloning involved genetic modification. But since the topics are related, many consumer surveys eliciting views about cloning typically do so in conjunction with the eliciting of views on genetic modification. More recently though, and particularly in the years immediately before and after the 2008 risk assessment from the FDA, a number of surveys have focused specifically on attitudes about animal cloning as a distinctly separate issue from biotechnology.

Early surveys focused on consumers' initial reaction to cloning animals, not on whether they would accept it as a viable source of food. Later surveys began to ask about the likelihood of consuming products derived from cloned animals or their offspring – what we will refer to as 'cloned products' – and about who consumers trust to provide information about such products. This review focuses on four different questions that have been addressed in consumer studies, including:

a) level of familiarity with biotechnology and/or cloning
b) likelihood of purchasing/consuming 'cloned products,'
c) specific concerns about cloning, and
d) who consumers trust to provide information about the technology.

Most of the consumer studies on cloning, plus a number of other studies on acceptance of genetic modification of food, are summarized in table 2-1 below. Most of the work reviewed is relatively recent, within the past 12 years or so, and most has been with samples of US consumers. For each study, table 2-1 provides the author, source and year, the sample size if available and the questions that the study addresses (using the lettering system a – b – c – d above).

Table 2-1: Surveys on Cloning and Biotechnology

Author	Source	Year	Country	Sample Size	Main Focus	Questions Addressed			
						a	b	c	d
Hoban	Food Technology	1999	Japan USA	1000 Not stated	Biotech	X		X	
Marchant	European Molecular Biology Organization (EMBO)	2001	16 European Countries	16,000	Biotech	X			
Hoban	North Carolina State University (NCSU)	2003	Various	Various	Biotech	X			
Hallman, Hebden, Aquino, Cuite, and Lang	Food Policy Institute (FPI)	2001 2003	USA	1,200 1,200	Biotech	X	X		
Sosin and Richards	KRC Research	2005	USA	1,005	Cloning		X	X	X
The Mellman Group, Inc.	Pew Charitable Trust	2001 2002 2003 2004 2005 2006	USA	1,000 1,000 1,000 1,000 1,000 1,000	Biotech & Cloning	X	X	X	X
Storey	Center for Food, Nutrition, and Agriculture Policy (CFNAP)	2006	USA	1,040	Cloning		X	X	X
	International Food Information Council (IFIC)	2005 2006 2007 2008	USA	1,000 1,000 1,000 1,000	Biotech & Cloning	X	X	X	X
	Gallup Poll Inc	2001 - 2009	USA	Not stated	Cloning			X	
Huang, Qiu, Bai, Pray	Elsevier	2006	China	1,671	Biotech	X	X		
Knight	AgBioForum	2005	USA	432	Biotech	X	X		
Lusk	USDA	2008	USA	2,120	Cloning	X	X	X	X
Nonis, Hudson, Hunt		2010	USA	145	Cloning	X	X	X	X
The Gallup Organization	Eurobarometer	2008	Europe	25,000	Cloning	X	X	X	X

2.1 **Familiarity with biotechnology and cloning**

Hoban (2001) concluded that not many consumers have a direct connection with agriculture and food production which limits their literacy about developments in food

biotechnology. But during the 1990's, perhaps because of publicity given to trade disputes between the US and the EU on issues such as hormone use in animals and genetic modification of plants, more people became aware of biotechnology. Between 1992 and 2000, Hoban (2004) found that about 38% of American consumers had some familiarity with biotechnology, with a range of 29% to 53%. Perhaps because the issue has received less media attention in recent years, a study conducted for the Pew Charitable Trust found that awareness of genetically modified food declined from 44% in 2001 to 40% in 2006 (The Mellman Group, Inc 2006). The same study found that about 65% of respondents had heard of animal cloning.

The more information consumers have about a given food technology, the more accepting of the technology they appear to be. For example, Lusk (2008) found that respondents who were provided with a half-page of information about cloning expressed less concern about the technology than those who were provided just a two sentence definition. But it can be difficult to assess exactly what consumers "know" about an issue. Knight (2005) makes the distinction between what respondents know and what they think they know putting it this way - "perception of knowledge measures the level of knowledge a consumer thinks he or she has, while objective knowledge measures actual knowledge about a particular phenomenon." He goes on to state that while many consumers may not have an understanding of the science itself, it does not mean that they are not following the public debate.

Studies indicate that while most American consumers have likely heard of cloning, they tend to know relatively little about its applications. Sosin and Richards (2005), found that just one in four had heard about applying biotechnology to farm animals, and when asked to list food safety concerns, cloning was not mentioned. However, when asked about cloning, 64% assumed that it would be used by farmers at some point in the future. Storey (2006) reported that only half her sample believed it was possible to clone farm animals. Lusk (2008) found that respondents had a higher level of awareness about cloning compared to other reproductive technologies such as artificial insemination.

Since most survey respondents are not very familiar with cloning it seems likely that stated purchase intentions regarding cloned products will be influenced by the information provided in a survey, or by how a survey question is worded. For example, in a 2004 study for the Pew Initiative, the Mellman Group reported a significant increase in perceived safety of GM

foods as a result of informing respondents about the prevalence of GM ingredients in everyday foods.

2.2 **Acceptance of biotech/cloned products**

While it can be misleading to generalize, by and large the evidence to date suggests that European consumers are mostly opposed to new biotech products, Americans are split on the issue – even though they uncomplainingly consume hundreds of food products derived from GM corn and soybeans – and Asian consumers are generally accepting of plant genetic modification technologies. Illustrating those general tendencies, Environics (2001) found that a net 66% of Chinese consumers would continue to buy GM foods if they were more nutritious (where net = percent continuing to consume minus percent not continuing), a net 25% of Americans would continue to buy, but for German and UK consumers the net figures were -5% and -7% indicating that more would discontinue buying the product than would continue.

While most Americans are aware that cloning could be used as a form of reproduction for farm animals, acceptance of the process is low. Sosin and Richards (2005) asked respondents about their likelihood of continuing to buy meat or milk products if they learned they were derived from the *offspring* of cloned animals, given that the FDA ruled such products safe to eat. Responses indicated that one third of the sample would continue to buy the product, one third would consider it if they found out more about it, and one third would never buy it. Responses were statistically indistinguishable for meat and milk products. Given similar information (i.e., respondents told to assume that FDA considered the products safe), Storey (2006) reported almost identical results with purchase intent evenly split among those who would continue purchasing product derived from the *offspring* of cloned animals (32%), those who would consider it (32%), and those who would never buy it again (35%). As in the previous study, responses were almost identical when consumers were asked about meat or milk products.

In survey research for the International Food Information Council (IFIC, 2005), 43% of respondents indicated they would be “not at all likely to buy” products derived from clones, with a combined 34% indicating they would be “likely” or “somewhat likely.” When questioned about product derived from clone *offspring*, the results were largely similar with 37% “not at all

likely to buy" and a combined 39% either "likely" or "somewhat likely." Later IFIC studies found slightly higher levels of acceptance of product from clone *offspring* – at 41% in 2006, and 49% in 2007.

The data reported by the International Food Information Council also showed an increase in the percentage of respondents with a favorable impression of cloning – up from 17% in 2005 to 23% in 2008. In contrast however, studies conducted for the Pew Charitable Trust (Mellman Group, 2005, 2006) found only a slight decrease in opposition to animal cloning between 2005 and 2006 (from 66% to 64%).

Lusk (2008), like Sosin and Richards (2005) and Storey (2006), found respondents about equally split between those who considered animal cloning acceptable (34%), unacceptable (32%) or were neutral on the issue (34%). As in those earlier studies, acceptance was virtually identical for meat or milk products with about 31% of respondents willing to eat meat or drink milk from a cloned animal, and 43% unwilling. As in the earlier IFIC study (IFIC, 2005) results were very similar when respondents were asked about products derived from clones or products from the *offspring* of clones.

Consumers are more likely to view cloning favorably if it provides a benefit. The 2008 IFIC report found that 50% of consumers who were very likely to purchase biotech foods were willing to do so because they would provide healthful properties such as more beneficial fats, reduced saturated fats, reduced pesticide use, or taste better and fresher. The same report found that regardless of their acceptance of cloning, consumers agreed that it was important to find more sustainable production practices, grow more food to feed a growing world population, and reduce pesticide use. Sosin and Richards (2005) found that cloning would be acceptable to consumers if it improved animal health or bred animals immune to disease, or if it improved the nutrition of milk or meat.

2.3 **Consumer concerns about cloning**

Storey (2006) reported that two thirds of respondents were "mostly uncomfortable" about the use of cloning in animals, with significantly more women (78%) than men (54%) indicating discomfort. Similarly, the Pew surveys (Mellman Group, 2006) found that a majority of

respondents were uncomfortable with the technology – 61% among those who had heard of cloning and 68% among those who had not. The Pew (2006) survey also found a gender gap – with discomfort among men at 58% compared to 69% for women. Comfort level with cloning was higher among more educated respondents, but was lower among those who attended religious services more frequently. Lusk (2008) also found that males and respondents with higher levels of education were more accepting of cloning.

A number of surveys have tried to identify the specific reasons for this discomfort and most lean toward finding that the concerns are less about food safety than about ethical/moral issues. Storey (2006) found that there was no single dominant reason chosen by those who expressed discomfort. The most commonly cited reason was that cloning was morally wrong (32%) followed by uncertainty about food safety (26%), the fear that animal cloning might lead to human cloning (23%), and concerns for animal welfare (14%).

The Pew surveys found that religion and ethics top the list of concerns among those who are uncomfortable with cloning (Mellman Group 2005). Ongoing Gallup polls from 2001 to 2009 show that the proportion of respondents who believe animal cloning is morally unacceptable has hovered at about 30% with little deviation (Gallup, Inc. 2009). Roberts (2008) found that many consumers are concerned that animal cloning may be a slippery slope toward human cloning. In a similar vein, Lusk (2008) found that people are relatively unconcerned with the safety of products derived from cloned animals, but that their major objection is to the 'unnaturalness' of the process, and the idea that animal cloning might lead to human cloning.

2.4 **Who do consumers trust on cloning**

According to Martineau (2001), much of the "food fight" about genetically modified foods could be averted if the public was provided with hard facts about tests that support the safety of GM foods for both human consumption and the environment. However, the facts are typically buried in scientific publications, distributed by agencies that lack trust, or are not conveyed accurately by the media or consumer organizations. It is understood that when factual information is provided to consumers about a specific technology, their overall acceptance level tends to increase (Hoban 1999). Knowing which source has the most credibility with consumers

is useful in terms of understanding (or influencing) consumer opinion. Because of this, a number of surveys have tried to ascertain who consumers trust in terms of providing information about technologies such as cloning. The results from those studies have been mixed.

Sosin and Richards (2005) asked respondents to rate their trust in different sources of information about cloning. The top rated sources were USDA (69% approval rating), veterinarians and physicians (67%), FDA (66%), Department of Health and Human Services (63%), the Environmental Protection Agency (59%), the World Health Organization (55%), and universities (53%). Lower trust ratings were given to consumer protection agencies and animal rights groups such as People for the Ethical Treatment of Animals (36%), and the Sierra Club (24%). Lusk found a lower level of trust in government, with less than 30% expressing trust in information about cloning from agencies like the USDA and FDA. But even when consumers do express trust in government, they still indicate unwillingness to consume clone product even if its safety is affirmed by those agencies. As noted above, Sosin and Richards (2005) found that 43% of respondents were "not at all likely to buy" clone product, even if FDA had ruled it safe for consumption.

Government agencies in the EU have lost a significant amount of public trust in the wake of high publicized events such as mad cow disease and dioxin contamination of animal feed in Belgium (1999), Ireland (2008), and more recently in Germany (2011). Europeans generally have low trust in their governments (Hoban 2001). In the 2000 EMBO report, the Eurobarometer survey showed that fewer than half (45%) of Europeans gave governments positive ratings in regulating biotechnology.

Since the release of FDA's risk assessment on cloning in 2008, consumers may have educated themselves more about the subject, or have heard about and trusted the FDA's findings. The IFIC continuing surveys showed that in 2008, 65% of US consumers were "somewhat or very likely" to purchase products derived from clone offspring if FDA determined them to be safe, up from 61% in 2007 and 57% in 2006. When the same respondents were told that USDA and FDA had determined meat from cloned animals to be safe, 48% stated they would buy cloned product.

3 Policy Review

While the science of cloning has made considerable technological advances, it has also attracted some controversy. In 1996, when Dolly was born most people viewed the event as a scientific sensation with little or no implications for the food industry. Later, after the initial media attention had subsided, the realization that the ability to clone food animals had very real implications for industry struck political leaders and consumers alike.

3.1 Bans on human cloning

The first major hurdle for politicians was banning the use of cloning for humans. In 1997, one hundred sixty eight member nations of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) signed the Declaration on the Human Genome and Human Rights. The declaration described the human genome as, in a symbolic sense, the "heritage of humanity" and stated in Article 4 that it should not "give rise to financial gains." The UNESCO declaration preempted bans on human gene and cloning therapies in several countries (Bonnickson 2001). Also in 1997, President Clinton, on the recommendation of his National Bioethics Advisory Commission, proposed a five year moratorium on federal and privately funded human cloning research, citing its potential to threaten "the sacred family bonds at the very core of our ideals and society" (Marshall 1997).

The subject of human cloning is complex in that it involves two distinct types: a) reproductive cloning – in which the objective is to produce a cloned human, and b) therapeutic cloning – in which the objective is not to produce a human being but may for example be to produce stem cells which could lead to the production of a replacement organ. While the objectives are different both processes share common steps such as the harvesting of DNA, replacement of DNA in a female egg cell, and the subsequent growth of a human embryo. Efforts to ban human cloning have faced opposition from those who support embryonic stem cell research and therapeutic cloning.

By 2004, human reproductive cloning had either been banned completely or allowed only with limited research application in Australia, China, South Africa, Canada, and most of the E.U

(Australian Government 2002, Republic of South Africa 2003, Government of Canada 2004, Peoples Republic of China 2003, European Communities 2000). Bills restricting or banning human cloning have been repeatedly introduced in the US Congress, but to date, none have been signed into law. In July 2001, the U.S. House of Representatives passed HR2505 – the Human Cloning Prohibition Act introduced by Reps. Weldon (R-FL) and Stupak (D-MI) which would ban both reproductive and therapeutic human cloning – by a vote of 265 for and 162 against. At the same time, the House defeated a bill that would have banned only reproductive cloning. In January 2002, a companion bill to HR2505, Senate Bill 1899, was introduced by Sen. Brownback (R-Kansas) and later sponsored by Sen. Landrieu (D-LA) in the US Senate. That bill was stalled in committee and was never brought to a vote in the Senate. The same fate befell other bills introduced by Sen. Feinstein (D- CA, S. 1758) and Sen. Harkin (D-IA, S. 1893) that would have banned only reproductive cloning (technically the bills would ban implantation of a cloned embryo).

In 2003, HR 534, introduced by Rep. Weldon, passed the Republican controlled House by a 241-155 vote but again failed to receive a vote in the US Senate. Senate Bill S303 – the Human Cloning Ban and Stem Cell Research Protection Act - introduced by Sen. Hatch (R-UT) also failed to receive a Senate vote. Similar fates befell similar bills reintroduced in subsequent years.

As of 2006, 13 states had banned reproductive cloning, and of those six also prohibited therapeutic cloning (Johnson and Williams 2006). At the federal level, the so called Dickey Amendment prohibits the Department of Health and Human Services from funding research in which human embryos are destroyed. The Dickey Amendment is, technically, a rider attached to the appropriations act funding the Departments of Labor, Health & Human Services, and Education, and has been included in each such bill since 1995. Also potentially related to human cloning, the Science, Justice and Commerce Appropriations Act, 2006 (P.L. 109-108) prohibits the granting of patents "directed to or encompassing a human organism," a restriction that potentially deters research on human cloning since researchers would be unable to patent their discoveries (CRS, 2006).

The only human cloning regulation signed into law has been a prohibition on the use of private funds for research and exclusively reserving human embryo research to government funding (Wright 2004).

After years of deliberation, the United Nations adopted a non-binding declaration on human cloning in which member states were called on to adopt "all measures necessary to prohibit all forms of human cloning inasmuch as they are incompatible with human dignity and the protection of human life" (United Nations 2005). While this declaration did not end the debate on human cloning, it did quell the controversy long enough to redirect attention to animal cloning. In the intervening years, animal cloning technology had made significant advances, and by 2005 nearly a dozen animal species had been cloned. Even at prices as high as $20,000 to $50,000 per animal, the process was seen to have potential for application in production agriculture.

3.2 **Regulations governing animal cloning**

While no country has yet passed legislation regulating the use of animal cloning for food production, risk assessments have been carried out by government agencies in the U.S., E.U., Japan, Canada, Australia, and New Zealand (Food and Drug Administration 2008, EFSA 2010, Japanese Research Institute 2002, R. F. Seamark 2003, Canadian Food Inspection Agency 2010). These assessments have concluded that food derived from cloned animals is safe for human consumption.

In 2001, the US Food and Drug Administration (FDA) undertook an assessment of the safety of foods derived from clones, and at the same time requested the livestock industry to refrain from introducing meat or milk from clones or clone offspring into the food supply. A first draft of the FDA risk assessment was released in December 2006. The final risk assessment, a risk management plan, and guidance for industry were issued in January 2008 (FDA 2008). 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 (including sheep), were as safe to eat as food from conventionally bred animals. This conclusion was in agreement with that of an earlier report by the National Academy of Sciences (NAS 2002).

The FDA had insufficient information for a recommendation on the safety of food from clones of sheep or other species. The final risk assessment did not call for any labeling of foods derived from clones or their offspring on the grounds that those foods were effectively

indistinguishable from products derived from conventionally bred animals. The opinion effectively cleared the way for meat and milk products from cloned animals to enter the market, but the guidance for industry document issued with the risk assessment recommended that products from clones of animals other than cattle, swine or goat (i.e. sheep) should continue to be kept out of the human food supply. FDA also noted that the ethical concerns related to cloning were not within the purview of the risk assessment.

At the same time as FDA's January 2008 risk assessment, the European Food Safety Authority (EFSA), following a request from the European Commission, issued a draft scientific opinion on the safety of foods derived from clones (EFSA 2010). While the EFSA opinion emphasized uncertainties in the risk assessment due to the limited number of studies available, and found that the health and welfare of a significant proportion of clones was adversely affected, it also concluded that it was very unlikely that there were any differences in terms of food safety between products derived from clones and clone offspring and foods derived from conventionally bred animals. Following review of public comments, the EFSA opinion was adopted in July 2008, and reaffirmed in statements issued in 2009 and 2010 (EFSA Journal 2010).

Concurrent with the EFSA opinion, the European Group on Ethics in Science and New Technologies (EGE) issued an opinion on the ethical aspects of animal cloning (EGE 2008, EFSA 2010). The EGE report, citing health problems of clones and surrogate dams, questioned whether animal cloning for food production was ethically justified and proposed that additional requirements be met before cloning could be deemed safe. These included: a) that safety of food products be guaranteed as a precondition for marketing, b) that the "five animal freedoms" including freedom from hunger, thirst and malnutrition; freedom from fear and distress; freedom from physical and thermal discomfort; freedom from pain, injury and disease ; and freedom to express normal patterns of behavior as recommended by the Organization for Animal Health (OIE) be met, c) enactment of legislation to ensure traceability for all cloned animals and their products, and d) the import of cloned animals, their offspring, and materials derived be documented (EGE 2008).

At this time, special interest and consumer advocacy groups were pressuring members of the European Parliament to ban animal cloning. The Novel Foods legislation of 1997 (Regulation EC 258/97) required that any food or ingredient not used for human consumption within the EU

prior to 1997 must undergo a safety assessment before being placed on the market. That law provided a framework for regulating genetically modified organisms, but GMO's were subsequently regulated under separate legislations (Directive 2001/18/EC – on the release into the environment of genetically modified organisms; Regulation (EC) 1829/2003 and 1830/2003 on the traceability and labeling of genetically modified organisms). In January 2008 the European Commission published proposals to replace the 1997 novel food legislation with the aim of streamlining the authorization process for new foods – particularly foods that had not traditionally been sold in the EU but that had a safe history of use in other countries (Jukes 2011). The Commission proposed a central authorization process for novel foods, including assessment by EFSA, rather than having initial assessments carried out by member states. The proposal also included an updated definition of a novel food to clarify that use of new technologies such as nanotechnology and animal cloning would require a pre-market safety assessment.

In March 2009, the European Parliament indicated support for the Commission's proposal on novel foods, but adopted a report requesting that the Commission prohibit the marketing of any foods derived from cloned animals or their offspring. In June 2009, the Council of the European Union (the EU's main decision making body) approved a draft regulation on novel foods but required, over the objection of the Commission, that the scope of the regulation would extend to foods derived from the offspring of cloned animals. The Council adopted a first reading of the proposed regulation in March 2010, again with the Commission not in agreement that the law should extend to offspring of clones. In May 2010, the European Parliament Environment committee voted in favor of proposals to centralize the authorization of novel foods, but opposed any approval of foods derived from clones or their offspring and asked the Commission to create a separate proposal to ban such foods. On July 7, 2010, the Parliament supported a call for legislation, separate from the novel food proposal, which would ban foods derived from clones or their offspring. By voting to exclude foods derived from clones from the novel food rules, the Parliament was in opposition to the position of both the Commission and the Council. Until a law on cloned foods could be adopted, the Parliament requested an immediate moratorium on the sale of foods derived from clones or their offspring.

On July 29, 2010, the New York Times reported that "breeders in Switzerland, Britain and possibly other countries had imported semen and embryos from cloned animals or their

progeny from the United States" (Kanter 2010). In August, the UK Food Standards Agency (FSA) reported that meat from three offspring of a cloned cow had entered the food chain without authorization. The animals had been born in the UK from embryos taken from a cloned cow in the US. In its statement (FSA, 2010) the Agency noted "*While there is no evidence that consuming products from healthy clones, or their offspring, poses a food safety risk, meat and products from clones and their offspring are considered novel foods and would therefore need to be authorized before being placed on the market*." The news about clone offspring entering the food chain generated plenty of media attention with coverage focusing on the potential risks, or lack thereof, associated with cloning and on the apparent lack of enforcement of various regulations.

On October 11, 2010 the European Commission issued its opinion on amendments to the novel food regulation proposed by the European Parliament (European Commission 2010). The Commission rejected amendments pertaining to cloning that would require an immediate moratorium on food derived from clones and clone offspring, and that would require the introduction of legislation to ban those foods. The Commission argued in part that the novel food regulation was not the appropriate legal framework for addressing the cloning issue since products other than foods (e.g., semen, embryos) did not fall within its purview.

In October 2010, the European Commission announced a temporary five-year ban on the use of animal cloning for food production in the EU (Europa 2010, European Commission 2010). The ban was justified on animal welfare grounds, but, contrary to the wishes of the EU Parliament, did not include a ban on imports of foods derived from clone offspring. The Commission argued that such an import ban was: a) unnecessary since food from cloned animals is safe, and b) difficult to enforce since products derived from clones were indistinguishable from those from conventionally bred animals.

In December 2010, the European Council rejected the Parliaments proposed amendments to the novel food draft proposal. The rejection by the Council set the stage for a conciliation procedure. As of March 2011 the different EU legislative bodies were still debating the amendments to the novel foods regulation, and the main sticking point still appeared to be the issue of animal cloning. Views on the proposed ban differed primarily between members of the European Parliament who sought a strict ban on products derived from clones and their

offspring, and member states governments (via the Parliament) who would agree to a ban on products derived from clones but favored allowing products derived from clone offspring.

In the U.S., Representative Rosa DeLauro (D-Connecticut) introduced H.R. 6325 - the Consumer Right to Know Food Labeling Act of 2010. The bill was referred to the House Agriculture Subcommittee on Livestock, Dairy, and Poultry in September 2010, but did not come to a vote before the end of the 2010 Congress. The bill would have required any food product derived from advanced agro-biotechnology, including cloning, to be labeled as such. In arguing for the legislation, Congresswoman DeLauro referenced studies showing that consumers "actively oppose the cloning process, and are very suspicious of genetically-modified foods" (Richards 2010).

3.3 Arguments for and against cloning for food production

Proponents of animal cloning tout its potential economic benefits in livestock production. Opponents articulate concerns about human and animal health, welfare, ethics, agro-biodiversity, and sustainability. Below, each position and their advocates are discussed. While the arguments are basically the same, cloning opponents appear to be better organized in Europe than they are in America.

3.3.1 The arguments for cloning

Advocates for animal cloning focus on its potential impact on efficiency in livestock production, and the resulting impact on the human food supply. The claim is that cloning can accelerate the production of genetically superior animals and allow them to stay in production longer. Cloning advocates are diverse and include university scientists, research science associations, leaders in production agriculture, non-government associations (NGO's), biotechnology and pharmaceutical companies, some religions, and legislators who advocate for technological advancement. Advocates argue that they support advanced technology that will sustain and enhance human life, benefit the environment and enhance economic development. Their arguments emphasize the following points:

a) ***Food safety*****:** Foods derived from clones and clone offspring are identical to those derived from conventionally produced animals and have been found safe for human consumption.

b) ***Production efficiency*****:** Cloning accelerates the reproduction of genetically superior animals and thus enhances the efficiency of livestock production. Within any herd, production animals can vary widely in genetic merit. For example, consider a dairy herd with 100 cows in which the best animal is 20% more productive than the herd average. For simplicity, assume average production is 10,000 kg and the best cow produces 12,000 kg. Total production for the herd is 1 million kg (i.e., 100 x 10,000). If all animals were as productive as the best cow, total production would be 20% higher at 1.2 million kg. Conventional breeding techniques cannot exactly replicate that best animal, but cloning can. Given constraints on the amount of land that can be used for food production, gains in food production efficiency are needed to feed a growing world population.

c) ***Replicating desirable attributes:*** While the illustration above emphasizes a production attribute, the benefits of replicating the "best cow" also applies to attributes such as resistance to disease, efficiency in feed conversion, etc. The Biotechnology Industry Organization (2010) suggests that cloning could reduce the use of antibiotics, growth hormones and other chemicals.

d) ***Environmental benefits:*** If cloning can enhance animal productivity and reduce the use of antibiotics and other chemicals, an ancillary benefit would be a reduction in the environmental impact (carbon footprint) of animal agriculture. Looking at the example above in another way, if all cows were as good as the best cow, the same total level of production, 1 million kg, could be produced with 84 (10^6 / 12,000 = 83.3) instead of 100 animals. At a 2010 European Commission hearing on animal cloning, Keith Campbell, one of the creators of Dolly, argued that cloning genetically superior animals could provide sufficient milk and food, but also meant there could be fewer animals and a reduced environmental impact (Campbell 2010).

e) ***Consumer benefits:*** Improvements in production efficiency lead to lower costs per unit output (see Suk et al, 2007) which in turn lead to lower prices for consumers. But consumers can also benefit from improvements in product consistency. For example, attributes such as meat tenderness are influenced by genetics and can vary substantially across animals with similar (but not identical) genetics. Cloning offers the potential to deliver more uniform products at lower cost.

f) ***Producer's rights:*** Some advocates argue that producers should have the right to use a technology that is proven to be safe and effective and "allow the marketplace to decide their success or failure" (AMI 2010).

Cloning remains an expensive proposition and its use remains limited to replicating premium sires and show animals. Until the embryo transfer patents held by the two largest U.S. cloning companies Viagen and Cyagra are opened to the public, cloning technology will continue to be expensive and most likely will not be used to produce commercial livestock (Lanza and West 2002, Gibori and Aurora 2010).

3.3.2 The arguments against cloning

Opponents of animal cloning have been aggressive in their position against the technology citing concerns about human health and animal health and welfare, ethical objections, and the potential risks for agro-biodiversity and sustainability. Opponents represent a fairly homogenous group that includes animal and consumer activist groups such as The Humane Society of the United States and Europe's Friends of the Earth. Environmentally sensitive corporations such as Whole Foods and Ben & Jerry's in the United States, and Tesco, Morison's, and Marks & Spencer in Europe have publicized their opposition to the technology (Hisey 2007). Other food processors including Smithfield Foods Inc., Tyson Foods Inc., Kraft Foods Inc., and Wal-Mart Stores Inc. have indicated that they will not sell cloned products (Zhang and Jargon 2008). The arguments against cloning include:

a) ***Animal welfare:*** The Humane Society emphasizes the admission by scientists that "cloning research reveals abnormalities and high failure rates" (HSUS 2010). Success rates are quite low ranging from 5% (Oback and Wells 2003) to upwards of 30% (Suk, et al. 2007), but have improved significantly since Dolly, whose birth represented one success following 276 failed attempts. Opponents also point to high rates of fetal abnormalities (HSUS 2010, FOE n.d.). According to the FDA, swine and goat clones are no more susceptible to abnormalities than their conventionally bred counterparts. However, in cattle and sheep some clone fetuses grow too large during pregnancy, and have serious birth defects – a set of abnormalities known as "large offspring syndrome" (FDA 2008). But rates of this syndrome have decreased as the technology has improved, and most clones that are born with health problems appear to overcome them and are indistinguishable from conventional calves and lambs at around six months of age.

b) ***Ethical concerns:*** From the moment Dolly was introduced to the world in 1996, ethical concerns about the technology have been at the forefront. Once human cloning was set aside in 2005 (United Nations 2005), the discussion immediately turned to the ethics of animal cloning for human food consumption. Cloning occurs in nature (identical twins are clones) and has been used in plant production (grafting), but opponents believe that when humans artificially facilitate asexual reproduction in the animal kingdom, it is akin to playing God (Cloer 2010). The Catholic Church is not technically opposed to animal cloning. They state "there is a place for research, including cloning, in the vegetable and animal kingdoms, wherever it answers a need or provides a significant benefit for man or for other living beings, provided that the rules for protecting the animal itself and the obligation to respect the biodiversity of species are observed" (Correa 1997). Opponents of cloning believe that in their quest for knowledge, scientists make God obsolete by artificially giving life to animals and therefore surpassing the need for higher power. Opponents also argue that misuse of animal cloning technology could have unforeseen negative consequences that humans would be unable to control (EGE 2008).

c) ***Inability to distinguish clones:*** Opponents argue that cloned animals and their offspring, because they are indistinguishable from conventionally bred animals, need to be tracked and identified as such. Failure to do so denies to consumers their right to know and choose how their food is produced. As noted above, legislation that would requires such tracking and labeling was introduced to the US House of Representatives (but not passed) by Congresswoman DeLauro who explained that the Consumer Right to Know Food Labeling legislation would require "labeling of these products, both in supermarkets and restaurants, to alert American consumers to what they are eating and enable them to make informed purchase decisions" (Gabbett 2010). During parliamentary arguments on the EU proposed ban on cloning, Anna Maria Corazza Bildt, member of the European Parliament from Sweden, expressed the concern that the inability to tell the difference between clone derived and non-clone derived products effectively eliminated the consumer's right to choose products they preferred.

3.4 **Cloning and Trade**

The issue of animal cloning has the potential to disrupt trade in meat and other animal products depending on how different countries regulate the technology. The treatment of products derived from clone offspring will be particularly important as such products will be far more plentiful than those derived from clones, and furthermore very difficult to track and identify. As noted above, the EU Commission's temporary ban on cloning does not, contrary to the wishes of the European Parliament, ban imports of foods derived from clone offspring. Had it done so, it would likely have prevented imports of all meat and dairy products from the U.S. However, US exports of meat and dairy products are already restricted by EU rules on the use of growth promoting hormones, so any cloning related ban on trade with the EU would likely not be of particular concern to the US but certainly an added constraint. In 2010, for example, US exports of red meat and dairy products were valued at over $12.8 billion, of which exports to the EU accounted for less than $300 million or about 2 percent (FAS 2010). In terms of total exports, markets in North America (Mexico, Canada) and East Asia (Japan, South Korea) are much more important for the US livestock sector (FAS 2010) and it does not appear likely at this

time that those countries will restrict products from clone offspring given prior food safety protocols are reached (Health Canada 2003, Canadian Food Inspection Agency 2010, Japan Food Safety Commission 2009).

World Trade Organization (WTO) rules governing trade in food products are included in the Agreement on Technical Barriers to Trade (TBT). Agencies including the Sanitary and Phytosanitary Standards (SPS) Commission, the Codex Alimentarius Commission and the World Organization for Animal Health (OIE) require that import standards are derived from scientifically proven risk assessments. If a country cannot show that its import standards are science based, the WTO will typically rule against that country in a trade dispute. For example, in the dispute between the US and EU over GMOs, the WTO ruled against the EU import restrictions (Europa 2006).

Given that scientific assessments in both the US and EU have found products derived from clones to be safe for human consumption, it seems likely that any trade dispute would similarly end up in a ruling against the import restrictions. At the same time, the cloning issue involves the added dimension of animal welfare that was not a factor in previous trade disputes over hormones or GMOs. Both the European Group on Ethics in Science and New Technologies (EGE) and the U.S. Council for Agriculture Science and Technology (CAST) have addressed the animal welfare issue (EGE 2008, Wall, et al. 2009). It is possible that in arbitrating a trade dispute involving cloning that such an official finding on animal welfare could provide the necessary "scientific" basis to justify an import restriction on products from cloned animals.

3.5 **Conclusions**

As the science of cloning advances, political and economic policies regarding it will evolve, as will consumer perceptions and preferences. It appears likely that the EU will, with the eventual passage of a new novel foods regulation, implement significant permanent restrictions on cloning but the extent to which those restrictions will impact trade remains to be seen. Current US policy does not restrict cloning for food production and, as costs decrease and benefits begin to be realized, it seems likely that the technology will be adopted by more producers. Passage of any legislation that requires labeling of products from cloned animals however may significantly

restrict its adoption as consumers are unlikely to perceive much benefit from consuming products from clones and many would like to avoid them.

4 Data Collection and Survey Description

Labeled products from cloned animals are not currently marketed so demand for those products cannot be estimated using market data. Because animal clones are exact copies of parent donors, even if labeling laws were passed cloned product would be very difficult to track. For that reason the characteristics of market demand for cloned products can only be estimated using stated preference type data such as can be obtained from a survey, or perhaps from revealed preference data from a market experiment. For this study, data was collected from samples of undergraduate students on four continents using both an online and a printed version of a survey instrument.

4.1 Acquiring Data

Most of the data for this study came from an online survey using Survey Monkey and conducted using specific classes of undergraduates at different institutions in the United States, Europe, and Latin America. Survey Monkey allows the user to design a survey instrument that is easy for a respondent to follow, and also includes a number of features that maintain the integrity and completeness of the responses. These features include the ability to prevent the respondent from returning to earlier questions, restricting responses to one per question (when that feature is desired), or requiring that a question be answered in order to proceed with the survey. The Chinese version was designed in Survey Monkey but submitted by hand on paper printouts.

Respondents were not provided with any information about the subject prior to taking the survey. This ensured that subjects would not choose to participate or not participate based on the subject matter. Subjects in the Kansas State classes were offered a small amount of extra credit to complete the survey. Subjects in all other samples were not provided any incentive to complete the survey.

Each survey was translated into French, Spanish, and Chinese for the respective collectors in France, Honduras, and China. Survey Monkey includes special controls for languages, which allows response buttons, descriptions, and important instructions to be automatically translated into the appropriate language. These language features made Survey

Monkey an ideal platform for collecting data from an international sample. Figures 5.1 to 5.3 below show screen shots of one question from the survey instrument in English, French and Spanish.

Figure 4-1: Survey Monkey Internet Price Screen English Version

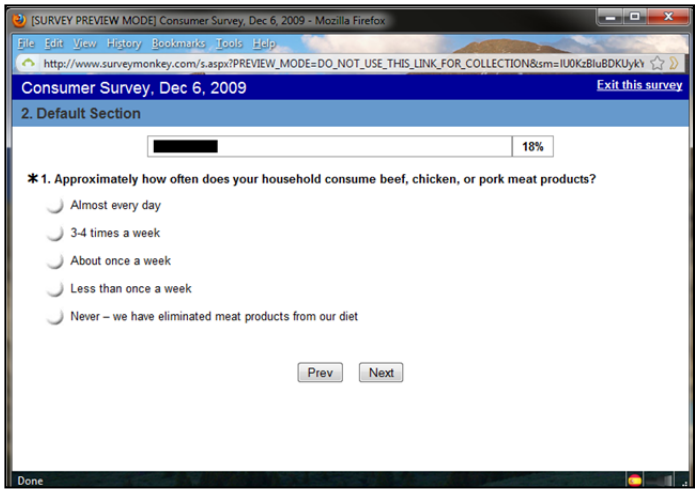


Figure 4-2: Survey Monkey Internet Print Screen French Version

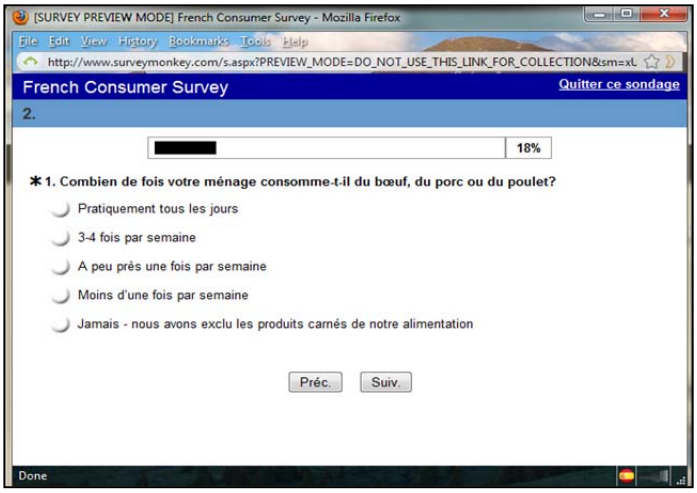
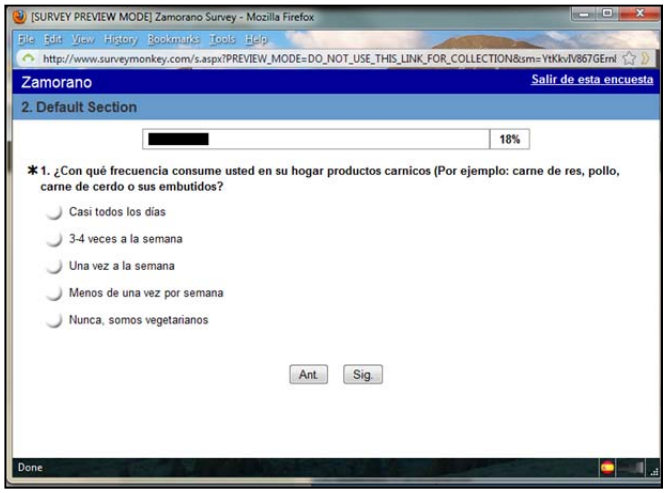


Figure 4-3: Survey Monkey Internet Print Screen Spanish Version



4.2 **Data Sources**

Data was collected from samples of respondents in the United States, France, Ireland, Honduras, and China. For all samples except China, an identity specific internet link was emailed to the respondent's college email addresses. The survey could be viewed using either Internet Explorer or Mozilla Firefox. Once respondents were finished or had closed the survey window, their results were automatically updated in a data interface that was only accessible to the survey creator. From that interface the data could be downloaded into excel files for analysis. But the data interface itself also offered some basic statistical analysis, much of it in graphical form (pie charts, bar charts) that could be easily interpreted and manipulated.

In total, surveying by each collector lasted approximately 2 months. To keep the survey results as consistent as possible, the request of recruited surveyors was that the questionnaire respondents be limited to undergraduates only. Admittedly, the student sample does have limitations because many students are not regular food purchasers and they have limited income; however, Lusk, et al. (2005) found that student samples were not different from more representative population samples in willingness to pay analysis for genetically modified food products. In addition, the results from this particular age group are important, as they are the most likely to consume cloned product once it reaches the market on a wider level. Irrespective of the limitations from the sample, the cross continental comparison provides interesting insights. The total sample size was 714 of which 644 were complete and usable. A brief description of the country subsamples follows.

- **United States**: Data was collected from undergraduates in three classes – Agricultural Economics, Sociology, and English – at Kansas State University. The respective instructors were emailed an identity preserved link to the survey which they forwarded on to their class rosters. A total of 166 students were sampled resulting in 141 complete responses – a response rate of eighty five percent.

- **France**: Data were collected with the assistance of collaborators based at Purpan School of Agriculture, Toulouse, France. The collaborators were emailed an identity preserved link to the translated survey; however information on the specific classes that were surveyed was unavailable. The survey was forwarded to approximately 320 students in

the 3rd year of their program, resulting in 164 complete responses – an estimated response rate of fifty one percent. The translation was done by French colleagues participating in an exchange program at the Agricultural Economics Department at Kansas State University.

- **Ireland**: Data was collected with the assistance of collaborators at University College Dublin, Ireland. The collaborators were emailed an identity preserved link to the survey, but, as in France, information on the specific classes that were surveyed was unavailable. It is estimated that 584 students were sampled resulting in 119 complete surveys – a response rate of twenty percent.

- **Honduras**: Data was collected with the assistance of collaborators at the Universidad de Zamorano of Tegucigalpa, Honduras. The collaborators were emailed an identity preserved link to the survey which they forwarded to a university wide email list. Unfortunately this list included an undisclosed number of addresses and was not limited to just students. It was estimated the email list included 2,000 recipients of which 134 completed the survey. Using responses to questions about age and income, an effort was made to limit responses to those believed to come from students by isolating based on high reported salaries or age groups outside the target area. The final usable number was 94 observations. The translation and authenticity check was performed by several colleagues from Central and South America studying in the Agricultural Economics Department at Kansas State University.

- **China**: Data was collected from a sample of students at the Beijing Vocational College of Agriculture, China with the assistance of collaborators based at the College. The collaborators were emailed a PDF copy of the translated Chinese survey. The translation and authenticity check was made possible by several colleagues from the Peoples Republic of China studying at the Agricultural Economics Department at Kansas State University. The collaborators in China then made hard copies of the survey and passed them out in several classes. On completion, the surveys were mailed back to the United States where the data was inputted by hand. A total of 152 surveys were returned and

140 contained usable answers. Human error with data entry is a potential concern with this dataset. In addition, because the surveys were completed on hard copies, we did not have the same degree of control over the responses as with the electronic survey, and a number of response errors were detected and several surveys were incomplete.

4.3 Variables and Hypothesis

The survey data allowed for the construction of several variables which are listed in Table 5-1 below. Appendix A includes copies of each survey instrument used.

Table 4-1: Description of Model Variables

Variable	*Question #*	*Variable Description*	*Model Variable*
Respondent ID		Respondent ID number in Survey Monkey	respondentid
Collector ID		Collector ID number in Survey Monkey	collectorid
KSU Ag Econ		Collector name for AgEcon respondents at KSU	agecon
KSU English		Collector name for English class respondents at KSU	english
KSU Sociology		Collector name for Sociology class respondents at KSU	sociology
Ireland UCD		Collector name for University College Dublin respondents	ireland
France SAP		Collector name for Purpan respondents	france
Honduras Zamorano		Collector name for Zamorano respondents	zamorano
China		Collector name for Beijing respondents	china
Meat Consumption	1	Weekly meat consumption frequency From 0 = Never, to 4 = Almost every day	meatconsume
Concern about Food Issues		Question 2 elicited levels of concern on a scale from 1 = Not concerned to 5 = Very Concerned	
Packaging	2	Concern about product packaging	packaging
Price	2	Concern about product pricing	price
Food Handling	2	Concern about food handling and preparation	foodhandlingpreparation
Ingredients	2	Concern about food ingredients	ingredients
Food Borne Pathogens	2	Concern about food borne pathogens	foodbornepathogens
Chemicals Pesticides	2	Concern about chemicals and pesticides	chemicalspesticides
Hormones	2	Concern about the use of hormones in production	useofhormones
Biotechnology	2	Concern about use of biotechnology in production	biotechnology
Cloning	2	Concern about cloning technology in production	cloning
Attention to Labels	3	Attention paid to labels on meat packaging From 1 = Don't know to 5 = A lot	attention
Knowledge of Technology	4	Self-evaluated knowledge of biotech, cloning, genetic engineering. From 1 = nothing to 4 = A great deal	knowtech
Likely to consume	5	Likelihood of consuming meat from cloned animals From 1 = Not at all likely to 5 = Very likely	likely1
Reason for Discomfort	6	Question 6 elicited the main reason the respondent would be uncomfortable with meat from cloned animals.	answerstoq7

Reason Morally Wrong	6	Main reason for discomfort is moral objection	morallywrong
Reason Food Safety	6	Main reason for discomfort is food safety concern	foodsafety
Reason Human Cloning	6	Main reason for discomfort is possibility of human cloning	humancloning
Reason Animal Safety	6	Main reason for discomfort is animal safety	animalsafety
Reason Don't Know	6	Do not know reason for discomfort	dontknow
Reason Not Uncomfortable	*6*	*Not uncomfortable with animal cloning*	*notuncomfortable*
Reason Don't Care	6	Do not care about animal cloning	dontcare
Likely to consume 2	7	Likelihood of consuming meat from cloned animals after learning about FDA/EFSA safety assessment	likely2
Likely to consume 3	8	Likelihood of consuming meat from cloned animals at a 10% price reduction	likely3
Gender	9	Gender of respondent: = 1 if female	female
Religious Affiliation	10	Respondent has a religious affiliation: = 1 if yes, 0 if no or prefer not to answer	religious
Agriculture Background	11	Respondent has farm or ranch background = 1 if yes, 0 if no	farm
Political Affiliation	12	Respondents general political/social affiliation 1 = conservative, 2 = moderate, 3 = liberal, 4 = no affiliation, 5 = liberal on some, conservative on other, 6 = other, 7 = prefer not to answer	politics
Age	13	Respondents age - from 1 = 20 or younger, 2 = 21-25, etc to 10 = 71 or older.	age
Education level	14	Respondents highest level of education, from 1 = some high school, to 5 = post graduate (6 = other)	education
Income	15	Approximate 2008 household income before taxes. Categorical from 1 = < $20,000, 2 = $20,000 to $30,000, etc (with appropriate conversions for non-US respondents).	income
Household Residents	16	Number of people living in household	household
Children Under 6	17	Children under 6 living in household: 1 = yes, 0 = no.	under6
Children From 6 to18	17	Children between 6 – 18 living in household; 1 = yes, 0 = no.	from6to18
Food Tech Concern	2	Index of concern about food technology. Constructed as the average of concern about *useofhormones* and *biotechnology* from question 2	FoodTechConcern

Below is a list of the dependent and independent variables with a hypothesis summary of how the variable will behave with consideration to the major topic study:

4.3.1 Dependent Variables

Given the focus of the study, in order to understand consumer's perception of animal cloning, it was important for us to ask about the respondent's likelihood of consuming products derived from cloned animals. However, a simple "yes" or "no" response would not allow for a precise

enough assessment of what consumers might be likely to do when provided with all the information they might have in the marketplace. That information would include price, government approval, any information on the label, and the actual appearance of the products. The survey was designed to provide additional information about cloning as the respondent progressed through the instrument, and to assess the impact of that additional information on their likelihood of consuming a cloned product. Thus, the question about likelihood of consuming a cloned product was asked three times, with information about safety and price interjected between the repeated questions. Responses to those three questions, as described below, provide data on the dependent variable in a series of regression models.

1. **Question 5: Likelihood of consuming meat from cloned animals (Likely 1)**
   How likely are you to buy and eat meat from cloned animals?
   - This question was designed to elicit the initial reaction on the likelihood of consuming cloned product. Answer options were on a Likert scale from 1= Not at all Likely, to 3 = Somewhat Likely, to 5 = Very Likely.
     Note that the question deals only with meat from cloned animals and not with meat from the offspring of clones. This was a strategic decision made to keep the survey instrument as simple as possible. A number of studies have found that respondents make little or no distinction between products from clones and those from clone offspring (Lusk 2008, Brooks and Lusk 2010, Sosin and Richards 2005). However, our results pertain only to products derived from clones themselves.

2. **Question 7: Likelihood of consuming meat from cloned animals after being informed about EFSA/FDA safety assessments (Likely 2)**
   - The question was worded as follows: “Both the United States Food & Drug Administration (FDA) and the European Food Safety Authority (EFSA) have determined that meat and dairy products from cloned animals and their offspring are no different from products derived from conventionally bred animals, and thus are safe for human consumption. Knowing this, if meat from cloned animals were

being sold in your local grocery stores, how likely would you be to buy and consume it?"

- Responses were elicited using the same Likert scale used in question 5. Individual responses to this question allow us to investigate the effect of providing information about product safety (or, more accurately, assessments of product safety by government agencies) on the respondent's likelihood of consuming cloned product.
- Government has traditionally played a large role in regulating food products, including the technologies used in production and the steps necessary in ensuring food safety. In 2008, both the FDA and the EFSA released statements which gave the green light to human consumption of products derived from cloning technology. China, Japan, and New Zealand have all copied or referenced the 2008 FDA assessment in their own regulations, indicating the international respect for the FDA opinion. Theoretically, given this additional piece of information, respondents should increase their stated likelihood of consuming cloned product. However, it is expected that the degree of consumer trust in government will impact any change in their likelihood rating between question 5 and question 7 (Sosin and Richards 2005, Lusk 2008).

3. **Question 8: Likelihood of consuming meat from cloned animals at a 10% price discount (Likely 3)**
    - The question was worded as follows: "If the price of meat from cloned animals was 10 percent lower than meat from conventional animals, would you be likely to buy and consume meat from cloned animals?"
    - Responses were elicited using the same Likert scale used in question 5. Individual responses to this question allow us to investigate the effect of price reduction might have on the respondent's likelihood of consuming cloned product.
    - Price is of universal importance to consumers worldwide. For centuries science and technology has attempted to find ways of increasing production while at the same time decreasing cost. Since the early 2000's, cloning technology has made

significant advances and is out of the laboratory and instead currently being used in the mainstream beef industry, primarily for high valued breeding animals. One potential benefit of cloning is enhanced production efficiency, which could lead to cost saving being passed onto the consumer. It is expected that some respondents, those who are more price conscious, may increase their stated likelihood of consuming cloned product in a situation where the product price is more competitive.

4.3.2 Independent Variables

The survey collected information on several variables that might be related to an individual's likelihood of consuming cloned product. The questions used to collect that information are described below.

1. **Collector List**

   Each subsample (or collector) in the study was identified using a dummy variable. Collector dummy variables include those for the Kansas State University classes in Agricultural Economics, English, and Sociology, European collectors for University College Dublin, Ireland and Purpan School of Agriculture in France, a Latin American collector dummy variable for Universidad de Zamorano in Honduras, and an Asian collector dummy variable for the Beijing Vocational College of Agriculture

   a. *Kansas State University*

      Prior work has found that American consumers are more accepting of animal cloning (Hoban 1999) At Kansas State University, it is likely that some students, particularly those in the College of Agriculture, are familiar with advanced agro-biotechnologies which could ease their concern about consuming cloned product

      i. *Agriculture Economics* – Likely originating from agriculture backgrounds, this subgroup is expected to be more accepting of animal cloning. Because cloning has become more widely accepted by Americans (Hoban, 2001, 1999) (The Mellman Group, Inc 2006), and utilized by cattle producers in the United

States (Coover 2010), there is a chance that some of these students have either directly or indirectly been involved in animal cloning themselves.

ii. *English* – Because undergraduate English is a required course in many majors, the students will come from a wide variety of backgrounds. Responses from this sub group may be more representative of the general student body population and perhaps more representative of US consumers in general.

iii. *Sociology* – While Sociology is a required course for some majors, it is required by fewer than those majors that require English. Because of this, it is probable that this class contains more students with a liberal arts interest who may be less accepting of animal cloning.

b. *University College Dublin of Ireland*

Europeans are known to be uncomfortable with biotechnology and animal cloning (Hoban 1999, 2001; Carlene 2007; European Commission 2008) and Ireland is no different. The 2008 Eurobarameter poll found that only 35% of Irish respondents were likely to consume products from cloned animals while 46% were not at all likely. Compared to the US agriculture students (Agricultural Economics), the expectation is that this sample of Irish undergraduate students in Agriculture will be less accepting of cloning.

c. *Purpan School of Agriculture of France*

The same 2008 Eurobarameter poll found that only 30% of French respondents were likely to consume cloned product, and 45% were not at all likely to consume (European Commission 2008). In general, the French have been vehemently opposed to biotechnology for many years and are unlikely to have a favorable view of an American originated agricultural biotechnology. The expectation is that the French agriculture students will be less accepting of cloning than their US counterparts (in Agricultural Economics).

d. *Universidad de Zamorano of Honduras*

Very little research has been done on consumer perceptions of biotechnology in Latin American countries and therefore there is no established base of comparison between Latin America and the US. The work that has been conducted shows that "biotechnology has had little effect on farmers or consumers in Latin American and the Caribbean" (Trigo, et al. 2002). Because many Latin American countries are low income, most people do not have the luxury of purchasing specialty foods but are more concerned about sustenance consumption. The hypothesis for this study is that results will show strong opinions towards animal cloning because it is a survey conducted from educated students with backgrounds in agriculture production; however, those opinions will not affect consumption perceptions and therefore will be more lenient toward products derived from animal cloning.

e. *Beijing Vocational College of Agriculture in China*

Several studies have been done on Chinese consumer perceptions of advanced agricultural biotechnologies; however, the results from those are mixed (Huang, et al. 2005, Li, et al. 2002). For all its advances, China is still a developing country and many consumers base their diet choices on sustenance consumption. Therefore they are less concerned with how the food is produced, but rather how it looks before it is consumed (Bieroth, Tucker and Anderson 2010). The hypothesis is similar to Honduras in that, there will be low overall perceptions of cloned product, but it may not affect likelihood to consume cloned product. As with Honduras, no hypothesis is proposed regarding how assessments of cloning from this sample might compare to that of their US counterparts.

2. **Question 1: Consumption**

"Approximately how often does your household consume beef, chicken, or pork meat products?"

- The question was designed to quantify meat consumption. Answer options were: 1 = Almost every day, 2 = 3-4 times a week, 3 = About once a week, 4 = Less than once a week, 5 = Never – we have eliminated meat products from our diet. These values

were reversed during data entry so that higher values would correspond to higher levels of meat consumption, i.e., 0 = never consume, up to 4 = almost every day.

- The expectation is that higher levels of meat consumption would be correlated with a higher willingness to consume cloned meat product. Individuals who consume meat less frequently may be more health conscious and may wish to avoid, for various reasons, products that involve use of new and "non-natural" technologies. If individuals with higher levels of consumption are more likely to consume cloned product this suggests that there would be less of a negative impact on overall meat consumption if unlabeled cloned products were introduced to the market.

3. **Question 2: Meat Product Concern**

"With regard to meat products, how concerned are you about the issues listed below?"

- The question was designed to evaluate concern about various issues related to food including cloning. Answers were elicited on a five point Likert scale from 1 = Not concerned to 5 = Very concerned. Level of concern was elicited about the following nine issues: *Packaging, Price, Food handling/preparation, Ingredients, Foodborne pathogens, Chemicals/Pesticides, Use of hormones, Biotechnology, and Cloning.* Comparison of the stated levels of concern across the different issues allows an assessment about the relative degree of concern about cloning compared to other food issues. The stated level of concern about some of these issues is hypothesized to be related to the individual's likeliness to consume cloned product.

- *Packaging*

  Overall level of concern for packaging is expected to be low. It is unlikely to have a relationship with likelihood of consuming cloned product.

- *Price*

  If consumers are more concerned about the price of their food, they may be less likely to be concerned about advanced production technologies such as cloning, which may be viewed as means of making production more efficient and thereby lowering price.

- *Handling/Preparation*

  As for packaging, concern about handling should be relatively low, particularly in higher income countries with advanced food safety protocols such as the US and Europe. This factor is unlikely to be related to likelihood of consuming cloned product.

- *Ingredients*

  The concern about ingredients would be expected to exceed that for packaging or handling. While the internal makeup of products is often a concern for many consumers, this factor is unlikely to have a strong correlation with likelihood of consuming cloned product. The reason being, consumers will be able to delineate that cloning is not an ingredient but rather a production process.

- *Foodborne Pathogens*

  Foodborne pathogens such as *E.coli* and *Salmonella* have attracted significant media attention in the US in recent years. Concern about this issue is expected to be relatively high in higher income countries. If individuals perceive cloning as having negative implications for food safety, higher levels of concern about foodborne pathogens may be related to a lower likelihood of consuming cloned product, but that relationship is not expected to be strong.

- *Chemicals/Pesticides*

  As for foodborne pathogens, the expressed level of concern is expected to be relatively high compared to other issues, but it is not expected to have a strong correlation with likelihood of consuming cloned product.

- *Use of Hormones*

  The more concern the individual expresses about hormone use the less likely they may be to consume cloned product. Many consumers are aware and concerned about the residues from additive hormones in food products (International Food Information Council 2008). It has been a highly publicized topic that for many consumers

becomes a "perception filter causing bias between reality and scientific evidence on the one hand and consumer perception of this reality on the other hand" (Verbeke, et al. 2006). In addition, the concern has been capitalized on in the form of an entirely new segment of the agriculture industry including organic and natural. Because of this, many consumers, especially those in the developed nations and including China (Bieroth, Tucker and Anderson 2010), will have strong negative opinions about the issue. The only group that may not be as concerned will be those from agricultural backgrounds.

- *Biotechnology*

  The expectation is that the expressed level of concern about biotechnology will be highly correlated with that about use of hormones, and that both will be negatively correlated with likelihood of consuming cloned product. To avoid multicollinearity issues, the average level of concern about hormones and biotechnology (a variable labeled '*foodtechconcern*') will be included in models explaining variation in expressed likelihood of consuming cloned product.

- *Cloning*

  Expressed level of concern about cloning will be compared to level of concerns about other issues, particularly foodborne pathogens, to ascertain the relative level of concern consumers have about the technology. Expressed concern about cloning is, of course, expected to have a strong negative correlation with likelihood of consuming cloned product. However, since both questions are essentially measuring the same thing, level of concern would effectively be a dominant variable in models explaining variation in likelihood of consumption, and for that reason will not be included in those models.

4. **Question 3: Attention to Labels**

   "Other than the price, do you pay attention to marketing labels on meat packaging?"

- The question is designed to see how much attention is paid to marketing labels on product packages. Answer options include: 1 = Don't Know, 2 = Not At All, 3 = A Little, 4 = Some, 5 = A Lot.
- Increased level of attention to labels is expected to be negatively correlated with likelihood of consuming cloned product, although that relationship may not be strong. Labeling products with specific types of information is a high stakes and often contentious discussion between policy makers, producers, and consumers. Numerous studies have been published trying to weigh the objectivity between what consumers need to know for proper marketplace decision making compared to what information may alienate advanced production technologies (Nonis, Hudson and Hunt 2010, Gruere and Rao 2007, Raab and Grobe 2003). If consumers pay attention to labels, they are either looking for product attributes they want to buy or attributes they want to avoid. At present, the US Food and Drug Administration (FDA) consider products derived from clones to be identical to those from animals produced conventionally. For that reason, FDA does not require labeling of products derived from clones. However, it will treat on a case by case basis requests for approval of 'negative labeling' – i.e., labels indicating that product is *not* derived from cloning. If such labels are introduced, consumers who pay more attention to labels will likely seek out those products.

5. **Question 4: Perceived Knowledge of Biotech**

"How much do you know about biotechnology, cloning, genetic engineering, or genetic modification?"

- The question is designed to elicit the respondent's perceived knowledge about advanced reproductive technologies. Answer options are: 1 = Nothing, 2 = Very Little, 3 = A Fair Amount, 4 = A Great Deal.
- Perceived knowledge may have an important influence on how a consumer will react to advanced reproductive technologies including cloning. In general, consumer knowledge about cloning technology is low (Hoban 2001, International Food Information Council 2008, Lusk 2008, The Mellman Group, Inc 2006). But as Knight (2005) discusses in his study on perceived versus objective consumer

knowledge, consumers "may be more likely to make purchase decisions based on their perceived level of knowledge even if that information is erroneous" (Knight 2006). While consumers are likely to exaggerate their level of knowledge (Knight 2006), the hypothesis is that higher self-reported knowledge of technology will be positively correlated with likelihood of consuming cloned product.

6. **Question 6: Reasons for Discomfort with Cloning**

"Which one of the following is the main reason you would be uncomfortable with eating meat from cloned animals? Please choose one."

- This question tries to narrow down the primary reason for discomfort with animal cloning. Respondents were allowed to choose one from a list of 7 responses including 1 = Animal cloning is morally wrong, 2 = Unsure of food safety from cloned animals, 3 = Animal cloning might lead to human cloning, 4 = Unsure that cloning is safe for animals, 5 = Don't know, 6 = Not uncomfortable, and 7 = Don't care. In the web-based survey, respondents were prevented from choosing more than one of the 7 response options. However, in the Chinese sample, where data was gathered on hard copies, several respondents chose more than one option from the list. Dummy variables were created to identify individuals who opposed cloning for the different reasons presented. These dummy variables will be included in models examining variability in the likelihood of consuming cloned product in an effort to ascertain the relative strength of opposition from individuals holding different objections to the process.
- The more specific information available on why consumers are concerned about animal cloning, the easier it will be to target information designed to reassure them about the technology. Based on numerous studies since early 2000, the most commonly cited objections to cloning have been the moral and ethical elements as well as overall uncertainty about the technology (Hoban 2001, Sosin and Richards 2005, The Mellman Group, Inc 2006, The Mellman Group, Inc. 2005, International Food Information Council 2008, Gallup, Inc. 2009, Nonis, Hudson and Hunt 2010, Lusk 2008). However, few surveys have narrowed down the actual reason why consumers, assuming they do, have a problem with animal cloning.

i. *Animal Cloning is Morally Wrong* – Nearly every survey done on animal cloning shows that some consumers have strong moral concerns about the technology (Hoban 2001, Sosin and Richards 2005, The Mellman Group, Inc 2006 - 2005, International Food Information Council 2008, Gallup, Inc. 2009, Nonis, Hudson and Hunt 2010, Lusk 2008). If respondents feel that cloning is morally wrong they are likely to be more adamant in their unwillingness to consume cloned product.

ii. *Unsure of food safety from cloned animals* – Most surveys have mentioned food safety as a concern about animal cloning (Hoban 2001, Sosin and Richards 2005, The Mellman Group, Inc 2006- 2005, International Food Information Council 2008, Gallup, Inc. 2009, Nonis, Hudson and Hunt 2010, Lusk 2008). As with those who consider cloning morally wrong, individuals who believe cloning is a food safety concern are likely to be less willing to consume cloned product. However, reassurances about the safety of the technology may resonate with these individuals more than with those who believe the technology is morally wrong.

iii. *Animal cloning might lead to human cloning* –The idea that animal cloning could lead to human cloning is frequently mentioned in newspaper articles and online blogs (Roberts 2008, Gallup, Inc. 2009). Again, respondents who feel cloning is a slippery slope to human cloning or feel that human cloning criminal, will be less likely to consume cloned product.

iv. *Unsure that cloning is safe for animals* – Many reports point out that while the technology of animal cloning is advancing, it still struggles with a low success rate. The FDA and EFSA point out that there are safety concerns for both the surrogate female and the cloned animal during the process (Food and Drug Administration 2008, European Food Safety Authority 2009). Anti-cloning activists draw attention to high animal mortality rates in hopes of swaying consumers and legislators against the technology (HSUS 2010). The expectation is that respondents who believe cloning is unsafe for animals will be less likely to consume cloned product.

v. *Don't Know, Not Uncomfortable, and Don't Care* – These categories were included to provide as complete a set of response options as possible for respondents.

7. **Question 9: Gender**

"What gender are you?"

- Response options, as coded by SurveyMonkey, were 1 = Male and 2 = Female. These were transformed into a dummy variable for Female gender, where the variable took a value of 1 for female respondents, and 0 otherwise.
- Based on some results from the literature (Hoban 1999, Knight 2006, Albrecht 2003) females are expected to be less likely to consume cloned product.

8. **Question 10: Religious Affiliation**

"Do you have a religious affiliation?"

- This question is aimed at identifying respondents with a religious preferences. Answer options included 1= Yes, 2 = No, and 3 = Prefer not to answer. These responses were transformed into a dummy variable (labeled Religious) which took a value of 1 for respondents indicating a religious affiliation, and 0 otherwise
- One of the controversies surrounding animal cloning is the moral or ethical objection consumers have to the technology (Hoban 2001, Sosin and Richards 2005, The Mellman Group, Inc 2006 - 2005, International Food Information Council 2008, Gallup, Inc. 2009, Nonis, Hudson and Hunt 2010, Lusk 2008). Several studies which have shown a negative relationship between acceptance of biotechnology and religious affiliation (Knight 2006, Biel and Nilsson 2005) The theory is that consumers who hold religious values may be less supportive of cloning and biotechnology in general because the science changes the natural order of nature. By modifying or manipulating the natural order, scientists are also modifying the creation of God (Biel and Nilsson 2005). The expectation is that individuals with a religious affiliation will be less likely to consume cloned product.

9. **Question 11: Farm Background**

"Are you from a farming or ranching background?"

- Response options were 1 = Yes (agriculture background), or 2 = No, which again was transformed into a dummy variable for agricultural background (1 = yes, 0 = no).
- While some of our subsamples targeted students in Agricultural programs, not all of those students will necessarily come from a farming background, and some in our other samples may come from that background. Respondents from an agricultural background may be more familiar with and more accepting of new reproductive technologies (although there is a possibility that this variable may be correlated with one measuring self-reported knowledge of technology).

10. **Question 12: Social Issues**

"Considering sociopolitical issues, would you consider yourself more:"

- This question is intended to find the political disposition of the respondent. Response options included: 1= Conservative, 2 = Moderate, 3 = Liberal, 4 = No Affiliation, 5 = Liberal on some, Conservative on others, 6 = Other, 7 = Prefer not to answer. Responses were used to create dummy variables corresponding to the different response options.
- While sociopolitical disposition is often used in sample descriptive statistics, it is rarely used in econometric modeling to explain, for example, consumer attitudes toward or perceptions of biotechnology. Oftentimes liberals and conservatives tend to be at odds with one another; however, for animal cloning it seems they are at odds with one another for different reasons. Surveys show that liberals tend to be more self-protective and therefore more skeptical about biotechnology and its unintended consequences on the environment (Hossain, Onyango and Adelaja, et al. 2002, Hossain and Onyango 2004). However, conservatives tend to be more religious (Layman and Carmines 1997) and for that reason may also have a negative view of technologies such as cloning. The dummy variables created from the responses to this question will allow for testing of various hypotheses such as "self identified liberals are less likely than others to consume cloned product." Given the potential offsetting effects mentioned, no hypotheses are put forward for the signs of these

effects, but it is expected that they would be relatively small after controlling for other covariates (knowledge of cloning, etc).

11. **Question 13: Age**

"Please select your age bracket"

- Response options included 1 = 20 or younger, 2 = 21 – 25, 3 = 26 – 30, 4 = 30 – 35, 5 = 35 – 40, 6 = 40 – 45, 7 = 46 – 50, 8 = 51 – 60, 9 = 61 – 70, 10 = 71 – older.
- Given the targeted samples used in this study most respondents are likely to be of college age. However, in some subsamples the survey may have been delivered to a broader group, perhaps including college faculty. If that occurred, the responses to this question would allow for limiting the sample to the target group of undergraduates (note that the survey does not include a question about the respondents profession or employment status). However, the main reason for including the question was to facilitate extension of the survey to other samples that might include adults. Some studies have shown that respondent age is related to acceptance of cloning, but the effect is rarely significant (Knight 2006, Lusk 2008). Lusk 2008 found that age was negatively correlated to willingness to consume products from cloned animals.

12. **Question 14: Education**

"What is the highest level of education you have completed?"

- Response options included 1 = Some high school, 2 = High school graduate, 3 = Some college, 4 = College graduate, 5 = Post graduate, 6 = Other. Similar to the question about age above, the main reason for including this question was to facilitate extending the survey to other samples in which responses would show more variability than in our targeted samples.
- Surveys have found those with only high school diplomas are less supportive of eating product derived from cloned animals while those with bachelor degrees or higher are slightly more likely to consume, but still have low acceptance (Lusk 2008, Knight 2006, The Mellman Group, Inc 2006). Our targeted respondents should all be

working toward a bachelor's degree and therefore should have marked 2 or 3. However, some that may have marked 4 in anticipation of obtaining the degree.

13. **Question 15: Income**

"In order to evaluate if we are getting a cross section of all people, we would like to know your approximate 2008 household income before taxes?"

- Answer options included 1= less than $20,000, 2 = $20,000 –30,000, 3 = $30,000 – $40,000, 4 = $40,000 – $50,000, 5 = $50,000 – $70,000, 6 = $70,000 – $100,000, 7 = $100,000 – $150,000, 8 = more than $150,000, 9 = Prefer not to answer. . For samples outside the US the currency values were converted to local values (European Union euro (€),Honduran lempiras (L), Chinese renminbi (¥)) that roughly corresponded to the values in the United States survey. For example, in the French and Irish surveys, response option 8 was "more than €110,000."
- Income is an important factor in demand and acceptance models because purchase behavior is, in theory, directly linked to the respondent's disposable income. Interestingly, the literature is relatively sparse on findings relating income to consumer perceptions of animal cloning. Respondents with higher incomes are generally more accepting of biotechnology in general (Albrecht 2003) and only marginally more accepting of animal cloning (Lusk 2008). In our sample however, the question is probably unnecessary. The majority of respondents were college age whose own income would likely be in the lowest category. However, some respondents may have reported their parent's income, particularly if they still lived at home. For those reason the models presented later will not include income as an explanatory variable.

14. **Question 16: People in Your Household**

"Including yourself, how many people live in your household?"

- This question is designed to identify families and total number of mouths being fed in the house. Answer options included 1 = 1 person, 2 = 2 people, 3 = 3 people, 4 = 4 people, 5 = 5 people, 6 = more than 5.

- Again, this question was unnecessary given our target audience. In a broader survey however, this question, in conjunction with household income would serve to help estimate the relative disposable income of different respondents.

15. **Question 17: Children living in the household**

"Are there any children living in your household?"

- Answer options included 1 = Yes and 2 = No for both "Under age 6" and "Between 6 and 18".
- In a broader sample, this could be an important variable. Families with young children are generally more concerned about the food they purchase. Lusk (2008) found that respondents with children under the age of 12 were less likely to believe product derived from cloned animals was safe to eat. But because this sample mainly includes college age students who likely do not have children, the variable will be unnecessary.

5 Describing Data

Below are the descriptive statistics for the entire data set. It is important to note that not every question had the total 644 observations, due to some non-responses to individual questions in the Chinese sample.

Table 5-1: Descriptive Statistics

Variable	*Total Observation*	*Mean*	*Std. Dev.*	*Min*	*Max*
Dependent Variables					
Likeliness to Consume (1)	644	2.188	1.227	1	5
*Government Approval (2)	644	2.523	1.357	1	5
**Price Reduction (3)	644	2.587	1.366	1	5
Independent Variables					
meatconsume	644	3.244	0.995	0	4
Concern about food					
packaging	642	2.804	1.326	1	5
price	644	3.905	1.102	1	5
foodhandlingpreparation	641	3.754	1.175	1	5
ingredients	641	3.657	1.245	1	5
foodbornepathogens	642	3.879	1.308	1	5
chemicalspesticides	639	3.573	1.369	1	5
useofhormones	641	3.399	1.464	1	5
biotechnology	640	2.897	1.397	1	5
cloning	640	2.98	1.513	1	5
foodTechConcern***	639	3.15	1.302	1	5
attention (to labels)	643	3.488	1.133	1	5
knowtech	643	2.356	0.846	1	4
Concern about cloning**	696				
morallywrong	123	0.191	0.393	0	1
foodsafety	232	0.36	0.48	0	1
humancloning	74	0.115	0.319	0	1
animalsafety	101	0.157	0.364	0	1
dontknow	65	0.101	0.301	0	1
notuncomfortable	51	0.079	0.27	0	1
dontcare	50	0.078	0.268	0	1
Demographic Variables					
female	644	0.452	0.498	0	1
farm (background)	641	0.64	0.48	0	1
Politics	639	3.562	1.73	1	7
Liberal	644	0.14	0.347	0	1
Moderate	644	0.517	0.5	0	1
Conservative	644	0.134	0.34	0	1
Other/No Affiliation	644	.0931	.291	0	1
age	644	1.845	0.644	1	4
education	644	3.632	0.866	1	6
income	636	4.89	3.494	1	9

household	638	3.378	1.521	1	6
under6	575	0.08	0.272	0	1
from6to18	574	0.22	0.414	0	1

* Likelihood of consuming cloned meat after receiving information about government approval.
** Likelihood of consuming cloned meat contingent on 10% price reduction
*** *FoodTechConcern* is an average of *useofhormones* and *biotechnology*
****Concern about cloning does not sum to 644 due to multiple responses from some Chinese respondents

5.1 **Response Rates and Timeline**

The online survey was conducted at four universities in four countries including Kansas State University, Manhattan, Kansas; University College Dublin, Dublin, Ireland; Ecole Superieure d'Agriclture de Purpan, Purpane, France; and Escuela Agricola Panamericana Zamorano, Honduras. In China, the data was collected using hard copies distributed by hand. Table 5-2 provides detail about the samples and response rates.

The total number of responses was 714. However, a number of responses were dropped from the final sample either due to incomplete answers or because of incompatibility with the desired sample group. A total of 429 responses were obtained from the online surveys with U.S., Irish and French respondents, from which 19 were dropped due to incomplete responses. In these cases, the respondent would begin but fail to complete the survey. In Honduras, the survey was made available to a much broader sample of respondents than was the case in any of the other online surveys. The total number to which it was made available was estimated to be 2,000 and the sample included not only undergraduate students but also staff and faculty at the University. Using responses to the age and education questions, 40 of the 134 responses were dropped because they were clearly not from undergraduate respondents. Because the Chinese respondents completed the survey using a paper copy, we had less control over how the survey was completed. Due to incomplete responses, 11 of a total of 151 responses were dropped. The final sample size was 644.

Table 5-2: Survey Completion Summary

	Sampled	Total Received	Total Completed	Completed Response Rate
Agricultural Economics (AgEcon)	70	61	59	84.29%
English	53	46	46	86.79%
Sociology	43	34	30	69.77%
TOTAL USA	166	141	135	81.33%
Ireland	584	123	112	19.18%
France	320	165	163	50.94%
Honduras	2000	134	94	4.70%
China	152	151	140	92.11%
TOTAL	3222	714	644	19.99%

Understanding the survey timeline is important due to the potential influence media attention given to animal cloning could have on the respondents (Neeteson, et al. 1999, Hoban 2001, Hoban 2004). This data was collected over a period of approximately 10 months between December 2009 and October 2010. During that period, there were few significant developments relative to cloning and relatively little media attention was given to the issue. Data was first collected from the classes at Kansas State University in December 2009. The survey was made available on 12/07/2009 with the majority of responses received by December 16, 2009. In France and Ireland, the survey was made available in April 2010 (beginning 04/11/2010 in France, and 04/12/2010 in Ireland). Responses were gathered for a period of about one month with collection shut off on 05/12/2010. It is important to note that all responses from the USA, Ireland, and France were received prior to the renewed European debate on animal cloning in July 2010 (Novel Foods Act 2010). In Honduras, the survey was made available for almost three months from 06/30/2010 until being shut off 09/05/2010. The link was emailed twice to the sample in an effort to boost the response rate. The majority of responses came in the second month of availability. For the Chinese survey, the PDF file was emailed to the collaborator in Beijing in August 2010. Copies of the survey were passed out in several classes then collected and posted in the mail back to the U.S. on 10/25/2010.

5.2 **Respondent Demographic Characteristics**

Given the final 644 respondents, the figures and tables below compare the demographic characteristics between each respondent group. Note that the targeted population for this study

was students attending university. Figure 5.1 shows the gender composition of the sample. The final dataset contains a relatively even split of males at 45% and females at 55%. In the U.S. sample, there is a slight majority of male respondents but within the individual classes comprising the U.S. sample there is some variability with a majority of males in the AgEcon class and a majority of females in the English class. The Sociology class is more closely balanced. The Irish and French samples have slightly more females than males, while the opposite is true with the Honduran and Chinese samples.

Figure 5-1: Gender Composition of the Sample

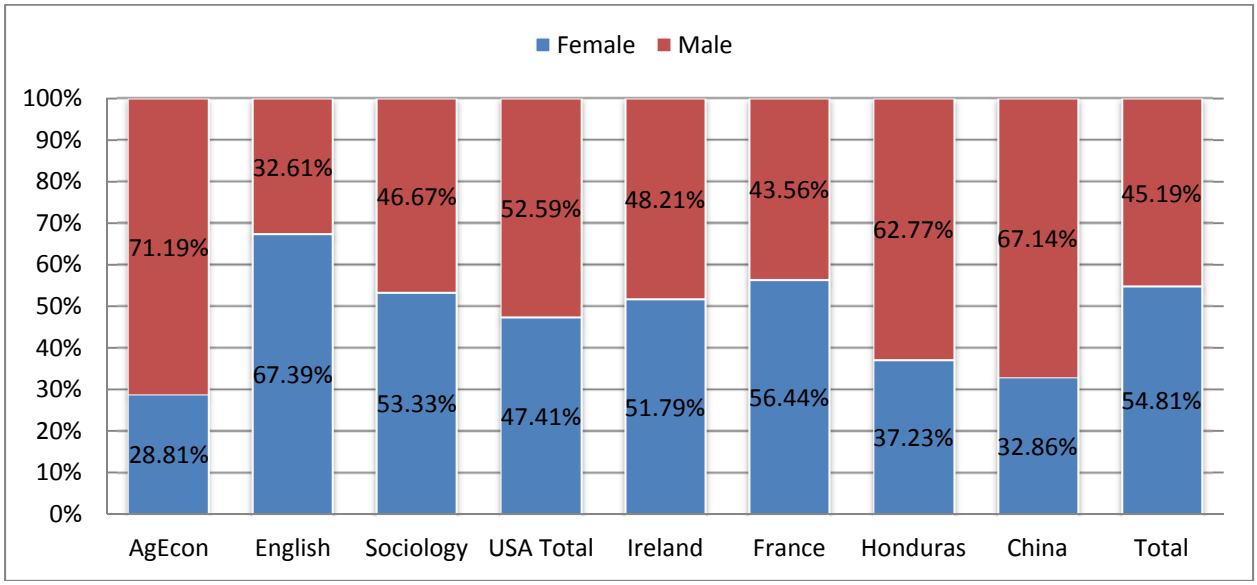


Figure 6-2 shows the age distribution of the sample. As already noted, the samples were selected to focus on undergraduate students and for that reason most respondents are under the age of 25. It is interesting to note that only France and China included students primarily from the ages of 20 or younger and 21 – 25. The data from the USA, Ireland, and Honduras included at least some respondents aged 26 or older.

Figure 5-2: Age Composition of the Sample

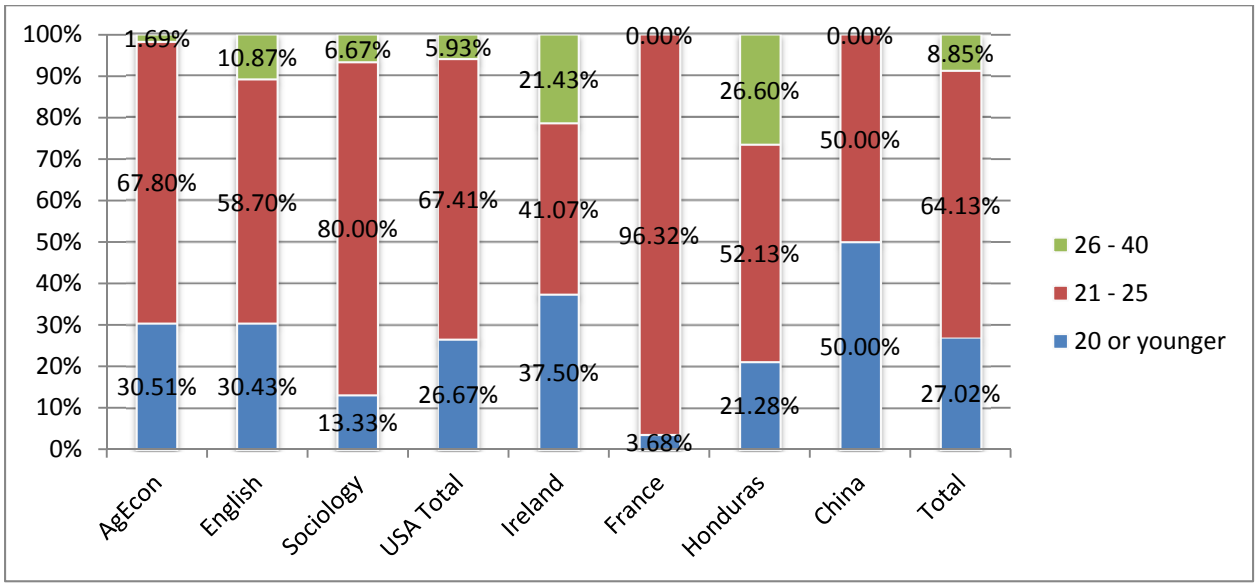


Table 6-3 contains data on the other demographic information collected from respondents. As expected 49% of respondents stated they had completed some college with an additional 28% indicating they were a college graduate. Income levels are also relatively uniform but, as expected, many respondents, 34% in total, chose the "prefer not to answer" response. In the Chinese sample, over 70% chose that response.

Responses to questions about household composition were very diverse as expected in a sample focused on students. Forty-six percent indicated that they lived in households with either three or four people. The French sample was notably different with over 37% indicating they lived in a single person household. As expected for this sample, less than 10 percent indicated that the household included a child under the age of 6 years. An exception was the Honduran sample, with over 30% from a household with a young child. While it is not uncommon for college students to have young children, the Honduran data may reflect a greater societal tendency for extended family members to live together.

Table 5-3: Other Demographic Characteristics

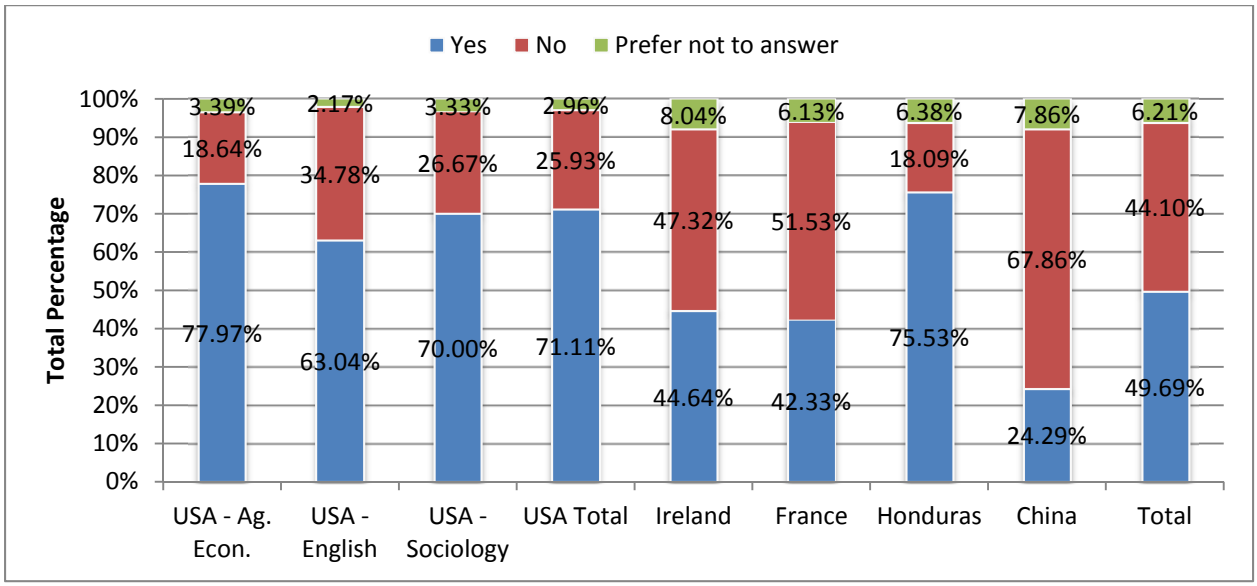
	AgEcon		English		Sociology		Ireland		France		Honduras		China		Total	
	N	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*	*N*	*% Freq.*
Total Number	59		46		30		112		163		94		140		644	
Education Level																
Some High School	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.61%	0	0.00%	1	71.00%	2	0.31%
High School Graduate	4	6.78%	2	4.35%	0	0.00%	8	7.14%	2	1.23%	0	0.00%	6	4.29%	22	3.42%
Some College	54	91.53%	39	84.78%	23	76.67%	47	41.96%	19	11.66%	26	27.66%	109	77.86%	317	49.22%
College Graduate	1	1.69%	5	10.87%	7	23.33%	36	32.14%	70	42.94%	47	50.00%	15	10.71%	181	28.11%
Post Graduate	0	0.00%	0	0.00%	0	0.00%	20	17.86%	70	42.94%	21	22.34%	3	2.14%	114	17.70%
Other	0	0.00%	0	0.00%	0	0.00%	1	0.89%	1	0.61%	0	0.00%	6	4.29%	8	1.24%
Income																
less than $20,000	24	40.68	21	45.65	13	43.33%	7	6.25%	82	50.31%	46	48.94%	16	12.12%	209	32.45%
$20,000 - $30,000	5	8.47	8	17.39	5	16.67%	11	9.82%	4	2.45%	12	12.77%	6	4.55%	51	7.92%
$30,000 - $40,000	1	1.69	3	6.52	1	3.33%	10	8.93%	5	3.07%	6	6.38%	4	3.03%	30	4.66%
$40,000 - $50,000	4	6.78	2	4.35	0	0.00%	18	16.07%	5	3.07%	0	0.00%	1	0.76%	30	4.66%
$50,000 - $70,000	3	5.08	0	0.00%	2	6.67%	10	8.93%	3	1.84%	4	4.26%	5	3.79%	27	4.19%
$70,000 - $100,000	6	10.17	4	8.7	1	3.33%	11	9.82%	2	1.23%	3	3.19%	0	0.00%	27	4.19%
$100,000 - $150,000	5	8.47	2	4.35	2	6.67%	11	9.82%	1	0.61%	0	0.00%	3	2.27%	24	3.73%
more than $150,000	3	5.08	1	2.17	2	6.67%	4	3.57%	1	0.61%	3	3.19%	4	3.03%	18	2.80%
Prefer not to answer	8	13.56	5	10.87	4	13.33%	30	26.79%	60	36.81%	20	21.28%	93	70.45%	220	34.16%
People in Household																
1 person	11	18.64	6	13.04%	4	13.33%	7	6.25%	61	37.42%	6	6.38%	1	0.75	96	14.91%
2 people	6	10.17	8	17.39%	8	26.67%	17	15.18%	35	21.47%	14	14.89%	5	3.73	93	14.44%
3 people	10	16.95	10	21.74%	6	20%	16	14.29%	29	17.79%	10	10.64%	59	44.03	140	21.74%
4 people	20	33.9	15	32.61%	4	13.33%	22	19.64%	21	12.88%	21	22.34%	53	39.55	156	24.22%
5 people	8	13.56	3	6.52%	3	10%	27	24.11%	11	6.75%	30	31.91%	7	5.22	89	13.82%
more than 5 people	4	6.78	4	8.70%	5	16.67%	23	20.54%	6	3.68%	13	13.83%	9	6.72	64	9.94%
Children in Household																
Under age 6 (Yes)	2	3.51%	4	9.09%	0	0.00%	5	5.10%	5	3.16%	25	31.25%	5	4.55%	46	7.14%
Between 6 & 18 (Yes)	13	22.81%	6	13.04%	4	13.33%	42	38.89%	24	15.19%	30	40.00%	7	7.00%	126	19.57%

5.3 **Respondent Other Characteristics**

Other characteristics that were measured in the survey were religious disposition, political disposition, and whether or not the respondent had an agricultural background.

The question about religious disposition was included because it was hypothesized that it might have an impact on likeliness to consume cloned product. Figure 5.3 shows the distribution of responses for the different subsamples for religious affiliation. The samples from the United States and Honduras have the highest rates of religious affiliation at 71% and 76%, respectively. These countries have strong religious institutions that are supported by communities throughout the nation (CIA 2011). The lowest level of religious affiliation was in the Chinese sample at 24% - a level that might be surprisingly high for a nation that defines itself as atheist. In France and Ireland, 45% and 42% respectively indicate a religious affiliation which might be surprisingly low for countries in which the populations are majority Roman Catholic - 87.4% in Ireland and 83% in France (CIA 2011). Again however, our samples are focused on university age students, a group among which church affiliation might be expected to be much lower than in the general population.

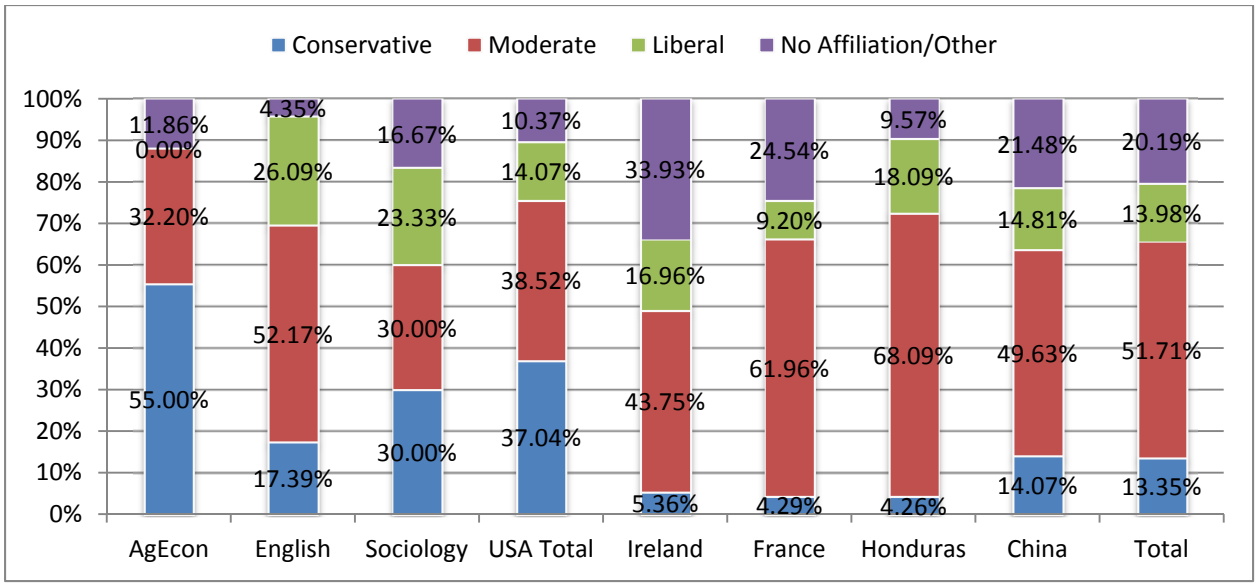
Figure 5-3: Religion: Response to "Do you have a religious affiliation?"



Regarding political predisposition, a majority of respondents identified themselves as "moderate". But looking closer to the data there were some interesting comparisons across

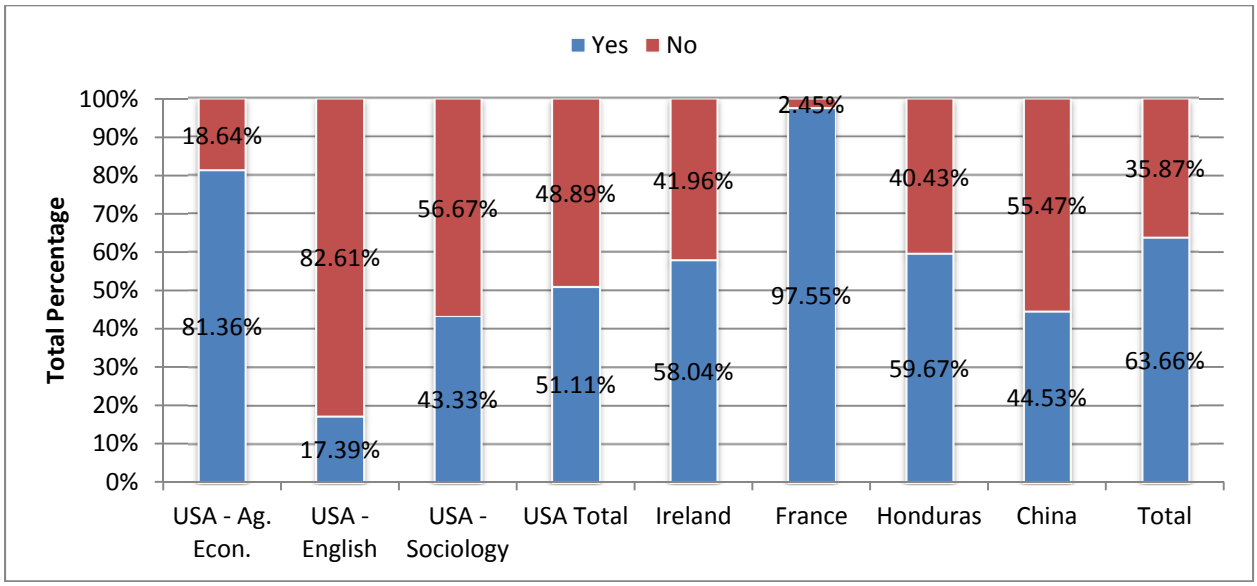
groups. For example, the AgEcon class at K-State had a majority of conservatives, with not even one respondent identifying themselves as "liberal." Meanwhile, the English and Sociology classes, more like the samples from Europe, China and Honduras, had a majority of respondents identifying themselves as either "moderate" or "liberal." In Ireland, France and Honduras, fewer than 10 percent identified themselves as "conservative."

Figure 5-4: Political Predisposition



Regarding the respondent's agricultural background, figure 5.5 shows that over sixty percent of respondents indicated that they came from a farming or ranching background with that percentage varying from a low of 17 percent in the English class at K-State to a high of 97 percent in the French sample.

Figure 5-5: Agricultural Background



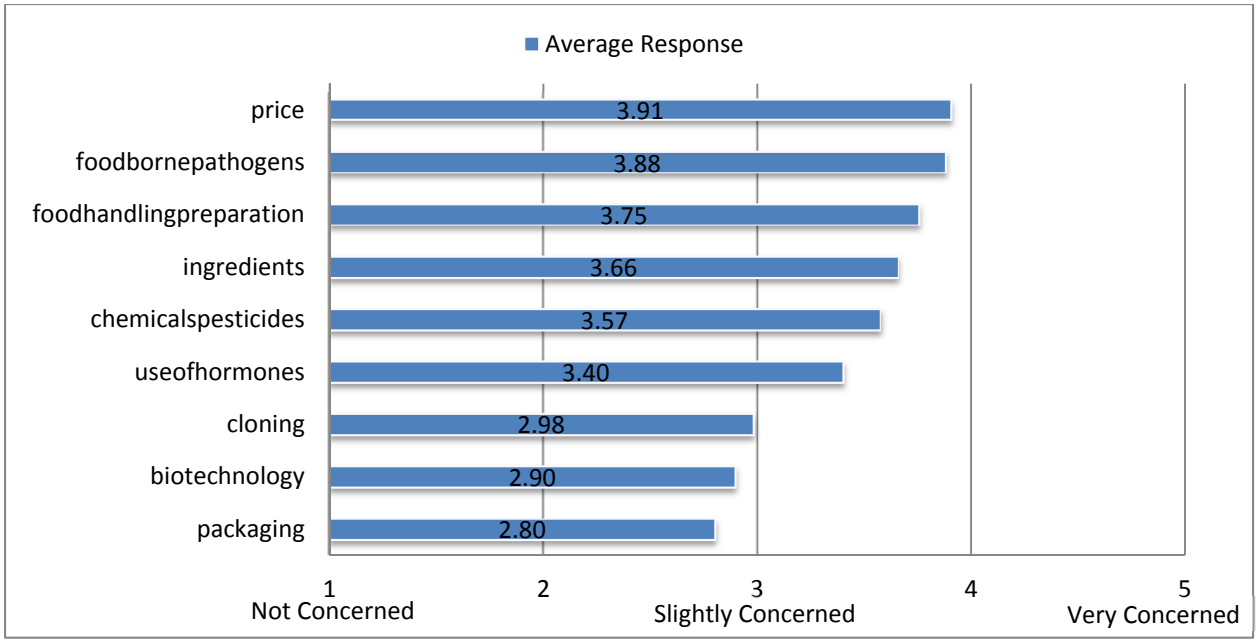
5.4 Concern for Food Product Issues

Using a 5 point Likert scale, question 2 elicited levels of concern about different food related issues. Table 5-4 shows the average reported concern for the questions about *packaging, price, foodhandlingpreparation, ingredients, foodbornepathogens, chemicalspesticides, useofhormones, biotechnology*, and *cloning*. Many of these variables were not used in the model, but could provide insight into individual's general perceptions toward food related issues. The average response for each food issue was found using the entire dataset (figure 5.6) as well as broken down for each group individually (table 5.4). Note that these questions were asked before the likeliness questions were presented which gave additional information about animal cloning.

Figure 5-6 shows that the order of average level of concern from largest to smallest for the entire dataset was *price, foodbornepathogens, foodhandlingpreparation, ingredients, chemicalspesticides, useofhormones, cloning, biotechnology,* with the lowest being *packaging*. Table 5-4 shows average concern levels broken down by each group. The highest average concern was 3.91 for price indicating that consumers are more than 'slightly concerned' about that issue. This was followed by concern about foodborne pathogens (avg.=3.88) and food handling (avg.=3.75). The average response for price tended to be ranked first, second, or third

for each group. Interestingly, the highest level of concern was not in the price category but rather the foodborne pathogens category indicated by the Honduras group (avg. =4.72). On the price issue, the highest level of concern was in the French sample (avg. =4.31).

Figure 5-6: Average Response for Concern for Food Issues (Total Dataset)



Packaging (avg. = 2.80) had the lowest average level of concern, followed by biotechnology (avg. =2.90) and animal cloning (avg. =2.98). These values indicate that consumers are only 'slightly concerned' about biotechnology and animal cloning. Two of the lowest average values were in the AgEcon group which reported a 1.98 average level of concern for both biotechnology and animal cloning. The only lower group average was also in the AgEcon group which had a value of 1.97 for use of hormones. Overall, the average concerns for both biotechnology and cloning tended to be among the lowest ranked (7^{th}, 8^{th}, or 9^{th}) concern for each group. The average biotechnology value for the total dataset was not significantly different (indicated by superscript 'ab') from Ireland, China, France, English, and Honduras. The AgEcon and Sociology groups indicated average levels of concern that were significantly lower than the overall average. For cloning, the average level of concern was significantly higher than the overall average for both France and Ireland, and significantly lower for the AgEcon group.

From these results, it is apparent that while price concerns were the most important, biotechnology and cloning were among the issue of least concern to respondents. This is especially interesting for this study as it deals directly with a technology respondents are only 'slightly concerned' about.

Table 5-5 is the non-grouped correlation table which shows measureable relationships that exist between the variables. The largest correlation coefficient is between biotechnology and cloning where the correlation is 0.74. This indicates moderate correlation and shows there is a positive relationship between concern for biotechnology and cloning. In addition biotechnology, cloning, and use of hormones are all slightly correlated where the correlation coefficients are 0.66 and 0.63 for correlations on use of hormones to biotechnology and cloning, respectively. These correlations are not surprising as cloning and additive hormones are technological subsets of biotechnology and many studies have found that consumers also see them as closely connected (Hoban 2001).

Table 5-4: Food Concerns Likert Scale Mean Values (Question 2)

	packaging		price		food handling preparation		ingredients		foodborne pathogens		chemicals pesticides		use of hormones		biotechnology		cloning	
	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*	Avg.	*Std. Dev.*
AgEcon	2.59^{cde}	*1.27*	3.37^{f}	*1.11*	3.56^{cdef}	*1.15*	2.83^{e}	*1.16*	3.34^{de}	*1.32*	2.64^{g}	*1.36*	1.97^{e}	*1.26*	1.98^{f}	*1.18*	1.98^{d}	*1.15*
English	2.76^{bd}	*1.37*	3.96^{bc}	*1.01*	3.98^{b}	*0.93*	3.59^{bc}	*1.27*	3.76^{bc}	*1.25*	3.46^{bef}	*1.29*	3.15^{bc}	*1.32*	2.80^{ace}	*1.24*	2.85^{b}	*1.35*
Sociology	2.70^{be}	*1.02*	4.07^{ab}	*0.94*	3.70^{bf}	*1.12*	3.37^{bcd}	*1.27*	3.27^{de}	*1.17*	3.03^{fg}	*1.16*	2.67^{cd}	*1.24*	2.50^{de}	*0.90*	2.70^{bc}	*1.24*
USA	2.67^{cde}	*1.25*	3.73^{cdef}	*1.08*	3.73^{be}	*1.08*	3.21^{d}	*1.26*	3.47^{ce}	*1.27*	3.01^{g}	*1.34*	2.53^{d}	*1.37*	2.38^{e}	*1.20*	2.44^{c}	*1.29*
Ireland	2.68^{cde}	*1.20*	3.81^{be}	*1.09*	3.86^{bc}	*1.16*	3.78^{ab}	*1.12*	3.87^{b}	*1.19*	3.63^{bc}	*1.20*	3.82^{a}	*1.30*	3.12^{a}	*1.37*	3.34^{a}	*1.53*
France	2.20^{f}	*1.09*	4.31^{a}	*0.85*	3.47^{f}	*1.11*	3.71^{bc}	*1.18*	3.60^{cd}	*1.43*	3.48^{cde}	*1.44*	3.91^{a}	*1.31*	3.09^{a}	*1.37*	3.29^{a}	*1.49*
Honduras	3.94^{a}	*1.29*	3.54^{f}	*1.09*	4.48^{a}	*0.88*	3.96^{a}	*1.12*	4.72^{a}	*0.68*	4.20^{a}	*1.06*	3.66^{a}	*1.35*	2.73^{bcd}	*1.48*	2.87^{b}	*1.57*
China	2.96^{b}	*1.28*	3.93^{bd}	*1.26*	3.54^{ef}	*1.31*	3.73^{ac}	*1.38*	4.05^{b}	*1.33*	3.76^{b}	*1.42*	3.14^{c}	*1.49*	3.12^{a}	*1.46*	2.91^{b}	*1.54*
TOTAL	2.80^{bc}	*1.33*	3.91^{b}	*1.10*	3.75^{bd}	*1.17*	3.66^{bc}	*1.25*	3.88^{b}	*1.31*	3.57^{bd}	*1.37*	3.40^{b}	*1.46*	2.90^{ab}	*1.40*	2.98^{b}	*1.51*

^{a,b,c,d,e,f,g} numbers sharing the same superscript are not significantly different.

Table 5-5: Correlation Table for Food Concerns (Question 2)

	packaging	price	food handling preparation	ingredients	foodborne pathogens	chemicals pesticides	use of hormones	biotechnology	cloning
packaging	1.0000								
price	0.0830	1.0000							
foodhandlingpreparation	0.4261	0.2198	1.0000						
ingredients	0.3101	0.2607	0.5454	1.0000					
foodborne pathogens	0.3664	0.1872	0.4638	0.4922	1.0000				
chemicalspesticides	0.3304	0.1644	0.4012	0.5301	0.6307	1.0000			
useofhormones	0.1592	0.1994	0.3445	0.4754	0.4570	0.6293	1.0000		
biotechnology	0.1365	0.2021	0.3193	0.4515	0.3678	0.5308	0.6567	1.0000	
cloning	0.1075	0.1527	0.2400	0.3446	0.3354	0.4710	0.6288	0.7431	1.0000

5.5 **Likelihood of Consuming Cloned Product**

Each of the likeliness to consume questions used a five point Likert Scale with 1= very unlikely, 3=somewhat likely, and 5=very likely. The data are reported in Tables 5-4 to 5-7 and in Figures 5.6. The first question about likelihood of consuming cloned product was presented with little prior information given to respondents. Prior to the 2nd question, respondents were informed about safety assessment by the U.S. Food and Drug Administration and the European Food Safety Authority. The data shows an increase in the stated likelihood of consuming cloned product between the first and second assessments, which can be attributed to the influence of that information about product safety. On the 5 point scale, the average likelihood of consuming increases from 2.19 to 2.52 between the first and second assessments, an increase that is statistically significant at the 1% level ($p = 0.00$). Average likelihood of consuming increased for all subsamples, but the change was not statistically significant for the French or the Sociology class groups. The third question about likelihood of consuming cloned product was based on a scenario in which the price of cloned product was 10 percent lower than meat from conventionally bred animals. Again, the average likelihood of consumption increased, from 2.52 to 2.59 on the Likert scale, but in this case the change was not statistically significant. The change was positive for all subgroups except for the Honduran respondents where the average likelihood of consuming fell from 3.42 to 3.35. However, none of the differences in each subgroup were significant at any level, likely due to the small average increase. The greatest increase was in the Sociology group where likelihood of consuming increased from 2.53 to 2.80, but that change was not statistically significant. Given the experimental design, we cannot claim that the effect of providing information about safety exceeded that of lowering price - to do so we would need to randomize the order in which those pieces of information were presented across respondents.

Comparing likelihood of consuming cloned product across the different subgroups shows that the highest likelihood is found in the AgEcon subgroup, where the average score increases from 3.22 in the first question to 3.80 in the third. Meanwhile the lowest level of acceptance is from the Chinese group, where the average response is 1.71 to the first question, increasing to 1.96 for the third. Across groups within the initial likeliness level, the value for the USA sample (indicated by superscript ‘b’) was significantly higher than those for Ireland, France, and China

but significantly lower than that for Honduras. For the second likeliness level which shows reaction due to government approval, the value for the USA sample is again significantly higher than Ireland, France, and China but is not significantly different from Honduras. The same pattern is found for the average values of the 3rd likelihood of consumption question.

While the questions presented in this survey do not measure trust in government explicitly, the results do measure the change in consumption as a result of government approval. Therefore these results can be compared to current literature which has found similar outcomes. Sosin and Richards (2005) show that consumers trust government agencies (FDA, USDA) most as reliable sources of information about animal cloning. In addition, Lusk (2008) found that people who had more trust in government agencies and were convinced of the safety of cloned animals because of government agencies, were also highly likely to consume product from cloned animals.

Table 5-6: Likeliness to Consume Cloned Product Likert Scale Mean Values

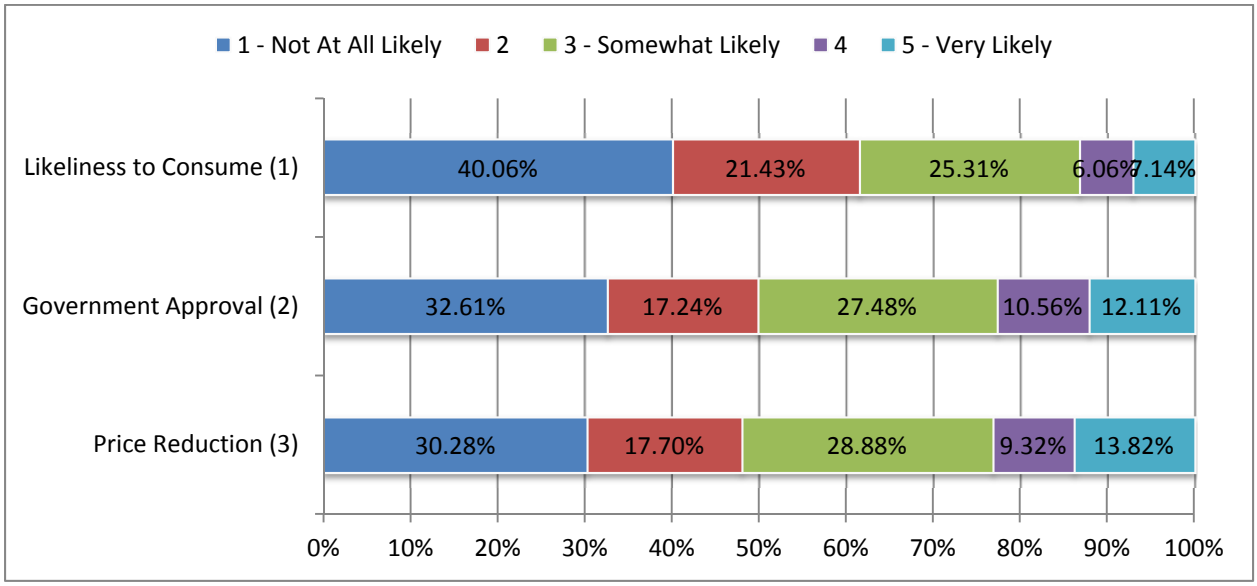
	Likeliness to Consume (1)		Government Approval (2)			Price Reduction (3)			
	Mean	*Std. Dev.*	Mean	*Std. Dev.*	Diff. b/w (1) & (2)	Mean	*Std. Dev.*	Diff. b/w (2) & (3)	Diff. b/w (3) & (1)
Ag Econ	3.22[a]	*1.27*	3.73[a]	*1.26*	0.51**	3.80[a]	*1.35*	0.07	0.58**
English	2.20[ce]	*0.96*	2.94[cd]	*1.24*	0.74***	3.17[bc]	*1.31*	0.24	0.98***
Sociology	2.10[cd]	*1.06*	2.53[de]	*1.25*	0.43	2.80[cdf]	*1.22*	0.27	0.70**
USA	2.62[b]	*1.23*	3.19[bc]	1.33	0.57***	3.36[b]	*1.36*	0.17	0.74***
Ireland	1.95[de]	*1.11*	2.31[ef]	*1.36*	0.37**	2.36[e]	*1.30*	0.04	0.41***
France	1.93[d]	*0.94*	2.10[fg]	*1.09*	0.17	2.20[ef]	*1.30*	0.10	0.28**
Honduras	3.01[a]	*1.49*	3.42[ab]	*1.38*	0.40*	3.35[b]	*1.42*	-0.06	0.34
China	1.71[f]	*1.00*	1.94[g]	*1.06*	0.23*	1.96[g]	*1.06*	0.01	0.24
TOTAL	2.19[c]	*1.23*	2.52[e]	*1.36*	0.34***	2.59[d]	*1.37*	0.06	0.40***
Avg Change					0.43			.10	0.53

[a,b,c,d,e,f,g] numbers sharing the same superscript are not significantly different.
*,**, and *** indicates statistical significance at the 10%, 5%, and 1% levels.

Figure 5-6 shows how the distribution of responses for the entire sample changed from the first to the second to the third question about likelihood of consuming cloned product. This same data broken down by group for Likeliness to Consume (1) is shown in table 5-5, Government Approval (2) shown in table 5-6, and Price Reduction (3) shown in table 5-7. Overall, the 'not at all likely" category fell from 40% for the first question to 30% for the third question. For the 2nd question (given information about product safety), about 1 in 3 respondents

indicated they would be ‘not at all likely’ to consume cloned product – a proportion that corresponds well with previous findings. For example, Lusk (2008) and The Mellman Group (2006) found a general 1/3, 1/3, 1/3 breakdown between consumers who would purchase cloned product, who would not purchase, and those who were unsure.

Figure 5-7: Likeliness to Consume Cloned Product (Total Data)



A closer look at the distribution of likeliness between the first to the second to the third question about likelihood of consuming cloned product, creates a more specific picture of the breakdown across groups. First, the majority of Chinese (63%) respondents and Ireland (50%) respondents were initially ‘not at all likely’ to consume while Honduras (25%) respondents and AgEcon (22%) respondents were ‘very likely’ to consume cloned product. With the additional information about government approval, all groups notably decreased in their indication of ‘not at all likely’ and instead shifted toward the ‘very likely category’, except France which stayed at 40% through the change. China showed no increase in ‘very likely’ to consume staying at 1.43% after learning about government approval and instead increasing to nearly 40% in the ‘somewhat likely’ category. In the final likeliness to consume category, all groups consistently shifted stated likeliness levels toward the ‘very likely’ category. Honduras was the only group to break from the pattern and increase in the ‘not at all likely’ category to a total of 16% which was met

with a total 2% decrease in the in between '4' category to 12%. This is consistent with the negative average difference Honduras shows between price reduction and government approval.

Table 5-7: Likeliness to Consume (1)

	Not At All Likely -1	*2*	*Somewhat Likely - 3*	*4*	*Very Likely - 5*
Ag. Econ.	8.47%	23.73%	27.12%	18.64%	22.03%
English	23.91%	43.48%	23.91%	6.52%	2.17%
Sociology	33.33%	40.00%	10.00%	16.67%	0.00%
USA Total	19.26%	34.07%	22.22%	14.07%	10.37%
Ireland	48.21%	20.54%	23.21%	4.46%	3.57%
France	40.49%	31.90%	23.93%	1.84%	1.84%
Honduras	25.53%	8.51%	29.79%	11.70%	24.47%
China	62.86%	6.43%	28.57%	0.71%	1.43%
TOTAL	40.06%	21.43%	25.31%	6.06%	7.14%

Table 5-8: Likeliness to Consume – Government Approval (2)

	Not At All Likely -1	*2*	*Somewhat Likely - 3*	*4*	*Very Likely - 5*
Ag. Econ.	5.08%	15.25%	18.64%	23.73%	37.29%
English	13.04%	26.09%	28.26%	19.57%	13.04%
Sociology	23.33%	30.00%	26.67%	10.00%	10.00%
USA Total	11.85%	22.22%	23.70%	19.26%	22.96%
Ireland	38.39%	25.00%	12.50%	15.18%	8.93%
France	39.26%	23.93%	27.61%	6.13%	3.07%
Honduras	13.83%	8.51%	31.91%	13.83%	31.91%
China	52.86%	4.29%	40.00%	1.43%	1.43%
TOTAL	32.61%	17.24%	27.48%	10.56%	12.11%

Table 5-9: Likeliness to Consume - Price Reduction (3)

	Not At All Likely -1	*2*	*Somewhat Likely - 3*	*4*	*Very Likely - 5*
Ag. Econ.	8.47%	11.86%	15.25%	20.34%	44.07%
English	13.04%	17.39%	28.26%	21.74%	19.57%
Sociology	20.00%	13.33%	43.33%	13.33%	10.00%
USA Total	12.59%	14.07%	25.93%	19.26%	28.15%
Ireland	33.93%	25.00%	21.43%	10.71%	8.93%
France	33.74%	29.45%	25.15%	6.13%	5.52%
Honduras	15.96%	8.51%	31.91%	11.70%	31.91%
China	50.00%	7.86%	40.00%	0.71%	1.43%
TOTAL	30.28%	17.70%	28.88%	9.32%	13.82%

6 Ordinary Least Squares Analysis of Likelihood to Consume Cloned Product.

The data from the Likert Scales on likelihood to consume cloned product is treated as the dependent variable in an Ordinary Least Squares (OLS) regression model. Separate models were estimated for each subsample, and for each of the three times the question about likelihood to consume cloned product was posed to respondents. Regression modeling was done using Stata®10 software.

6.1 OLS Theoretical Model

OLS is used to find the marginal impacts independent variables have on dependent variables. For the purpose of this study, three models were run using three separate assessments of the likelihood of consuming cloned product as the dependent variable - Likeliness to Consume (1), Government Approval (2), and Price Reduction (3) – where Government Approval and Price Reduction represent likelihood of consumption following the provision of information on product safety from government scientists, and contingent on a ten percent price reduction respectively. The independent variables hypothesized to influence likelihood of consuming cloned product are *meatconsume, price, foodtechconcern, attention, knowtech, morallywrong, foodsafety, humancloning, animalsafety, female, farm,* and *religiousyes*. These variables were chosen based on their theoretically plausibility to influence a consumer's likeliness to consume cloned product (see discussion in Chapter 5) without causing multicollinearity concerns in the model. Equation 1.1 below is the theoretical model where y_i is represented by one of the dependent variables 'Likeliness to Consume (1)', 'Government Approval (2)', and 'Price Reduction (3)' representing likelihood of consuming cloned product.

$$y_i = f(meatconsume, price, foodtechconcern, attention, knowtech, morallywrong, foodsafety, humancloning, animalsafety, female, farm, religiousyes) \quad (6.1)$$

OLS regression estimates coefficients that minimize the sum of squared residuals in the model (Studenmund 2001). When a set of assumptions (the so called classical assumptions – see Studenmund) are met, OLS estimates are unbiased and have the lowest variance of any linear unbiased estimator. The classical assumptions include a zero mean for the error term, error terms being uncorrelated with each other and with any independent variables in the model, errors being normally distributed and having constant variance, and no explanatory variable being a perfect linear function of other explanatory variables. The dependent variable is assumed to be continuous.

- Let X be a $n \times k$ matrix where we have n observations on *k* independent variables
- Let *y* be a $n \times 1$ vector of observations on the dependent variable
- Let ϵ be a $n \times 1$ vector of errors terms
- Let β be a $k \times 1$ vector of unknown population parameters which are estimated in the model

The OLS model is represented by the following equation:

$$y = X\beta + \varepsilon \quad (6.2)$$

By rearranging the equation, the vector of residuals *e* is given by:

$$e = y - X\hat{\beta} \quad (6.3)$$

Therefore the sum of squared residuals is as follows:

$$\begin{aligned} e'e &= \left(y - X\hat{\beta}\right)'\left(y - X\hat{\beta}\right) \\ &= y'y - \hat{\beta}'X'y - y'X\hat{\beta} + \hat{\beta}'X'X\hat{\beta} \\ &= y'y - 2\hat{\beta}'X'y + \hat{\beta}'X'X\hat{\beta} \end{aligned} \quad (6.4)$$

By taking the derivative of equation (7.3) with respect to $\hat{\beta}$, this gives us the coefficient values for each variable which minimize the sum of squared residuals.

$$\frac{\partial e'e}{\partial \hat{\beta}} = -2X'y + 2X'X\hat{\beta} = 0 \qquad (6.5)$$

To be sure this is the minimum, the second partial derivative of $\frac{\partial e\prime e"}{\partial \hat{\beta}\prime \hat{\beta}} > 0$ would be taken to be sure that the coefficients are at a local minimum. Finally the identity matrix of $k \times k$ is found giving us:

$$\hat{\beta} = (X'X)^{-1}X'y \qquad (6.6)$$

6.2 **Correlations among Independent Variables**

To avoid a potential problem with multicollinearity it is useful to analyze correlation values between the independent variables. Correlation tables (see tables 6-1 to 6-8) were estimated for the complete dataset (n = 664) and for each of the subsamples: AgEcon, English, Sociology, Ireland, France, Honduras, and China. None of the estimated correlation coefficients in any of the subsamples reach 0.80, the absolute value many textbooks cite as a level that would cause concern (Studenmund 2001). The largest correlation coefficient is the AgEcon subsample - between *foodtechconcern* and *price* where the correlation is 0.62.

Note that the variables indicating the primary reason respondents were uncomfortable with cloning (*morallywrong, food safety, humancloning, and animalsafety*) are necessarily negatively correlated with each other – because respondents could only choose one of those reasons as their primary reason for discomfort. However, in the Chinese sample the responses could not be restricted and respondents were able to indicate more than one reason for discomfort. This led to some positive correlation, the largest being between *morallywrong* and *humancloning* at 0.31.

Table 6-1: Correlation Table for Total Data Set

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	Animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.1322	1.0000										
foodtechconcern	-0.0717	0.2154	1.0000									
attention	0.0976	0.0376	0.1740	1.0000								
knowtech	0.2482	-0.1166	0.0373	0.3304	1.0000							
morallywrong	-0.0034	0.0417	0.0876	-0.0027	0.0348	1.0000						
foodsafety	-0.1257	0.0964	0.0657	0.0804	-0.0907	-0.3082	1.0000					
humancloning	-0.0065	0.0351	-0.0335	-0.0238	0.0380	-0.1020	-0.1972	1.0000				
animalsafety	-0.1529	-0.0304	0.0518	0.0169	-0.1445	-0.1466	-0.1156	-0.0748	1.0000			
female	-0.0031	0.0570	0.0883	0.0184	0.0070	0.0987	-0.0315	0.0591	-0.0371	1.0000		
farm	0.1157	0.1077	-0.0099	0.1168	0.1218	0.1584	-0.0873	0.0736	-0.1011	-0.0941	1.0000	
religiousyes	0.2271	-0.0389	-0.1046	0.0473	0.1676	-0.0279	-0.0099	0.0445	-0.0606	-0.0412	0.1086	1.0000

Table 6-2: Correlation Table for AgEcon

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	Animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.1203	1.0000										
foodtechconcern	0.0087	0.6186	1.0000									
attention	0.1086	0.1360	0.0918	1.0000								
knowtech	0.0253	-0.3295	-0.4615	0.0843	1.0000							
morallywrong	0.0760	-0.0633	-0.0777	0.0485	-0.0381	1.0000						
foodsafety	0.0334	0.3097	0.3915	0.1099	-0.3989	-0.1341	1.0000					
humancloning	-0.1663	-0.0579	-0.1142	-0.0640	0.0802	-0.0795	-0.3038	1.0000				
animalsafety	-0.0907	0.2015	0.4435	-0.0620	-0.1017	-0.0434	-0.1657	-0.0982	1.0000			
female	-0.1897	0.2599	0.0796	-0.0521	-0.1560	-0.1192	0.2559	-0.0617	0.0231	1.0000		
farm	0.0141	-0.1932	-0.2769	-0.0093	0.3128	0.0897	-0.2088	-0.0390	-0.2854	0.0163	1.0000	
religiousyes	-0.1177	-0.0798	-0.0476	-0.2453	0.0216	0.0996	-0.2240	-0.0019	0.1230	-0.1132	0.1655	1.0000

Table 6-3: Correlation Table for English

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.1126	1.0000										
foodtechconcern	-0.0471	0.2454	1.0000									
attention	0.0606	0.2076	0.3156	1.0000								
knowtech	-0.0109	-0.0724	0.4854	0.1707	1.0000							
morallywrong	0.2242	-0.0421	-0.2713	-0.0514	-0.0362	1.0000						
foodsafety	-0.3899	0.1273	0.0716	0.1323	0.1219	-0.3883	1.0000					
humancloning	0.0174	0.1160	0.1379	0.0733	0.1915	-0.0903	-0.1954	1.0000				
animalsafety	0.1751	-0.1353	0.0317	-0.2109	-0.1718	-0.2233	-0.4830	-0.1124	1.0000			
female	-0.3183	0.2482	-0.0515	-0.0450	-0.1635	0.2947	0.0789	0.1483	-0.0831	1.0000		
farm	0.1812	0.0200	-0.1118	0.1043	-0.0267	0.2846	-0.3054	-0.0978	0.1753	0.1968	1.0000	
religiousyes	0.1914	-0.0784	-0.1083	0.0928	-0.2397	0.1990	-0.2025	-0.0576	0.1851	-0.1483	0.1137	1.0000

Table 6-4: Correlation Table for Sociology

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.2894	1.0000										
foodtechconcern	-0.2942	-0.2980	1.0000									
attention	0.0260	0.1324	0.0817	1.0000								
knowtech	0.1171	-0.0542	0.0440	-0.0020	1.0000							
morallywrong	0.0000	-0.1436	-0.0282	0.1258	0.2989	1.0000						
foodsafety	-0.0829	0.3550	-0.1585	-0.0448	-0.2396	-0.3563	1.0000					
humancloning	0.1657	-0.3070	-0.1585	-0.0112	-0.0126	-0.0891	-0.2857	1.0000				
animalsafety	0.0000	-0.2154	0.4235	0.0838	0.0944	-0.1667	-0.5345	-0.1336	1.0000			
female	-0.0829	-0.0048	0.2150	0.0392	-0.0505	0.3118	0.1964	-0.2857	-0.0334	1.0000		
farm	0.0417	0.0821	-0.3475	0.0479	-0.2317	0.1570	0.0090	-0.2337	-0.1009	0.0090	1.0000	
ReligiousYes	0.0000	0.2820	-0.4251	-0.1555	-0.2781	-0.0242	0.2624	-0.1166	-0.4001	-0.1750	0.1321	1.0000

Table 6-5: Correlation Table for Ireland

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	0.1746	1.0000										
foodtechconcern	0.1248	0.1246	1.0000									
attention	0.0005	0.1435	0.2247	1.0000								
knowtech	-0.1252	-0.0420	0.1272	0.0294	1.0000							
morallywrong	-0.0172	-0.0494	0.1300	0.0519	0.2516	1.0000						
foodsafety	0.0926	0.0558	0.0959	0.0569	-0.0290	-0.3148	1.0000					
humancloning	0.1076	-0.1611	0.0411	-0.2495	-0.0039	-0.0987	-0.1505	1.0000				
animalsafety	-0.0912	-0.0427	0.1161	0.0065	-0.1690	-0.2703	-0.4120	-0.1292	1.0000			
female	-0.2482	-0.1717	-0.0608	-0.0226	0.1010	0.0362	-0.0198	-0.1245	0.1186	1.0000		
farm	0.1390	0.1842	-0.0190	0.0439	-0.2044	-0.0061	0.1140	0.0064	-0.1658	-0.4252	1.0000	
ReligiousYes	0.1865	0.0488	0.1866	-0.0251	-0.0681	-0.0749	0.1464	0.1526	-0.0850	-0.3016	0.2470	1.0000

Table 6-6: Correlation Table for France

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.0512	1.0000										
foodtechconcern	-0.1034	-0.0504	1.0000									
attention	-0.0535	-0.0974	0.3010	1.0000								
knowtech	-0.0940	-0.1513	0.0949	0.0517	1.0000							
morallywrong	-0.1051	-0.0775	0.1217	-0.0683	-0.1034	1.0000						
foodsafety	-0.0404	0.0867	0.0629	0.0817	0.0899	-0.4392	1.0000					
humancloning	0.0511	0.1312	-0.0759	0.0024	0.0857	-0.4077	-0.2631	1.0000				
animalsafety	-0.0123	-0.0224	0.0745	0.1287	0.0935	-0.1467	-0.0947	-0.0879	1.0000			
female	-0.0699	0.2454	0.1574	0.1066	-0.0597	-0.0568	0.0501	0.1227	0.0128	1.0000		
farm	0.0966	-0.0362	-0.0499	0.0104	0.0828	-0.1923	0.0844	0.0784	0.0282	-0.0594	1.0000	
ReligiousYes	0.1374	-0.0905	-0.1787	-0.0633	0.0729	-0.0490	0.0228	0.0767	-0.0804	-0.0487	0.0556	1.0000

Table 6-7: Correlation Table for Honduras

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.0792	1.0000										
foodtechconcern	-0.2028	0.1859	1.0000									
attention	-0.1357	-0.0333	0.0372	1.0000								
knowtech	-0.1564	0.0732	-0.0593	0.3661	1.0000							
morallywrong	0.0252	0.1272	0.0526	-0.1559	0.1008	1.0000						
foodsafety	-0.2107	0.0383	0.3359	0.1656	-0.0266	-0.2591	1.0000					
humancloning	0.0528	0.0261	-0.0079	-0.0352	-0.0132	-0.1011	-0.1768	1.0000				
animalsafety	-0.0184	0.0665	0.0446	-0.0352	-0.0952	-0.1011	-0.1768	-0.0690	1.0000			
female	-0.0664	-0.0322	0.0684	-0.0039	-0.0322	0.1644	-0.0438	0.2477	-0.0233	1.0000		
farm	0.0700	0.1465	-0.1092	0.0956	-0.1493	0.1894	-0.1015	-0.0488	0.0402	-0.0767	1.0000	
religiousyes	-0.0275	0.1119	0.0339	-0.1438	0.0678	0.0719	-0.0445	-0.0524	0.0491	0.1366	0.0812	1.0000

Table 6-8: Correlation Table for China

	meat consume	price	foodtech concern	attention	knowtech	morally wrong	food safety	human cloning	animal safety	female	farm	religious yes
meatconsume	1.0000											
price	-0.2503	1.0000										
foodtechconcern	-0.0058	0.2692	1.0000									
attention	-0.1319	0.1156	0.0114	1.0000								
knowtech	-0.0240	0.0626	0.0199	0.3674	1.0000							
morallywrong	0.0176	-0.0599	-0.1685	-0.0299	0.0075	1.0000						
foodsafety	-0.0137	0.1177	-0.0423	0.3286	0.1792	-0.0157	1.0000					
humancloning	0.0272	0.0029	-0.0344	0.1137	0.1513	0.3083	-0.0854	1.0000				
animalsafety	-0.1445	-0.0289	-0.1182	0.2809	0.0564	0.0878	0.0514	0.0352	1.0000			
female	0.1254	-0.1709	0.0159	-0.0091	0.1916	0.0816	-0.2265	0.0773	-0.1422	1.0000		
farm	-0.0055	0.0734	0.0896	0.1268	0.2105	0.0862	0.1574	0.0638	0.2198	-0.1561	1.0000	
ReligiousYes	-0.0834	0.0874	-0.0164	0.1087	0.1338	0.0922	0.0450	0.2047	0.1169	0.1829	0.1314	1.0000

6.3 **Likely to Consume (1)**

Table 6-9 presents results from models using the initial responses to the likelihood of consumption question – the variable we identify as Likely to Consume (1). This question was asked without providing any information about cloning. However, since the Chinese data was collected using a hard copy, it was possible for those respondents to read ahead and find the information about FDA/EFSA approval before responding to the question.

Table 6-9: Likely to Consume (1) - Likelihood of Consuming Cloned Product

Likely to Consume (1)	*Ag Econ*	*English*	*Sociology*	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues							
meatconsume	-0.0713	0.1604	-0.4883*	0.1139	0.0824	0.2771	-0.0524
price	0.2843**	0.1117	0.0513	0.0102	0.1289*	0.1773	-0.1470**
foodtechconcern	-0.4184***	-0.2811**	-0.2838	-0.3636***	-0.1233**	-0.3766***	-0.2059***
attention	0.2113*	-0.1783	-0.1563	-0.1065	-0.1459**	0.1777	0.0383
knowtech	0.2598	0.7906***	-0.1013	0.2287*	0.1882**	0.0970	0.1592
Reason for Concern							
morallywrong	-2.0701***	-2.6721***	-0.2426	-1.1755***	-1.3418***	-1.3512***	0.0369
foodsafety	-1.3661***	-1.6977***	-0.5271	-0.6338**	-0.8920***	-1.2816***	0.2459
humancloning	-1.1973***	-2.2426***	0.8584	-0.7274	-0.8827***	-1.0152*	0.2398
animalsafety	-0.6179	-1.2845***	-0.0543	-0.6392**	-0.5621	-1.2950**	0.0907
Demographic Info.							
female	-0.3467	0.5433	-1.0052***	-0.0737	-0.0483	-0.1820	0.2350
farm	0.2121	-0.4526	-0.8324***	-0.2607	0.3825	-0.1388	0.0052
ReligiousYes	-0.5990**	0.1510	0.3548	0.1817	0.0185	0.0334	0.0525
_cons	3.1279**	2.2616**	6.0028***	3.2734***	2.1789***	2.3133	2.3820***
Adjusted R-Squared	0.556	0.347	0.665	0.297	0.323	0.348	0.127
Root MSE	0.849	0.774	0.615	0.928	0.773	1.200	0.930
Total Observations	59	46	30	111	163	93	132
DF	46	33	17	98	150	80	119
Prob > F	0.648	0.006	0.001	0.000	0.000	0.000	0.004

*,**, and *** indicates statistical significance at the 10%, 5%, and 1% levels.

At first glance, the results indicate in table 6-9 that several variables are statistically significant and have the same sign in all or most subsample models. Every model has at least three statistically significant coefficients, and adjusted R-squares values range from 0.127 (China) to 0.665 (Sociology).

The *meatconsume* variable measures the respondents total meat consumption behaviors. Its coefficient has the expected positive sign in all models except AgEcon, Sociology, and China, but is only statistically significant at the 10% level for Sociology. The Sociology coefficient

indicates that as meat consumption increases (on the 0 to 4 scale, 4 = almost every day) it is associated with a -.49 decrease (again on a 1 to 5 Likert scale) in likelihood of consuming cloned product. The *price* variable measures the respondent's level of concern about food prices. Its coefficient has the expected positive sign in all models except that for the Chinese sample, but is statistically significant in only the AgEcon and French subsamples. In the AgEcon sample, the coefficient indicates that a one-unit increase in concern about food prices (on the 1 to 5 Likert scale) is associated with a 0.28 unit increase (again on a 1 to 5 Likert scale) in likelihood of consuming cloned product.

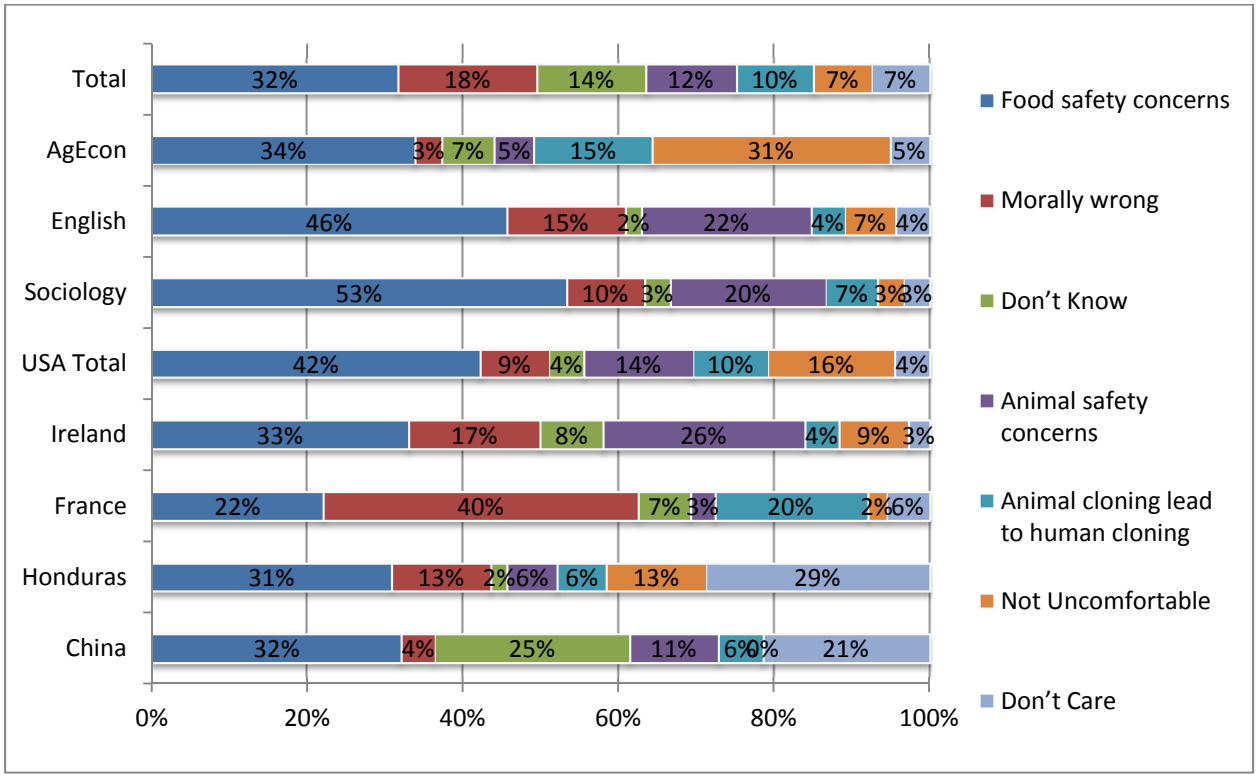
As expected, the variable *foodtechconcern* has a negative coefficient in all subsample models, and has a statistically significant impact in all but Sociology. As described in section 5 (Describing Data), this variable was created to measure the average concern consumers have for "*Use of Hormones*" and "*Biotechnology*". This variable has the largest impact in the AgEcon subsample where the coefficient value is -0.42. The conclusion is that consumers who are concerned about advanced agro-biotechnologies will be less likely to consume cloned product. Because cloning is often confused with genetic modification (Marks, et al. 2003), it makes sense that consumers who are concerned about advanced agro-biotechnology will also be concerned about cloning technology.

It was expected that the variable, *attention*, measuring attention to food labels would have a negative correlation with likelihood of consuming cloned product but, as shown in table 6-9, its effect is not consistent. It has a statistically significant negative effect only in the French sample, and is in fact positive and significant in the AgEcon sample. It was hypothesized that knowledge of technology, *knowtech*, would be correlated with a greater acceptance of cloned products and for the most part that appears to be the case. The variable has a positive coefficient in all but the Sociology group, and it statistically significant in three models. Its impact is strongest in the English class group, where a one unit increase in familiarity with technology (on a 4-point scale) is associated with a 0.79 unit increase in acceptance of cloned product.

The variables with the greatest impact in these models are the dummy variables that identify respondents by the specific reason they are concerned about cloning, *morallywrong, foodsafety, humancloning, animalsafety*. It is no surprise of course that these coefficients are all negative (they will be so almost by definition) – but what is of interest is their relative magnitude. The distribution of responses to the question eliciting the primary concern about

cloning is shown in figure 6.1. The China group has a large "Don't Know" subsection because it includes the multiple responses where respondents could identify more than one "primary" cause for concern. In all groups, over half the respondents identify with one of the four listed "concerns," and the distribution (see also Table 6-10) shows that food safety is the primary concern for almost 1 in 3 respondents. Note that these responses were elicited prior to providing information about official findings on the safety of cloned products.

Figure 6-1: Answers to "Reasons Uncomfortable with Animal Cloning" (Question 7)



However, even though food safety is the most commonly cited concern, the results in Table 6-9 indicate that the variable with the greatest impact on likelihood of consuming cloned product is that identifying respondents who believe that cloning is morally wrong. The dummy variable for *morallywrong* is negative in the models for all subsamples except China, and is statistically significant at the 1% level in five of the other six models (all bar Sociology). And in those five models, the magnitude of its coefficient exceeds that of any of the other coefficients identifying a specific cause for concern about cloning. For example, in the AgEcon sample, the coefficient on *morallywrong* is -2.07, compared to -1.36 for respondents citing *foodsafety* as their

primary concern, -1.19 for those concerned that animal cloning will lead to human cloning, and -0.62 for those concerned about animal safety.

In the English class sample, the coefficient on *morallywrong* is -2.67, indicating that, compared to individuals who "don't know," "don't care," or who are "not uncomfortable" with cloning, those who believe it is morally wrong rate their likelihood of consumption 2.67 points lower on the 5 point Likert scale. For comparison, the coefficient on *foodsafety* is -1.70, indicating that compared to those who have food safety concerns, those who believe the process is morally wrong rate their likelihood of consuming almost a full point lower on the Likert scale. A similar, if not quite so dramatic pattern is seen in the AgEcon, Irish and French samples. In the Honduran samples, the coefficients on *morallywrong* and *foodsafety* are more similar in magnitude, with *morallywrong* only slightly more negative.

The variable identifying respondents whose primary concern is *humancloning* (i.e., that animal cloning may lead to human cloning), is negative and significant in four of the seven models, while the variable identifying respondents whose primary concern is *animalsafety* is negative and significant in three. In the Chinese sample, none of the four variables identifying a cause for concern are significant – in fact all are positive and small in magnitude compared to the effects found in most of the other samples. This again may be due to the fact that data was collected on hard copies, where respondents could identify more than one "primary" cause for concern. These variables are also insignificant in the Sociology sample, a finding that is difficult to explain given the patterns in the other samples.

Table 6-10: Data for "Reason Uncomfortable with Animal Cloning" (Question 7)

	N	*% Freq.*
Food safety concerns	204	31.68%
Morally wrong	115	17.86%
Don't Know	90	13.98%
Animal safety concerns	75	11.65%
Animal cloning lead to human cloning	64	9.94%
Not Uncomfortable	48	7.45%
Don't Care	48	7.45%

It was hypothesized that females would be more concerned about consuming cloned product than males, but a statistically significant effect with the expected sign is found in only one of the seven samples – that for the Sociology class. Likewise, a positive effect on acceptance of cloning was hypothesized for respondents from a farming or ranching background, but none of the estimated models had a positive and significant coefficient for that variable. In the Sociology class sample, the effect of a farming background was in fact negative and significant. Similarly but less surprising given the possibility that individuals with religious affiliations could arguably take either a positive or a negative perspective on the technology, the coefficient on *religousyes* is significant in only one of the seven models.

This model was also run as an ordered logit model in order to constrain the dependent variable to the values indicated in the 'Likeliness to Consume' five point likert scale question. While the results are not shown in this thesis document, the signs, statistical significance, and integer value of the estimated coefficients generally replicated those from the OLS modeling which further supports these results.

6.4 Likelihood of Consuming Cloned Product given information about Safety – *Government Approval (2)*

Table 6-11 presents results from models using the second set of responses to the question about likelihood of consumption – the variable we identify as Government Approval (2). These models are similar to the first in that they use the same set of independent variables, and the hypothesized effects of those variables are similar. However, since acceptance (or likelihood to consume) is now measured following the provision of information about cloned product safety, we would expect the effect of the variable identifying respondents with food safety concerns to be diminished.

Model fit as measured by the adjusted R-squared values are similar for the first set ranging from 0.145 for China up to 0.583 for the Sociology class. Again, models for the different samples have at least three significant coefficient estimates, and by and large, the pattern of significant variables is similar to that in the first set of models. In fact there are 35 statistically significant coefficients which did not change from the previous model.

The variable measuring meat consumption level is nowhere significant, while that for concern about food prices again has the expected positive sign and is significant in the AgEcon and French samples. The coefficient on *foodtechconcern* is in all cases negative, and significant in five of the seven models. Attention to labels does not have a significant effect in any model, while familiarity with biotechnology (*knowtech*) has the expected positive sign and is significant in four models (compared to three in the earlier set).

The variables identifying reasons for concern about animal cloning – *morallywrong*, *foodsafety*, *humancloning*, and *animalsafety* – have similar coefficients to those observed in the first set of models. The coefficients on the *morallywrong* variable are negative and significant in all samples except China, and again this variable has the largest impact on the model. Consumers who question the morality of animal cloning continue to be the least likely to consume cloned product.

Table 6-11: Government Approval (2) – Likelihood of Consuming Cloned Product given information about USDA/EFSA Approval

	Ag Econ	*English*	*Sociology*	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues							
meatconsume	0.0101	0.3555	-0.3899	0.1678	0.1335	-0.0176	-0.0135
price	0.3556**	0.1338	-0.0857	0.0886	0.1844**	0.0863	-0.1472*
foodtechconcern	-0.3768**	-0.2564	-0.3108	-0.3041***	-0.1252**	-0.3360***	-0.1261*
attention	0.0996	-0.1151	-0.1184	-0.0654	-0.0774	0.1834	0.0182
knowtech	0.4779**	0.8400***	0.0928	0.4776***	0.1454	-0.1162	0.3029**
Reasons for Concern							
morallywrong	-1.9078***	-3.5860***	-2.6471***	-1.8683***	-1.5193***	-1.1712***	0.0154
foodsafety	-0.8231**	-1.9908***	-2.0147***	-0.5945*	-0.6223***	-1.1173***	0.3711*
humancloning	-1.4640***	-3.0153***	-1.6819*	-1.3594**	-0.7035***	-0.7978	0.4277
animalsafety	-0.9876	-1.4617**	-2.0941***	-0.7408**	-0.5546	-0.4421	0.0576
Demographic Info							
female	-0.1480	0.7866	-0.9844**	0.0910	-0.1732	-0.4098	0.0818
farm	0.0612	-0.6314	-0.2142	-0.4330*	0.3518	-0.1217	0.3064
ReligiousYes	0.0189	0.2895	-0.0851	0.2946	-0.1252	0.0421	0.1822
_cons	2.2421	2.0017	7.8322***	2.2688**	1.9490**	4.5912***	1.9441***
Adjusted R-Squared	0.412	0.303	0.583	0.289	0.332	0.274	0.145
Root MSE	0.964	1.032	0.809	1.143	0.891	1.173	0.986
Total Observations	59	46	30	111	163	93	132
DF	46	33	17	98	150	80	119
Prob > F	0.000	0.014	0.003	0.000	0.000	0.000	0.002

*,**, and *** indicates statistical significance at the 10%, 5%, and 1% levels.

The variable identifying respondents with food safety concerns is negative and significant in six of the seven models. While still consistently smaller in magnitude than the coefficients on the variable for *morallywrong*, the coefficient estimates are not consistently smaller in absolute value than those observed in the first set of models. In the AgEcon sample, the coefficient on *foodsafety* has fallen from -1.37 to -0.82, while in the Sociology sample it has increased in absolute magnitude from -0.53 to -2.01. This suggest that the information about government agencies finding cloned products safe did not have a uniformly reassuring effect for respondents whose primary concern was with *foodsafety*.

The most notable change between these and the previous models occur with the Sociology class sample. In the earlier model, none of the variables identifying respondents with specific concerns about cloning were significant, whereas in this model all four variables have the expected negative sign and are significant. Again, the pattern in the earlier model is difficult to explain.

Regarding the remaining variables, there is little that is noteworthy. The effect of gender is again only significant in the Sociology sample, while that of a farming background is only significant (with a negative sign) in the Irish sample. The *religiousyes* variable is nowhere significant.

6.5 Likelihood of Consuming Cloned Product at a 10% Reduced Price - *Price Reduction (3)*

The third and final likeliness model uses the same independent variables used in the first and second model, but uses the third set of response to the question about likelihood of consumption – the variable identified as Price Reduction (3). As before, the hypothesized effects on the independent variables are similar; however, since acceptance (or likelihood to consume) is now measured following the additional provision of information about a potential 10% price reduction, we expect the effect of *price* variable to become consistently positive throughout all groups.

Overall model fit as measured by the adjusted R-squared values are consistently lower for every group except China and France. Values range from 0.127 in China to 0.347 for Honduras. France and China were to the only adjusted R-squared values to increase, but only slightly.

Sociology experienced the greatest decrease from a value of 0.665 in the second (Government Approval (2)) model to 0.245 in this third model. This model broke from the pattern the previous two models set in that it decreased to a total of 28 statistically significant variables. The total decrease was caused by the decrease in negative and significant variables down to 19, although there was an increase in total positive and significant variables (total of 9). The greatest change occurred within the Sociology group which had at least two significant variables in the previous two models, but now has no significant variables across the entire model.

Table 6-12: Likeliness to Consume Cloned Product Given 10% Price Reduction

Price Reduction (3)	*Ag Econ*	*English*	*Sociology*	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues							
Meatconsume	0.0361	0.1166	-0.0120	0.1143	0.1314	-0.1776	0.1135
Price	0.5256***	0.0068	0.1628	0.3284***	0.3724***	0.1373	0.1069
foodtechconcern	-0.5966***	-0.3546*	-0.4198	-0.4321***	-0.1735***	-0.4073***	-0.2113***
Attention	0.0621	-0.2453	-0.0745	-0.0144	-0.0549	0.0751	0.1411*
Reasons for Concern							
knowtech	0.2456	0.7190**	0.1455	0.3257**	0.2889***	-0.0905	-0.1600
morallywrong	-1.1219	-4.1227***	-1.4200	-1.072***	-1.3705***	-1.1946***	-0.1686
foodsafety	-0.9440**	-1.9753***	-1.1838	-0.3080	-0.5743**	-1.3981***	-0.0999
humancloning	-0.9281**	-3.1990***	-0.6302	-0.6447	-0.8237***	-0.8042	0.3616
Demographic Info							
animalsafety	-0.6433	-2.1778***	-1.2730	-0.0724	-0.4247	-0.3329	0.1974
female	-0.6014*	1.1632**	-0.7641	0.1358	-0.1974	-0.3802	0.0251
farm	0.2062	-0.0782	-0.5924	-0.3731	0.2516	-0.0483	0.4192**
ReligiousYes	0.0371	06016	0.1558	0.3255	-0.0920	0.2850	-0.1348
_cons	2.7207	4.1873***	5.0398	1.7252*	1.0413	5.3959***	1.5879***
Adjusted R-Squared	0.3642	0.2811	0.2450	0.2637	0.3275	0.3799	0.0842
Root MSE	1.0757	1.1063	1.0556	1.1137	0.9344	1.1157	0.9915
Total Observations	59	46	30	111	163	93	132
DF	46	33	17	98	150	80	119
Prob > F	0.0005	0.0200	0.1339	0.0000	0.0000	0.0000	0.0295

*,**, and *** indicates statistical significance at the 10%, 5%, and 1% levels.

The variables measuring meat consumption and attention to labels are nowhere significant. The variable measuring familiarity with biotechnology (*knowtech*) continues to have the expected positive sign in five of the previous models, compared to the four in the second model and three in the first model.

The variable measuring concern for food prices has the expected positive sign in every respondent group and is statistically significant at the 1% level (p=0.000) in the AgEcon, Irish, and French samples. It is notable that the *price* variable became very statistically significant

(statistically significant at the 1% level) in the economically developed countries (USA, Ireland, France) where price is a leading factor in purchase intent as well as food related issue concern (average equals 3.37, 3.81, 4.31 respectively). In addition, this variable increased in absolute value in nearly all groups from the first two original models except in the English, Honduran, and Chinese samples although it was not statistically significant. This does give some indication that information on reduced price positively influences price conscience consumers and in fact increases stated likeliness to consume cloned product.

The variable measuring concern for food biotechnology (*foodtechconcern*) continues to be negative in all groups. However, it repeats the trend from the first model, which measures initial likeliness, and is significant in all groups except Sociology. This variable indicates that those consumers who are concerned with advance food biotechnologies are unlikely to consume cloned product even if it is cheaper than conventional product.

The variables identifying respondents concern about animal cloning –*morallywrong*, *foodsafety*, *humancloning*, and *animalsafety* – show the most interesting changes in coefficients observed from the previous two models. All variables continue to be negative for each group except for *humancloning* and *animalsafety* in the Chinese sample. However, each variable lost total significance across every group. The coefficient on the variable *morallywrong* decreased in absolute value from the first and second models, but continues to have the largest impact on each model except for the Chinese and Honduran samples. This suggests that the information about price decreased the impact for nearly every variable, but those consumers who have moral objection to the technology are still the least likely to consume cloned product.

The variable *foodsafety* is negative and significant in four of the seven models. The absolute value is consistently smaller than the *morallywrong* coefficients across all groups, except in the Honduran sample where *foodsafety* is -1.40 and *morrallywrong* is 1.19. The variable *humancloning* is now only statistically significant in the AgEcon, English, and French samples. The variable *animalsafety* changed the most of all the 'concern' variables, and is now only significant in the English sample.

There is little that is noteworthy in the remaining variables. The gender effect is now negative and significant in the AgEcon group where it indicates females are less likely to consume cloned product; however, conversely it is positive and significant in the English group

which indicates females are more likely to consume cloned product. The *religiousyes* variable is nowhere significant.

6.6 Summary – Influences on Likelihood of Consuming Cloned Product

Now that all three models for likeliness to consume cloned product have been estimated, we can examine which variables have consistent effects.

These models were estimated using variables that might be most likely to explain why consumers may or may not consume cloned product. The variable which most consistently had a statistically significant impact throughout all twenty one models was 'foodtechconcern'. While this variable did not have the largest impact on any of the models, it was statistically significant seventeen times and negative all twenty one times. It can be concluded from this that those consumers who are concerned with biotechnology and hormone use in food production are very unlikely to consume cloned products.

Following *foodtechconcern* were the variables *foodsafety* and *morallywrong* which each had fifteen statistically significant and negative occurrences. This is notable as *morallywrong* consistently had the greatest impact on each model in terms of the magnitude of its coefficient. This suggests that consumers who feel cloning is morally wrong are very unlikely to consume cloned product even if educated about the food safety issue.

Very few coefficients were positive and statistically significant. The variables *knowtech* and *price* had ten and seven statistically significant and positive coefficients respectively. It is important to note that each of these variables also had some negative estimated coefficient values, and in addition, the coefficient on *price* was actually negative and significant in two models. However, in general we can say that consumers who feel they have knowledge and understanding of cloning technology and biotechnology are more likely to consume product from cloned animals. It is interesting to note that this particular variable was only positive and statistically significant in the higher income countries in the sample (US, Ireland, and France) where consumers likely have better opportunities to educate themselves.

Table 6-13: Total Significant Positive and Negative Coefficients by Variable

	Likeliness to Consume (1)		Government Approval (2)		Price Reduction (3)		TOTAL	
	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.
Food Related Issues								
meatconsume		1						1
price	2	1	2	1	3		7	2
foodtechconcern		6		5		6		17
attention	1	1			1		2	1
knowtech	3		4		3		10	0
Reasons for Concern								
morallywrong		5		6		4		15
foodsafety		5	1	6		4	1	15
humancloning		4		5		3		12
animalsafety		3		3		1		7
Demographic Info.								
female		1		1	1	1	1	3
farm		1		1	1		1	2
religiousyes		1						1
TOTAL	6	29	7	28	9	19	22	76

In total, the Ag Econ, English, and French models had the most statistically significant variables with a total of eighteen each. English had the most negative and statistically significant variables at fourteen with Ag Econ and France close behind with thirteen at each. Sociology had the most negative variables at thirty, but the least statistically significant variables at eight. China interestingly had the least negative and statistically significant variables out of all the respondent groups with just five in total. This is less than half of most of the respondent groups except for Sociology.

Table 6-14: Total Significant Positive and Negative Coefficients by Respondent Group

	Likeliness to Consume (1)		Government Approval (2)		Price Reduction (3)		Total	
	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.	Pos. & Sig.	Neg. & Sig.
Ag Econ	2	5	2	4	1	4	5	13
English	1	5	1	4	2	5	4	14
Sociology		3		5			0	8
Ireland	1	4	1	6	2	2	4	12
France	2	5	1	4	2	4	5	13
Honduras		5		3		3	0	11
China		2	2	2	2	1	4	5
Total	6	29	7	28	9	19	22	76

7 Ordered Logit Analysis of Changes in Likelihood of Consuming Cloned Product

In order to have a greater understanding of why respondents might have changed their likeliness to consume cloned product throughout the survey, an ordered multinomial logit model was used. The ordered logit model was chosen because it allows for the probability in change of response to be measured against attributes of the respondent. For example, a respondent might have a higher probability to change their likeliness to consume cloned product if they are female or because they were reassured of their knowledge of the science of animal cloning. Marginal effects in the ordered logit model show the probability for consumers to either increase decrease, or maintain their likelihood of consumption level when an explanatory variables changes by one unit. This allows a closer analysis of the directional changes consumers might make in their rating of consumption likelihood in response to some external change such as the provision of information or a reduction in price. The sum of these marginal changes across categories equals zero because as the probability of an individual being in one category (e.g., increasing their likelihood of consumption) increases, their probability of being in another category (decreasing likelihood or same likelihood) must decrease. This information can be very helpful to producers and policy makers because it can provide insights about what might influence respondents to change their perceptions and attitudes toward the technology.

7.1 The Ordered Logit Model

The ordered logit models predict probabilities that a dependent variable will fall in one of several ordered categories based on a set of independent variables. These probabilities are used to study how the explanatory variables influence the changes in consumer's likeliness to consume cloned product given new information. For the purpose of this study, three variables were created in order to quantify the change consumers had in their likeliness to consume levels after being given new information. These change variables are:

$$Ordered\ Logit\ Variable\ 1 = Government\ Approval\ (2) - Likeliness\ to\ Consume\ (1) \tag{7.1}$$

$$Ordered\ logit\ Variable\ 2 = Price\ Reduction\ (3) - Government\ Approval\ (2) \tag{7.2}$$

$$Ordered\ Logit\ Variable\ 3 = Price\ Reduction\ (3) - Likeliness\ to\ Consume\ (1) \tag{7.3}$$

The independent variables which were chosen for the model include *knowtech*, *Likely1*, *morallywrong*, *foodsafety*, *humancloning*, *animalsafety*, and *female*. These variables were chosen based on their theoretically plausibility to influence the probability that a consumer would change their likelihood of consumption after receiving new information. Below is the theoretical model where y_i is the dependent variable representing Ordered Logit Variable (1), Ordered Logit Variable (2), and Ordered Logit Variable (3).

$$y_i = f(knowtech, likely1, morallywrong, foodsafety, humancloning, animalsafety, female) \tag{7.4}$$

The ordered logit model obtains parameter estimates by maximizing the log of the likelihood function.

The model is represented by the following equation;

$$y_i^* = x_i'\hat{\beta} + \varepsilon_i \tag{7.5}$$

where x_i represent the independent variables and $\hat{\beta}$ are the coefficients associated with the independent variables. The ε_i is the random error term. The error term is assumed to have a standard logistic distribution with a mean of zero and a variance of $\Lambda = \frac{\pi^2}{3}$ (Greene 1997, Crespi 2010). The dependent variable, y_i^*, is an unobserved latent variable. What can be observed are different categories of response. Below, y_i are the changes in response between the three

likeliness questions included in the survey. Per the model, since y_i^* is the latent variable, it is unobserved. What is observed is,

$$\begin{aligned} y_i &= -1 \; if \; y_i^* \leq \tau_1 \\ y_i &= 0 \quad if \; \tau_1 < y_i^* \leq \tau_2 \\ y_i &= +1 \; if \; y_i^* > \tau_2 \end{aligned} \tag{7.6}$$

while τ_i are the unobserved thresholds parameters which are estimated along with the β vector. Essentially these are the cut-off points for the dependent variables. For this model, if a respondent decreases their likeliness to consume after given new information, then the observed $y_i = -1$. If a respondent sustains their likeliness to consume cloned product after new information, the observed $y_i = 0$ and if they increase their likeliness to consume the observed $y_i = +1$.

The probability of observing an outcome is provided in the equations below, where the Λ is the standard logistic distribution function.

$$\begin{aligned} Prob(y_i = -1) &= 1 - \Lambda(x_i'\beta) = \Lambda(-x_i'\beta) \\ Prob(y_i = 0) &= \Lambda(\tau_1 - x_i'\beta) - \Lambda(-x_i'\beta) \\ Prob(y_i = +1) &= 1 - \Lambda(\tau_2 - x_i'\beta) \end{aligned} \tag{7.7}$$

Given these probabilities marginal effects can be found by taking the first order derivative with respect to x_i thereby measuring the change on the independent variable. These marginal effects are as follows:

$$\begin{aligned} \frac{\partial Prob(y_i = -1)}{\partial x_i} &= -\lambda\left(-x_i'\hat{\beta}\right)\hat{\beta} \\ \frac{\partial Prob(y_i = 0)}{\partial x_i} &= \left[\lambda\left(-x_i'\hat{\beta}\right) - \lambda\left(\tau_1 - x_i'\hat{\beta}\right)\right]\hat{\beta} \\ \frac{\partial Prob(y_i = +1)}{\partial x_i} &= \lambda(\tau_2 - x_i'\hat{\beta})\hat{\beta} \end{aligned} \tag{7.8}$$

Where the λ is the probability density function of the logistic distribution. These derivatives tell how a one-unit change in the variable x_i affects the probabilities of consumers increasing, sustaining, or decreasing their likeliness to consume cloned product.

7.2 Variables for Ordered Logit Model

In order to estimate the ordered logit model, the dependent variable had to be created and some observations had to be deleted as explained below.

7.2.1 Dependent Variables

Since the goal is to understand the change in the likeliness value from one assessment to another (i.e., following the provision of information), the first step in creating the dependent variable is to find the differences in responses. Each of the likeliness to consume questions were based on a 5 point Likert scale from 1= Not at all Likely, 3 = Somewhat Likely, and 5= Very Likely. The variable to be analyzed using the ordered logit model is the difference between the values obtained for the first two assessments of the likelihood of consumption – i.e. "Government Approval (2) – Likeliness to Consume (1)." (Similar models were estimated for the changes represented by "Price Reduction (3) – Government Approval (2)", and "Price Reduction (3) – Likeliness to Consume (1)" but, as shown below, there was very little change in the likelihood of purchase ratings between the 2nd and 3rd assessments and thus very little to be learned from analyzing those changes.) If a consumer increased their likeliness of consuming they were assigned a "+1" value for the new dependent variable. If they decreased their likeliness to consume (difference was a negative value), they were assigned a "-1" value. A "0" value was given to consumers who did not change their likeliness level.

Thus, the dependent variable is defined as:

$$y_i = \begin{cases} -1 \;\; if \;\; y^* \; is < 0 \\ 0 \;\; if \;\; y^* \; is = 0 \\ +1 \;\; if \;\; y^* \; is > 0 \end{cases} \tag{7.9}$$

As a consequence of their initial likeliness to consume value, some respondents were constrained in their responses. That is, respondents with extreme opinions may have wanted to increase or decrease their likelihood of consuming value, but were unable to do so because of the confines of the scaling. Consider a respondent whose response to the first "likeliness to consume" question is a "5" indicating they are "Very likely" to consume cloned product. If their opinion of cloned product is enhanced as a result of new information, they have no way to indicate that is the case and can only indicate again, by choosing response option "5" that they

would be “Very likely” to consume. If such observations are included in the ordered logit model, they will be misclassified as respondents whose opinion on cloning was unchanged as a result of the new information, whereas in fact their latent value (opinion of cloning) increased. The same argument applies at the other end of the scale. Thus, respondents who were on both ends of the scale, i.e. “1 = Not at all Likely” and “5 = Very Likely” and who did not change their response levels were deleted from the sample. If kept in the model, these respondents would artificially increase the number of “0” responses.

For essentially the same reason, the analysis does not consider the magnitude of change in the likeliness to consume value. The full range of potential values for the dependent variable is from -4 (for an individual whose scale changes from 5 to 1) to 4 (a change from 1 to 5). However, given the confines of the scale, we cannot always identify the desired change in rating for an individual whose new value is at either end of the scale – i.e., they may change from a 4 to a 5, but if 6 were an option they may have chosen it. To simplify the analysis, the categorization of changes is limited to being either positive, no change, or negative.

Table 7-1 below shows the proportion of observations remaining in each subsample after deleting observations where the response was potentially constrained. In addition, table 7-1 includes the percentage of those responses which were potentially constrained. The total for each group will add to 100% across each model specification. Both France and Ireland each had over 30% of respondents which did not change their initial stated likelihood of ‘Not At All Likely’ (Option 1) from the initial likeliness question to the second likeliness question (Model 2 – 1). The 30% of respondents who are ‘Not at all Likely’ to consume is generally consistent for France and Ireland in the Model (3) – (2) and the Model (3) – (1). China had the largest group of respondents who indicated they were ‘Not At All Likely’ to consume cloned product at around 44% for the first, second, and third models. These consistent indicators show that the European Union countries and China are far less willing to adjust their stated likelihood even if educated.

The groups which had the largest no change indication of ‘Very Likely to Consume’ (Option 5) were AgEcon and Honduras. For Model (2) – (1), AgEcon indicated 19% and Honduras indicated 23%. AgEcon showed the largest increase of consumers who were not willing to change indicated likelihood to consume in the Model (3) – (2) at 35% where Honduras indicated an increase to 30%. The final model resembled the initial Model (2) – (1) where

AgEcon indicated 20% and Honduras indicated 22% of respondents which did not change their minds in being very likely to consume cloned product.

The USA, English, and Sociology datasets did show measurable change in those consumers who sustained their stated likelihood to consume for 'Not at All Likely' (Option 1) and 'Very Likely' (Option 5). For each, the percentage in the 'Very Likely' (Option 5) from Model (2) – (1) and Model (3) – (1) most closely resembled each other, while Model (3) – (2) deviated for each. Interestingly, there was little similarity in the initial "Not at All Likely" (Option 1) percentages. Overall, the ordered logit model was estimated using 66.3% of the observations from the full dataset.

Table 7-1: Percentage of Observations Used for the Ordered Logit Model

	Model (2) - (1)			Model (3) - (2)			Model (3) - (1)		
	% in model	No Chng Option 1	No Chng Option 5	% in model	No Chng Option 1	No Chng Option 5	% in model	No Chng Option 1	No Chng Option 5
Ag Econ	76.27%	5.08%	18.64%	59.32%	5.08%	35.59%	74.58%	5.08%	20.34%
English	84.78%	13.04%	2.17%	78.26%	8.70%	13.04%	89.13%	8.70%	2.17%
Sociology	80.00%	20.00%	0.00%	76.67%	16.67%	6.67%	83.33%	16.67%	0.00%
USA	80.00%	11.11%	8.89%	69.63%	8.89%	21.48%	81.48%	8.89%	9.63%
Ireland	66.07%	32.14%	1.79%	66.96%	29.46%	3.57%	69.64%	28.57%	1.79%
France	66.87%	31.29%	1.84%	66.87%	30.06%	3.07%	69.94%	28.22%	1.84%
Honduras	62.77%	13.83%	23.40%	59.57%	10.64%	29.79%	63.83%	13.83%	22.34%
China	55.00%	44.29%	0.71%	57.14%	42.86%	0.00%	56.43%	43.57%	0.00%
Total	66.30%	27.48%	6.21%	64.29%	25.47%	10.25%	68.48%	25.47%	6.06%

1. **Logit Variable 1:** Government Approval (2) minus Likeliness to Consume (1)
    - This variable measures the change in response between the first two likeliness to consume questions – i.e., from Likeliness to Consume (1) to Government Approval (2).
    - The question describing government approval of animal cloning gave consumers new information about the safety of cloned products. Given the new information, respondents increased their "likeliness to consume" ratings. However, not all respondents increased their likelihood of consuming between the 1st and 2nd assessments.

2. **Logit Variable 2:** Price Reduction (3) minus Government Approval (2)
    - This variable measures the change between the third and second likeliness to consume question – Price Reduction (3) and Government Approval (2).
    - With the information about a potential 10% price reduction, consumers were given another piece of new information regarding cloned products besides the safety. There were observed increases in likeliness to consume levels; however, the increase was nominal. Therefore, this dependent variable will have the least amount of statistically significant variables to analyze.

3. **Logit Variable 3:** Price Reduction (3) minus Likeliness to Consume (1)
    - This variable measures the change between the third and first likeliness to consume question - Price Reduction (3) and Likeliness to Consume (1).
    - There is a total observed increase in likeliness to consume from the original question to the third question. This alone will likely make the model mirror the results using the Logit Model (1) variable. Therefore the hypothesis will be the same and little information will be gained from this model.

7.2.2 Independent variables

The independent variables in the ordered logit model were chosen based on their plausibility to potentially influence the observed change in the likelihood of consuming cloned product. The variables included were:

1. **Question 4: Perceived Knowledge**
    - This question is designed to elicit the perceived knowledge consumers have about advanced reproductive technologies. Answer options include: 1 = Nothing, 2 = Very Little, 3 = A Fair Amount, 4 = A Great Deal.
    - It is hypothesized that the more respondents know (or believe they know) about these technologies, the more likely they will be to increase their stated likelihood of consuming cloned product in response to new information. The thinking is that the

more familiar respondents are with technology, the more accepting they may be of information from scientists about product safety. Thus, a positive sign is expected.

2. **Question 5: Likely to Consume (1)**
   - This question was designed to find the initial reactions of respondents on their likeliness to consume product from cloned animals. Answer options were on a five point Likert scale from 1= Not At All Likely, 3 = Somewhat Likely, and 5= Very Likely.
   - Information about product safety or a price decrease would be expected to increase reported likelihood of consuming cloned product. It is expected that the lower the initial value for likelihood of consuming, the more likely it will be that the respondent will increase that likelihood rating. Thus the expected sign for the coefficient is negative.

3. **Question 6: Reason for Discomfort**
   - This question attempts to narrow down the primary reason for discomfort with animal cloning. There were seven possible responses, four of which were used to define dummy variables identifying respondents who were primarily concerned about: a) cloning being morally wrong, b) cloning's effect on food safety, c) animal cloning leading to human cloning and d) cloning being unsafe for animals.
   - *Animal Cloning is Morally Wrong*

     The hypothesis for this explanatory variable is if consumers are morally opposed to animal cloning they will either decrease or sustain their likeliness to consume cloned products. The coefficient is expected to be negative.
   - *Unsure of food safety from cloned animals*

     The hypothesis for this explanatory variable is that if consumers are concerned with the food safety of cloned animals, they should increase their likeliness to consume cloned products if given additional information about the safety. Therefore the coefficient on this variable is expected to be positive.

- *Animal cloning might lead to human cloning*

  The hypothesis for this variable is that if consumers are concerned that animal cloning is just a slippery slope toward human cloning, than they will decrease or maintain their likeliness to consume even if given additional information. Therefore the coefficient is expected to be negative.
- *Unsure that cloning is safe for animals*

  The hypothesis for this variable is that if consumers are concerned that animal cloning is unsafe for animals, than they will decrease or maintain their likeliness to consume even if given additional information, therefore the variable will be negative. There is a chance the coefficient will be positive if consumers believe that government approval also implies that animal safety is protected.

4. **Gender**
   - This is a dummy variable for Female = 1.
   - This variable is included to investigate whether females are more or less likely than males to change their assessment of cloning in response to new information. No hypothesis is made for the sign of its coefficient.

7.3 Ordered Logit Model: Government Approval (2) minus Likeliness to Consume (1)

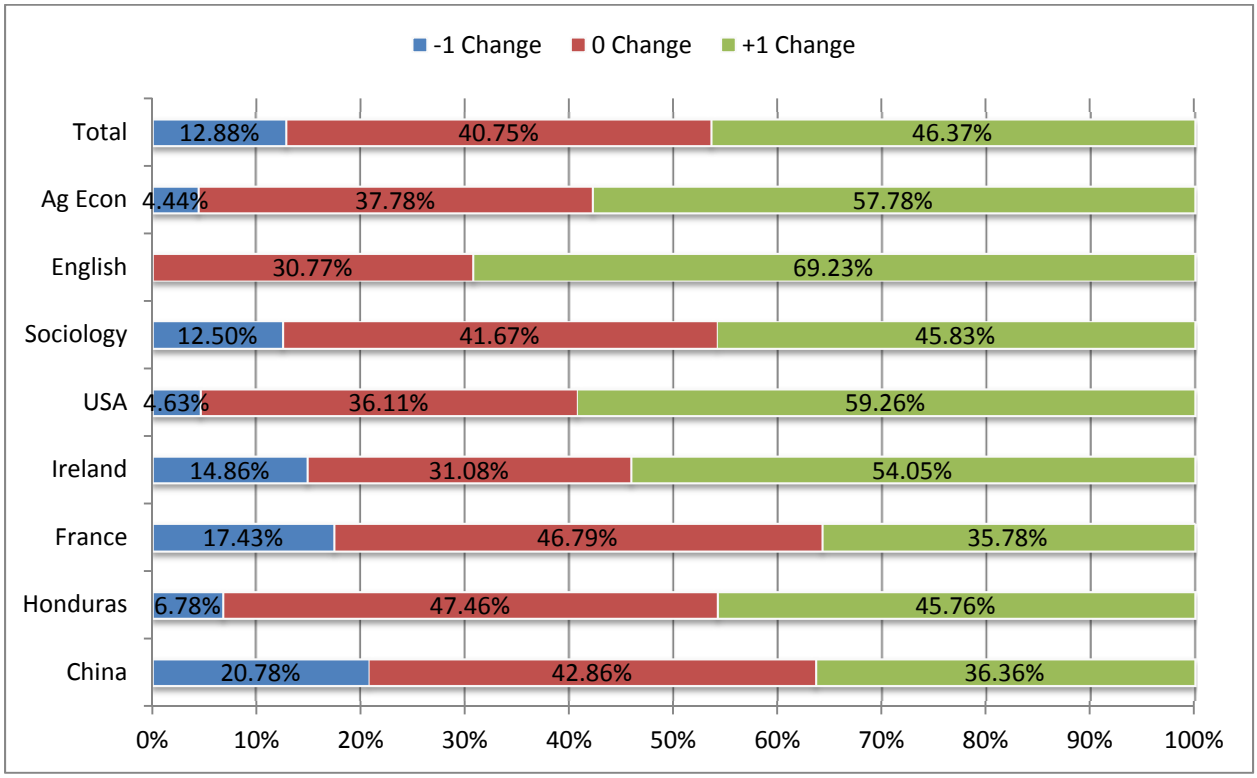
The first ordered logit model uses as its dependent variable the difference between the likeliness levels for Likeliness to Consume (1) and Government Approval (2). The model measures the effects of the explanatory variables on the probability that respondents either increase, maintain, or decrease their likelihood of consuming cloned product in response to new information about product safety.

Figure 7-1 gives a breakdown of consumers who decreased, sustained, or increased their likeliness to consume rating between the first and second assessments. Note that the data represented in the figure excludes respondents whose evaluation change was potentially constrained as explained above. The total number of respondents represented is 427 – or 66.3%

of the 644 observations in the earlier OLS models. As table 7-1 shows, 33.70% (27.48% from those who did not change their 1 response plus 6.21% from those who did not change their 5 response) of the respondents were on the extreme ends of the spectrum and did not change their opinions on animal cloning after learning additional information.

Only 12.88% of respondents decreased their likeliness to consume, indicated by a "-1" value. Conversely, 46.37% increased their likeliness to consume, indicated by a +1 value, and 40.75% maintained, indicated by a 0 value. Notably, 20.78% of Chinese respondents decreased their likeliness to consume cloned product following the provision of information about government approval. In France, 17.43% of respondents decreased their stated likeliness of consuming, whereas in the English class, none decreased their likelihood rating. There was also some variability in terms of the proportion increasing their likelihood of consuming ranging from a low of 35.78% in France and China, to a high of almost 70% in the English class.

Figure 7-1: Frequency Chart for Total Change Values of Likeliness Levels, Model (2) – (1)



7.3.1 Ordered Logit Results

Table 8.2 contains the results from the ordered logit model. Goodness of fit, as indicated by Pseudo R-squared shows that the Chinese model had the best overall fit. Initially, separate models were estimated for the AgEcon, English, and Sociology class samples but the ordered logit coefficients for the Sociology sample could not be estimated – likely a consequence of the limited number of observations. As a result, the data for the English, Sociology and AgEcon classes were combined into one sample, with dummy variables used to represent effects related to the different classes.

The *knowtech* coefficient is positive, as hypothesized, in four of the five models and statistically significant in two. The positive sign indicates that the more familiar the respondent is with animal reproductive technologies, the more likely they are to increase their stated likelihood of consuming cloned product in response to the new information about product safety.

The estimated coefficients on *likely1* are negative and statistically significant in each respondent group. This conforms with expectations - it was expected that the lower the initial value for likelihood of consuming (*likely1*), the more likely the respondent would be to increase their likelihood rating. This result suggests that the information about product safety has the greatest impact on individuals who were initially skeptical about cloned products. Importantly, this result is not driven by the fact that respondents who initially gave a high rating to their likelihood of consuming cloned product were constrained from offering an even higher rating in response to the new information, because all such observations are no longer part of the sample. What the result indicates is that an individual who initially gave a rating of perhaps 2 to their likelihood of consuming cloned product is much more likely to increase that rating than is an individual who initially gave a rating of 4.

Table 7-2: Ordered Logit Model Results

	USA	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues					
knowtech	0.544837*	0.8308015**	0.0759155	0.2401559	-0.155743
likely1	-0.9936818***	-0.9350056***	-1.056762***	-1.714988***	-2.998934***
Reasons for Concern					
morallywrong	-3.088459***	-3.243906***	-1.23625**	-0.8923555	1.448344
foodsafety	-1.48284**	-0.0659621	0.0276463	-0.3941371	0.4376977
humancloning	-2.619344***	-2.485061	-0.3917275	1.818788	0.4547694
animalsafety	-2.188432***	-0.464802	-0.4785274	2.094506	0.5579532
Demographic Info					
female	0.0379731	0.7377869	-0.0619967	-1.198007*	-0.2117327
english	0.7629247				
sociology	-0.7397264				
Number of obs	108	74	109	59	76
Pseudo R2	0.1538	0.159	0.0893	0.2987	0.4698
Log Liklihood	-74.953121	-60.932754	-102.00812	-36.986655	-42.717051

*,**, and *** indicates statistical significance at the 10%, 5%, and 1% levels.

7.3.1.1 Reason for discomfort with cloning:

The coefficient on *morallywrong* is negative in every country except China, and is statistically significant in three models. The negative value indicates that if consumers have moral objections to animal cloning, it is probable they will decrease their likeliness to consume given new information about government approval. This is consistent with the hypothesis for this variable. The variable has a positive impact in the Chinese sample, but this may be a consequence of data concerns previously noted.

The *foodsafety* coefficient was expected to be positive reflecting the idea that if consumers are concerned with the food safety of cloned animals, they should increase their stated likeliness to consume cloned products when given additional information about product safety. Results do not conform to this expectation, as the coefficient is never significantly positive and is in fact negative and significant in the US sample. The US result indicates that those who are concerned with food safety of cloned animals decrease their stated likelihood to consume cloned product even if given information about the food safety.

The coefficients *humancloning* and *animalsafety* were expected to be negative, but are statistically significant in the expected direction in only one of the five samples. The estimated *female* coefficient is positive in two models and negative in three, but only statistically significant (and negative) in the Honduran sample.

Given the patterns in table 7.2 above, the *English* and *Sociology* dummy variables show positive signs as expected. Compared to the AgEcon sample, respondents in the English class are more likely to increase their stated likelihood of consuming cloned product, while respondents in the Sociology class are more likely to reduce their stated likelihood of consuming. However, neither dummy variable coefficients are statistically significant.

7.3.2 Marginal Effects

Arguably the more descriptive analysis from this model is the marginal effects based on the directions of change. Since the dependent variable is categorical with values of "-1", "0", and "+1", the marginal effects give the probabilities on the directional change given a one-unit change in the independent variable. The total percentage change for each respondent group will equal zero because probabilities must sum to 1 and thus as the probability of being in one category increases, the probability of being in another must decrease. Table 7-3 presents the marginal effects. The discussion will focus on variables that had statistically significant coefficients in the ordered logit model.

First, we consider the *knowtech* variable, which had the expected positive sign in four of the five samples, and was statistically significant in two (USA and Ireland). In the Irish sample, the estimated marginal effects indicate that a one-unit increase in familiarity with technology, increases (by 20.6%) the probability that an individual will increase their stated likelihood of consuming cloned product, and reduce by 7.5% and 13.0% respectively the probability that they will reduce or maintain the same stated likelihood.

The *likley1* variable had the expected negative sign and was statistically significant in the models for all five samples. The marginal effects were most pronounced in the Chinese sample where a one-unit reduction in *likley1* was associated with a 59% increase in the probability that a respondents would increase (as opposed to decrease or maintain) their stated likelihood of consuming cloned product. Collectively the marginal effect on *likely1* indicates that individuals with higher initial levels of likelihood to purchase were more likely to reduce or maintain their evaluation of cloned product than they were to increase it.

The other variable which had a reasonably consistent effect in the ordered logit model was *morallywrong*. This variable had negative coefficient estimates in all samples except for

China. In the AgEcon sample, the estimated marginal effect indicates that an individual whose primary concern was that cloning was morally wrong was 57% less likely to increase their stated likelihood of consuming cloned product, compared to an individual in the baseline category (who was not uncomfortable with cloning). Similar results were found for the other three reasons that respondents might object to cloning. The results indicate that individuals who identify any of the four listed concerns as their primary concern with cloning are unlikely to increase their stated likelihood of consuming cloned product in response to receiving information from a government agency about the safety of cloned products. However, respondents who are morally opposed to the process have the highest probability of decreasing their likeliness to consume given new information about product safety.

Table 7-3: Marginal Effects from the Ordered Logit Model

		USA	*Ireland*	*France*	*Honduras*	*China*
Knowtech	Average Change	8.72%	13.74%	1.15%	3.97%	2.05%
1 – 4	P [Change -1]	-1.26%	-7.55%	-0.92%	-0.54%	0.66%
	P [Change -0]	-11.82%	-13.06%	-0.80%	-5.42%	2.41%
	P [Change +1]	13.08%	20.61%	1.72%	5.96%	-3.07%
Likely 1	Average Change	15.90%	15.47%	15.96%	28.35%	39.41%
1 – 5	P [Change -1]	2.30%	8.50%	12.79%	3.85%	12.73%
	P [Change -0]	21.56%	14.70%	11.15%	38.67%	46.38%
	P [Change +1]	-23.86%	-23.20%	-23.94%	-42.53%	-59.12%
morallywrong	Average Change	37.97%	40.64%	16.24%	13.73%	22.33%
0->1	P [Change -1]	28.42%	60.96%	18.84%	2.84%	-3.81%
	P [Change -0]	28.53%	-5.89%	5.51%	17.75%	-29.68%
	P [Change +1]	-56.96%	-55.07%	-24.35%	-20.59%	33.49%
foodsafety	Average Change	23.07%	1.09%	0.42%	6.47%	5.61%
0->1	P [Change -1]	3.95%	0.60%	-0.33%	0.93%	-1.96%
	P [Change -0]	30.65%	1.03%	-0.29%	8.77%	-6.45%
	P [Change +1]	-34.60%	-1.64%	0.63%	-9.70%	8.41%
humancloning	Average Change	35.98%	31.30%	5.72%	26.14%	6.36%
0->1	P [Change -1]	18.16%	45.75%	5.08%	-2.10%	-1.69%
	P [Change -0]	35.80%	1.21%	3.51%	-37.11%	-7.84%
	P [Change +1]	-53.97%	-46.95%	-8.58%	39.21%	9.54%
animalsafety	Average Change	32.57%	7.70%	6.68%	29.25%	7.62%
0->1	P [Change -1]	11.42%	4.57%	6.74%	-2.39%	-2.19%
	P [Change -0]	37.43%	6.98%	3.27%	-41.48%	-9.24%
	P [Change +1]	-48.85%	-11.55%	-10.01%	43.87%	11.44%
female	Average Change	0.61%	12.08%	0.94%	18.96%	2.73%
0->1	P [Change -1]	-0.09%	-6.83%	0.75%	3.21%	0.93%
	P [Change -0]	-0.82%	-11.29%	0.66%	25.24%	3.17%
	P [Change +1]	0.91%	18.12%	-1.41%	-28.45%	-4.10%
English	Average Change	11.81%				
0->1	P [Change -1]	-1.63%				
	P [Change -0]	-16.08%				
	P [Change +1]	17.71%				
Sociology	Average Change	12.08%				
0->1	P [Change -1]	2.12%				
	P [Change -0]	15.99%				
	P [Change +1]	-18.11%				
Pr(yx)	P [Change -1]	2.37%	10.12%	14.09%	2.30%	4.44%
	P [Change -0]	37.67%	35.53%	51.23%	52.19%	68.55%
	P [Change +1]	59.96%	54.35%	34.69%	45.51%	27.00%

7.3.3 Ordered Logit Model (2) and Ordered Logit Model (3)

The work and analysis for the ordered logit model for Price Reduction (3) – Government Approval (2) and Price Reduction (3) minus Likeliness to Consume (1) was in fact done for completeness of the study.

The results for Logit Model (2) indicated very low Pseudo R-Squared values and very few statistically significant variables. In fact the only statistically significant variable was *foodsafety* for China. The poor results are likely due to the very low increase for those respondents who were more likely to consume cloned product as seen in Figure 5-6. For this reason, the results will not be analyzed; however, the tables are available in Appendix 10-1.

The results for Logit Model (3) were consistent with the hypothesis and in fact closely mirrored the results from Logit Model (1) – Government Approval (2) minus Likeliness to Consume (1). Due to this, no new information is gained from a separate analysis; however, the tables are available in Appendix 10 – 2.

8 Conclusion

The objective of this thesis was to assess consumers' likelihood of consuming products from cloned animals and their progeny. Since the birth of 'Dolly the sheep' in 1996, animal cloning has become a highly contentious global political issue that is competing with needed efficiencies in a growing production environment. By examining samples from the US, Europe, Asia, and Central America, a current global perspective of consumer attitudes and their likeliness to consume cloned product emerges. The global comparison is especially important to potential trade concerns the US meat industry might have once the issue and product materializes on a larger scale. By comparing levels of concern for other food technologies, production practices, expressed levels of concern about cloning, and willingness to purchase cloned product, a much clearer picture evolves in how consumers will react once the technology has reached the marketplace. More specifically this study looked at: a) change in likeliness to consume cloned product after being given additional pieces of information about government approvals of food safety, b) expressed levels of concern about cloning and their effect on likeliness to consume cloned product, c) expressed levels of concern about other food technology issues and their effect on likeliness to consume cloned product.

8.1 Current Political State

The primary advantage cloning offers for food production is the ability to exactly replicate animals with superior production characteristics. By duplicating these superior breeding animals, cloning extends the longevity of genetically high-quality animals which has the potential to enhance overall herd genetics and thus increase overall productivity. This resulting increase in animal productivity has the potential to benefit both producers – through lower production costs – and consumers – either through lower retail prices or improved product quality and uniformity. Given the United Nations (2009) estimate that "food production will need to double by mid-century to meet demand from a growing world population," the production enhancing benefits of cloning become more appealing.

Concurrently however, active and well-organized consumer groups are working to implement stringent labeling laws or entire bans on cloning animals, especially for human consumption. These animal cloning opponents aggressively pushed their position citing concerns about human health and animal health and welfare, ethical objections to cloning, and the potential risks for agro-biodiversity and sustainability. The controversy has influenced several governments to conduct official reviews of the science and its application to the human food supply. Two risk assessments were released in January 2008 by the FDA and the EFSA (FDA 2008, EFSA 2010). Both concluded that it is very unlikely there are any differences between products derived from clones and clone offspring and foods derived from conventionally bred animals. However, subsequent to the released assessments, both agencies have noted that the ethical concerns related to cloning were not within the purview of the risk assessments and must be left to public debate.

The trade implications from these assessments are substantial. If legislation banning animal cloning or strict domestic and import labeling laws are passed, without being derived from adequate and scientifically proven human food and animal welfare risk assessments, it could result in WTO intervention. On July 7, 2010 the European Parliament passed legislation which would ban foods derived from clones or their offspring. In likely response and aversion to a potential trade conflict, the European Commission created a separate policy in October 2010 which implemented a five-year ban on the use of animal cloning for food production but which did not ban imports of foods derived from clone offspring. This ban cited justification based on animal welfare grounds and helps to temporarily avoid significant trade issues while Europe works to find an adequate political resolution.

8.2 **Application of Previous Research**

Much research has been conducted on consumer perceptions of biotechnology, but the studies during the years immediately before and after the FDA 2008 risk assessment have focuses primarily on attitudes toward animal cloning. Many of these surveys focus on one of four areas including: a) level of familiarity with biotechnology and/or cloning, b) likelihood of

purchasing/consuming 'cloned products,' c) specific concerns about cloning, and d) who consumers trust to provide information about the technology.

Hoban (2001) concluded that not many consumers have a direct connection with agriculture and food production which limits their literacy about developments in food biotechnology. However, the more information consumers have about a given food technology, the more accepting of the technology they appear to be (Lusk 2008). Even though it is difficult to assess exactly what consumers "know" about an issue, the perceptions consumers have toward food products are what influence consumers purchase behavior (Knight 2005). For cloning specifically, this translates to consumer misconception and confusion about its application to farming practices (Sosin and Richards 2005) which could affect buying habits. When asked directly, many studies find a one third split between respondents who indicate they would purchase cloned product, one third who might consider it given more information, and one third who would never purchase (Lusk 2008, Sosin and Richards 2005). These studies provided the basis of the survey which included questions about perceived knowledge, biotechnology concerns, and initial reactions to animal cloning. The results found in this study were generally consistent with those found in previous studies.

Beyond just consumer reactions, this study tried to narrow the focus on why consumers indicate discomfort from animal cloning. In order to create the options, major concerns were either replicated from previous surveys or derived from the major positions cloning objectors use when communicating to the public and policy makers. A review of the literature found the most commonly cited reasons for discomfort of animal cloning were morality concerns (32%) followed by uncertainty about food safety (26%), the fear that animal cloning might lead to human cloning (23%), and concerns for animal welfare (14%) (Storey 2006). The Mellman Group (2005) found that religion and ethics tops the list of concerns among consumers who are uncomfortable with animal cloning. For completeness of analysis, other demographic information such as religious affiliation and gender where included as well.

8.3 **Results**

Initial results from this study indicated an overall increase of likeliness to consume after being presented with additional pieces of information regarding the FDA and EFSA approvals as well as a situation where cloned product would be 10% less expensive. Concurrently, the basic average analysis and the percentage change logit analysis indicated an overall increase in likeliness to consume. This increase can be attributed to the influence of the information about product safety and price. The logit model also signified that the lower the initial value for likelihood of consuming (likely1), the more likely the respondent would be to increase their likelihood rating after positive information was presented. This result suggests that the information about product safety has the greatest impact on individuals who were initially skeptical about cloned products. From an aggregate standpoint, the total percentage breakdown of respondents who indicated they were 'not at all likely' to consume, 'somewhat likely' to consume, and 'very likely' to consume were relatively consistent with current literature (Lusk 2008, Sosin and Richards 2005). Overall, the 'not at all likely" category fell from 40% for the first question to about 30% in the second and third questions.

The regression analysis illustrated the effect demographic information, biotechnology concerns, and animal cloning concerns might have on purchase intent. First, consumers who indicated negative concerns with advanced food technology, such as hormone use, are consistently unlikely to consume cloned products. This was consistent across all groups. Second, the top four listed identified "concerns" including morality, food safety of cloned product, potential for human cloning, and animal welfare concerns had consistent negative impacts on the models across respondent groups. The coefficient describing moral concerns consistently had the greatest magnitude impact in both the OLS and ordered logit models across most groups. These listed concerns verified that consumers who agreed with the negative identifiers were very unlikely to consume cloned product even if educated about the food safety issues or price reductions. Furthermore, the logit analysis showed that there is a high probability that consumers who identify with at least one of these concerns will either maintain or decrease their likeliness to consume cloned product even if given new information about approval of food safety and price reductions.

The results of the entire analysis were relatively consistent in the overall conclusions. While economic analysis expects some deviation, most of the countries followed the same

pattern with the exception of China which had known data issues. This relative consistency suggests that once animal cloning reaches a larger market, consumer reactions will likely be the same from both US domestic consumers as well as America's major trade partners in Europe, Latin America, and Asia. Since the results show low initial reaction to animal cloning, information and education about the science, its approved food safety, and its potential lower market prices will be important in creating consumer acceptance of the technology. So long as the political systems do not create bans or strict labeling which might affect consumer perceptions, there is potential for cloned product to be accepted in the marketplace.

8.4 **Limitations and Recommendations**

Limitations of this dataset were limited responses from each country surveyed and data entry concerns for especially the China and Honduras datasets. In addition, the survey was presented to college age students who, especially in Honduras and China, are likely not regular purchasers of retail food products and already have higher education levels than many in their respective countries. Many of the students are likely utilizing available cafeteria accommodations and have little need to purchase and cook their own food. With these two demographic realities alone, the sample may not be a true picture of current protein buyers even if some studies have found students samples to be on par with representative samples (Lusk, et al. 2005). However, these respondents are the demographic which will be potential buyers if cloning technology actually emerges as a mainstream production practice. In addition, the survey mainly referred to product derived from 'animal clones' and not necessary the 'progeny of animal clones'. Because of production price however, it is unlikely animal clones will reach the marketplace.

There are several recommendations in applying this study to current and future marketing and policy procedures. Without explicit knowledge of where the political debate will conclude, and so long as the production costs stay high, it is likely that animal cloning will only be used for specific situations and will not emerge as mainstream livestock production technology. However, if the United Nations (2009) estimates on needed production increases materializes, and the cost of cloning technology continues to decrease, the economic and productivity benefits

of the technology will be become more appealing. Until then, the economic and political benefits of understanding consumer perceptions will be essential to effectively placing the product in the marketplace. We suggest that these perceptions are monitored over time as the political and media climate changes toward the technology and in addition find willingness to pay for cloned animals versus non cloned animals. This study will be a part of shaping prospective studies and product messaging into the future.

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Sosin, Jennifer, and Mark David Richards. *What Will Consumers Do? Understanding conusmer response when meat and milk from cloned animals reach supermarkets.* Survey Report, Washington, DC: KRC Research, 2005.

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10 Appendix Pages

10.1 Ordered Logit Model (2): Price Reduction (3) – Government Approval (2)

Because there was not much change between likeliness levels between Price Reduction (3) and Government Approval (2), it greatly affected the significance of the ordered logit model and made it very hard to gain any new information from the model. Below are the results from the analysis to show that work was done on this model.

Figure 10-1: Frequency Chart for Total Change Values of Likeliness Levels, Model (3) – (2)

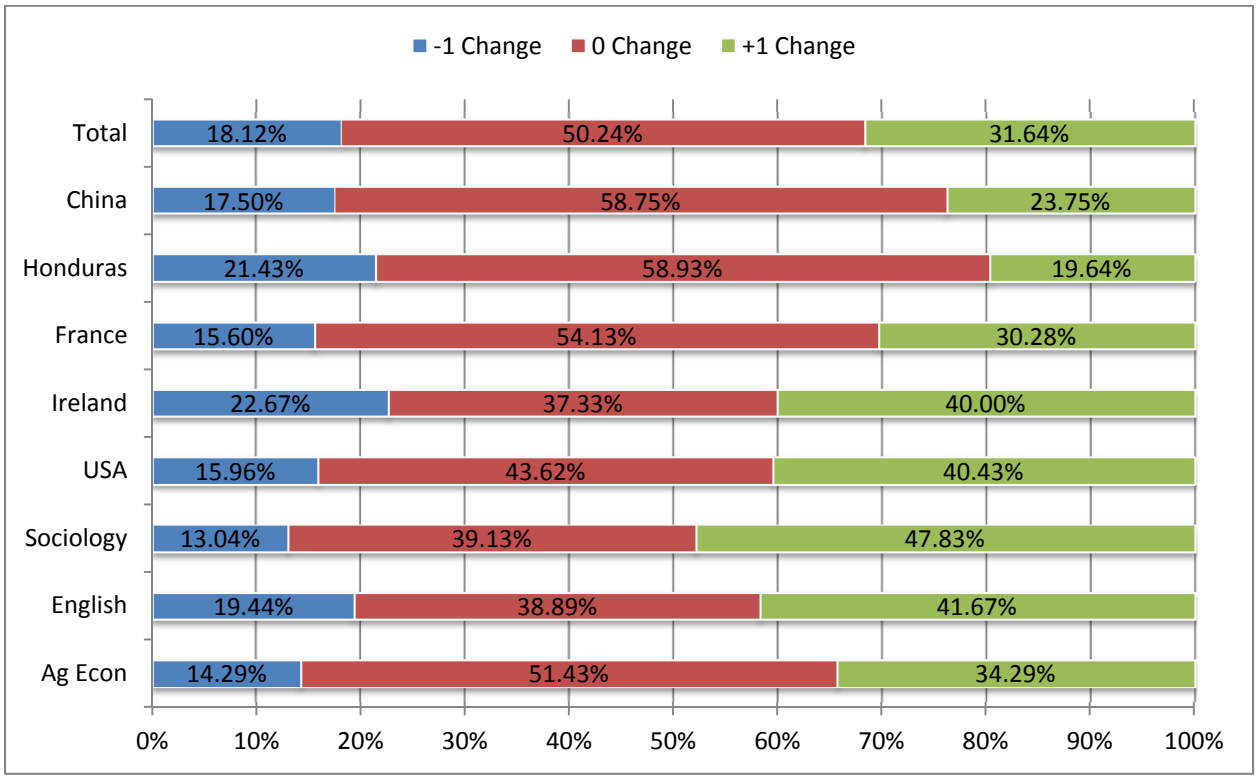


Table 10-1: Ordered Logit Model Coefficient Results for Logit Model (2) – (1)

	USA	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues					
knowtech	-0.1600267	-0.7530452**	0.2661465	-0.136781	-0.6666715*
likely1	0.3396821	-0.427308*	0.0830583	-0.1952307	0.1609873
Reason for Concern					
morallywrong	-0.2783378	2.17446*	1.14235*	0.0562155	-0.3630942
foodsafety	-0.0925916	-0.3747203	0.3949875	-0.8678078	-1.476604***
humancloning	1.362185	-0.449215	0.0944416	-0.2323233	-0.343621
animalsafety	0.1600346	0.2036932	0.548949	0.2704362	0.4583864
Demographic Info					
female	0.6642777	-0.7380855	-0.0169459	0.0591082	-0.541748
english	-0.4641543				
sociology	0.2429324				
Number of obs	94	75	109	56	79
Pseudo R2	0.0438	0.0925	0.03	0.0312	0.0933
Log Liklihood	-91.759639	-72.884179	-104.02089	-52.157726	-69.068897

Table 10-2: Marginal Effects from Ordered Logit Model (3) – (2)

		USA	*Ireland*	*France*	*Honduras*	*China*
Knowtech	Average Change	4.44%	11.79%	3.70%	1.47%	7.21%
1 – 4	P [Change -1]	3.46%	11.99%	-3.30%	2.21%	8.60%
	P [Change -0]	3.20%	5.70%	-2.25%	-0.14%	2.21%
	P [Change +1]	-6.66%	-17.68%	5.55%	-2.07%	-10.81%
Likely 1	Average Change	1.48%	6.69%	1.15%	2.10%	1.74%
1 – 5	P [Change -1]	1.15%	6.80%	-1.03%	3.16%	-2.08%
	P [Change -0]	1.06%	3.23%	-0.70%	-0.20%	-0.53%
	P [Change +1]	-2.22%	-10.03%	1.73%	-2.95%	2.61%
morallywrong	Average Change	21.78%	32.16%	17.08%	0.60%	3.60%
0->1	P [Change -1]	-11.53%	-19.95%	-11.85%	-0.90%	5.16%
	P [Change -0]	-21.14%	-28.28%	-13.77%	0.04%	0.25%
	P [Change +1]	32.67%	48.23%	25.62%	0.86%	-5.41%
foodsafety	Average Change	2.55%	5.80%	5.67%	9.69%	17.03%
0->1	P [Change -1]	-1.99%	6.10%	-4.60%	14.54%	17.90%
	P [Change -0]	-1.84%	2.60%	-3.90%	-1.88%	7.64%
	P [Change +1]	3.83%	-8.70%	8.50%	-12.66%	-25.54%
humancloning	Average Change	10.90%	6.59%	1.33%	2.66%	3.48%
0->1	P [Change -1]	-6.90%	8.06%	-1.15%	3.99%	4.77%
	P [Change -0]	-9.45%	1.82%	-0.84%	-0.70%	0.45%
	P [Change +1]	16.35%	-9.88%	1.99%	-3.29%	-5.23%
animalsafety	Average Change	7.12%	3.22%	8.30%	2.92%	5.14%
0->1	P [Change -1]	6.41%	-3.14%	-5.66%	-4.09%	-5.68%
	P [Change -0]	4.28%	-1.69%	-6.79%	-0.29%	-2.02%
	P [Change +1]	-10.69%	4.84%	12.46%	4.38%	7.70%
female	Average Change	3.87%	11.46%	0.24%	0.64%	5.57%
0->1	P [Change -1]	-3.03%	11.72%	0.21%	-0.95%	7.43%
	P [Change -0]	-2.78%	5.47%	0.14%	0.06%	0.92%
	P [Change +1]	5.81%	-17.19%	-0.35%	0.90%	-8.35%
English	Average Change	2.54%				
0->1	P [Change -1]	2.02%				
	P [Change -0]	1.80%				
	P [Change +1]	-3.81%				
Sociology	Average Change	5.50%				
0->1	P [Change -1]	-3.98%				
	P [Change -0]	-4.27%				
	P [Change +1]	8.25%				
Pr(yx)	P [Change -1]	14.57%	19.86%	14.49%	20.28%	15.22%
	P [Change -0]	45.72%	42.46%	55.91%	61.15%	64.41%
	P [Change +1]	39.71%	37.68%	29.60%	18.57%	20.37%

10.2 Ordered Logit Model (3): Price Reduction (3) – Likeliness to Consume (1)

The difference between Price Reduction (3) and Likeliness to Consume (1) was actually a result of the difference between Price Reduction (3) minus Government Approval (2) plus Price Government Approval (2) and Likeliness to Consume (1). The greatest magnitude in difference came from Government Approval (2) and Likeliness to Consume (1) which affected the model. In fact the results mirrored those from Ordered Logit Model (1) and gave no new information worth analyzing.

Figure 10-2: Frequency Chart for Total Change Values of Likeliness Levels, Model (3) –(1)

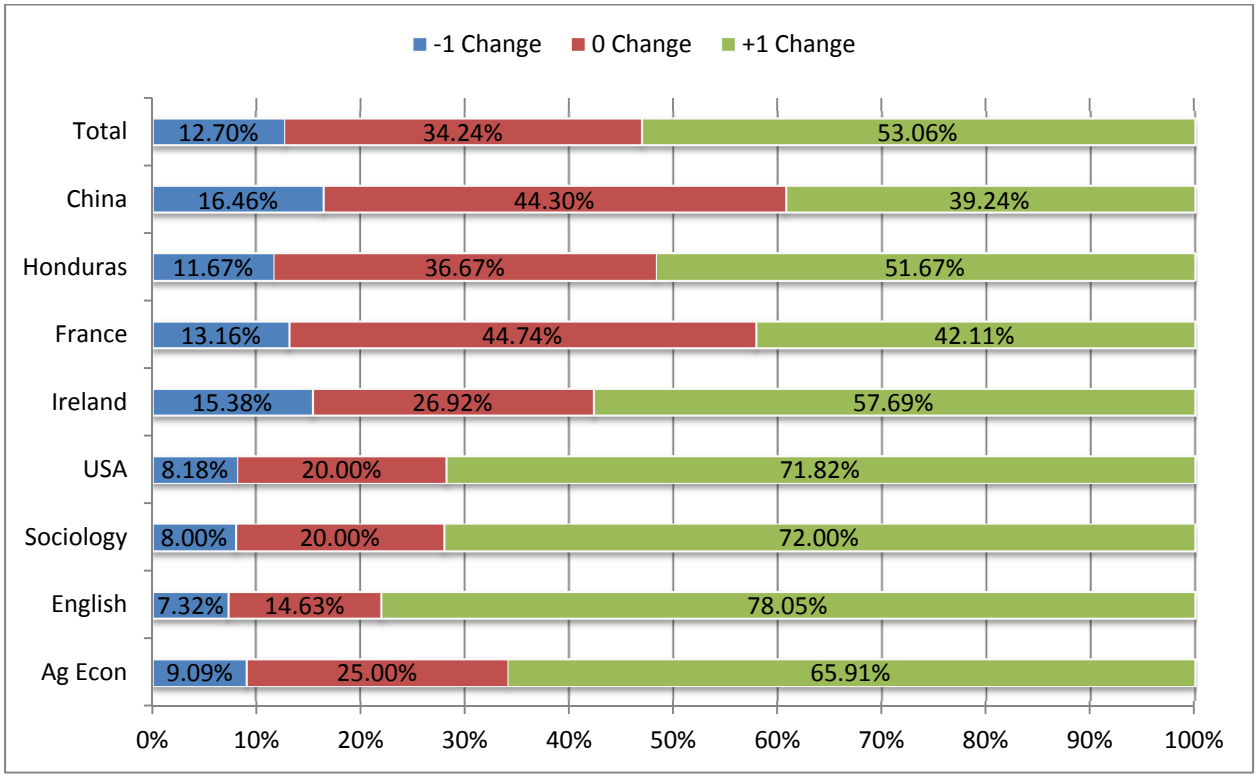


Table 10-3: Ordered Logit Model Coefficient Results for Logit Model (3) – (1)

	USA	*Ireland*	*France*	*Honduras*	*China*
Food Related Issues					
knowtech	0.5002639	0.0338419	0.251944	-0.01755	-0.1206049
likely1	-0.8695822***	-1.357478***	-1.203609***	-1.767804***	-2.882581***
Reason for Concern					
morallywrong	-1.263392	-1.083733	-0.39996	-0.98795	0.7274352
foodsafety	-1.537744**	-0.4138402	0.535893	-0.56452	-0.9311406
humancloning	-1.753076**	-2.418197	-0.13933	1.229751	0.2081301
animalsafety	-2.347724***	-0.3172254	0.294949	1.574938	1.20999*
Demographic Info					
female	0.7009683	0.7075431	0.003176	-1.141086*	-0.2487018
english	0.5732544				
sociology	0.5962384				
Number of obs	110	78	114	60	78
Pseudo R2	0.1213	0.1807	0.1069	0.2717	0.4868
Log Liklihood	-73.885954	-61.256257	-100.894	-41.9388	-41.122659

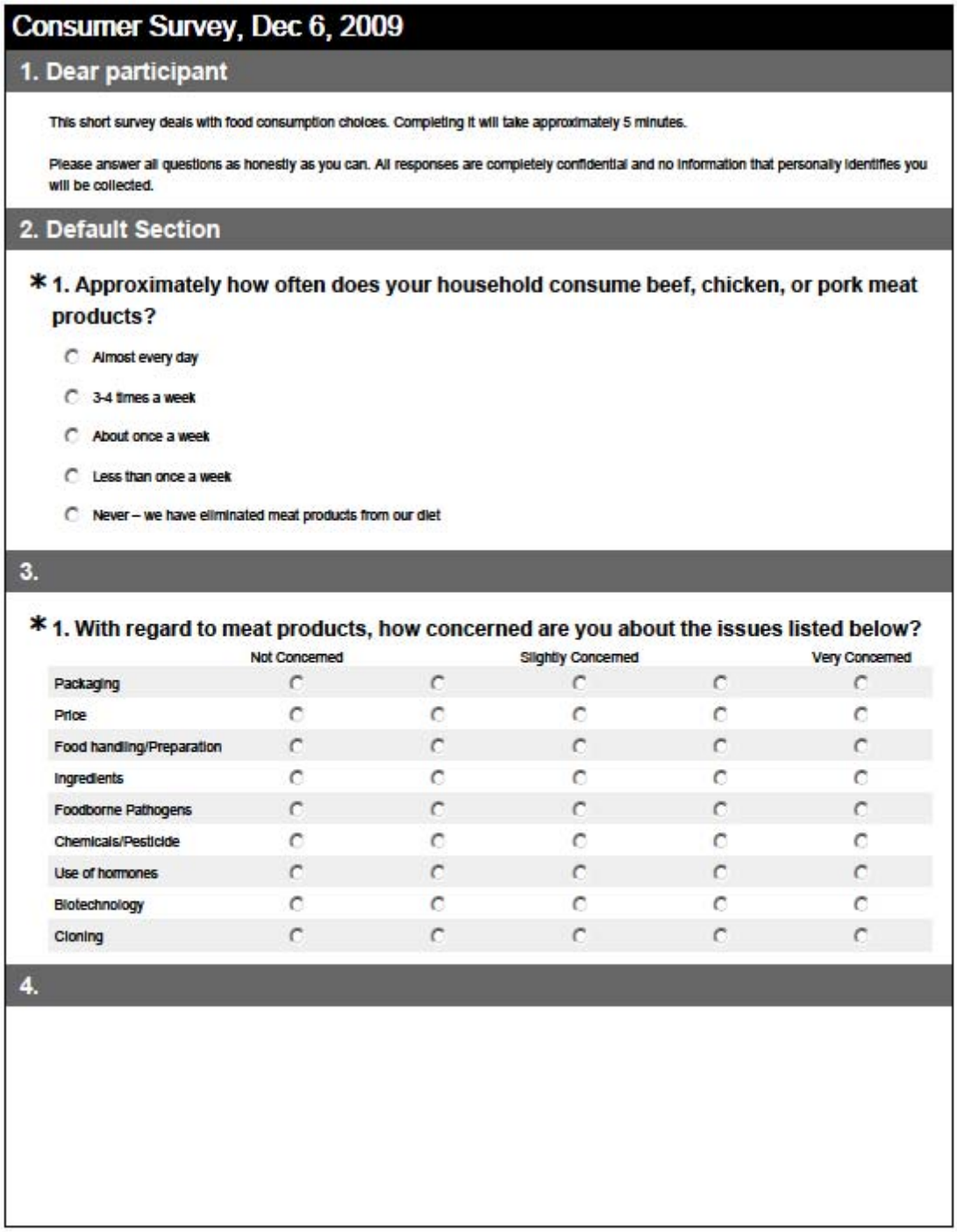
Table 10-4: Marginal Effects from Ordered Logit Model (3) – (1)

		USA	*Ireland*	*France*	*Honduras*	*China*
Knowtech	Average Change	6.19%	0.55%	4.07%	0.29%	1.80%
1 - 4	P [Change -1]	-2.60%	-0.32%	-2.29%	0.08%	0.38%
	P [Change -0]	-6.69%	-0.51%	-3.80%	0.36%	2.32%
	P [Change +1]	9.29%	0.82%	6.10%	-0.43%	-2.70%
Likely 1	Average Change	10.77%	22.01%	19.42%	29.16%	43.04%
1 - 5	P [Change -1]	4.51%	12.73%	10.96%	7.92%	9.12%
	P [Change -0]	11.64%	20.28%	18.17%	35.83%	55.44%
	P [Change +1]	-16.15%	-33.01%	-29.13%	-43.75%	-64.56%
morallywrong	Average Change	18.86%	17.58%	6.32%	16.04%	11.56%
0->1	P [Change -1]	10.66%	14.29%	3.92%	6.26%	-1.80%
	P [Change -0]	17.63%	12.08%	5.55%	17.80%	-15.54%
	P [Change +1]	-28.28%	-26.37%	-9.48%	-24.06%	17.34%
foodsafety	Average Change	19.28%	6.74%	8.76%	9.31%	14.02%
0->1	P [Change -1]	8.94%	4.06%	-4.45%	2.73%	2.84%
	P [Change -0]	19.98%	6.05%	-8.69%	11.23%	18.20%
	P [Change +1]	-28.91%	-10.11%	13.13%	-13.96%	-21.03%
humancloning	Average Change	26.44%	32.33%	2.23%	17.49%	3.17%
0->1	P [Change -1]	17.11%	44.85%	1.31%	-3.47%	-0.62%
	P [Change -0]	22.54%	3.64%	2.04%	-22.76%	-4.14%
	P [Change +1]	-39.66%	-48.49%	-3.35%	26.23%	4.75%
animalsafety	Average Change	34.59%	5.19%	4.84%	21.57%	18.50%
0->1	P [Change -1]	25.84%	3.15%	-2.41%	-4.28%	-3.43%
	P [Change -0]	26.05%	4.63%	-4.85%	-28.08%	-24.32%
	P [Change +1]	-51.88%	-7.78%	7.27%	32.35%	27.75%
female	Average Change	8.58%	11.33%	0.05%	18.49%	3.66%
0->1	P [Change -1]	-3.63%	-6.60%	-0.03%	5.88%	0.82%
	P [Change -0]	-9.24%	-10.39%	-0.05%	21.85%	4.67%
	P [Change +1]	12.86%	16.99%	0.08%	-27.73%	-5.49%
English	Average Change	6.83%				
0->1	P [Change -1]	-2.81%				
	P [Change -0]	-7.42%				
	P [Change +1]	10.24%				
Sociology	Average Change	6.76%				
0->1	P [Change -1]	-2.70%				
	P [Change -0]	-7.44%				
	P [Change +1]	10.14%				
Pr(yx)	P [Change -1]	5.49%	10.48%	10.13%	4.70%	3.27%
	P [Change -0]	19.15%	31.27%	48.80%	40.25%	62.86%
	P [Change +1]	75.35%	58.25%	41.07%	55.05%	33.87%

10.3 **Consumer Surveys**

Below is each of the translated surveys. Included are the English, French, Spanish, and Chinese translations. Translations were completed by colleagues in the Kansas State University Department of Agricultural Economics including: Dr. Tian Zian, Yue Zheng, Jaeljattin Jean, Sandra Contreas, and Quentin Baudouin.

10.3.1 English Version Survey



Consumer Survey, Dec 6, 2009

1. Dear participant

This short survey deals with food consumption choices. Completing it will take approximately 5 minutes.

Please answer all questions as honestly as you can. All responses are completely confidential and no information that personally identifies you will be collected.

2. Default Section

*** 1. Approximately how often does your household consume beef, chicken, or pork meat products?**

- Almost every day
- 3-4 times a week
- About once a week
- Less than once a week
- Never – we have eliminated meat products from our diet

3.

*** 1. With regard to meat products, how concerned are you about the issues listed below?**

	Not Concerned		Slightly Concerned		Very Concerned
Packaging					
Price					
Food handling/Preparation					
Ingredients					
Foodborne Pathogens					
Chemicals/Pesticide					
Use of hormones					
Biotechnology					
Cloning					

4.

Page 1

Consumer Survey, Dec 6, 2009

*** 1. Other than the price, do you pay attention to marketing labels on meat packaging?**

- Don't know
- Not at all
- A little
- Some
- A Lot

5.

*** 1. How much do you know about biotechnology, cloning, genetic engineering, or genetic modification?**

- Nothing
- Very little
- A fair amount
- A great deal

6.

*** 1. How likely are you to buy and eat meat from cloned animals?**

	Not at all likely		Somewhat likely		Very likely
Please rate	○	○	○	○	○

7.

*** 1. Which one of the following is the main reason you would be uncomfortable with eating meat from cloned animals? Please choose one:**

- Animal cloning is morally wrong
- Unsure of food safety from cloned animals
- Animal cloning might lead to human cloning
- Unsure that cloning is safe for animals
- Don't know
- Not uncomfortable
- Don't care

8.

Consumer Survey, Dec 6, 2009

*** 1. Both the United States Food & Drug Administration (FDA) and the European Food Safety Authority (EFSA) have determined that meat and dairy products from cloned animals and their offspring are no different from products derived from conventionally bred animals, and thus are safe for human consumption. Knowing this, if meat from cloned animals were being sold in your local grocery stores, how likely would you be to buy and consume it?**

	Not at all likely		Slightly likely		Very likely
Please rate	○	○	○	○	○

9.

*** 1. If the price of meat from cloned animals was 10 percent lower than meat from conventional animals, would you be likely to buy and consume meat from cloned animals?**

	Not at all likely		Slightly likely		Very likely
Please rate	○	○	○	○	○

10.

*** 1. What gender are you?**

- ○ Male
- ○ Female

*** 2. Do you have a religious affiliation?**

- ○ Yes
- ○ No
- ○ Prefer not to answer

*** 3. Are you from a farming or ranching background?**

- ○ Yes
- ○ No

Consumer Survey, Dec 6, 2009

*** 4. Considering social issues, would you consider yourself more:**

- Conservative
- Moderate
- Liberal
- No Affiliation
- Liberal on some, Conservative on other
- Other
- Prefer not to answer

*** 5. Please select your age bracket.**

- 20 or younger
- 21 - 25
- 26 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 46 - 50
- 51 - 60
- 61 - 70
- 71 - older

*** 6. What is the highest level of education you have completed?**

- Some high school
- High school graduate
- Some college
- College graduate
- Post graduate
- Other

*** 7. In order to evaluate if we are getting a cross section of all people, we would like to know your approximate 2008 household income before taxes?**

- less than 15,000€
- 15,000€ – 22,000€
- 22,000€ – 30,000€
- 30,000€ – 37,000€
- 37,000€ – 52,000€
- 52,000€ – 75,000€
- 75,000€ – 110,000€
- more than 110,000€
- Prefer not to answer

Consumer Survey, Dec 6, 2009

*** 8. Including yourself, how many people live in your household?**

- 1 person
- 2 people
- 3 people
- 4 people
- 5 people
- more than 5

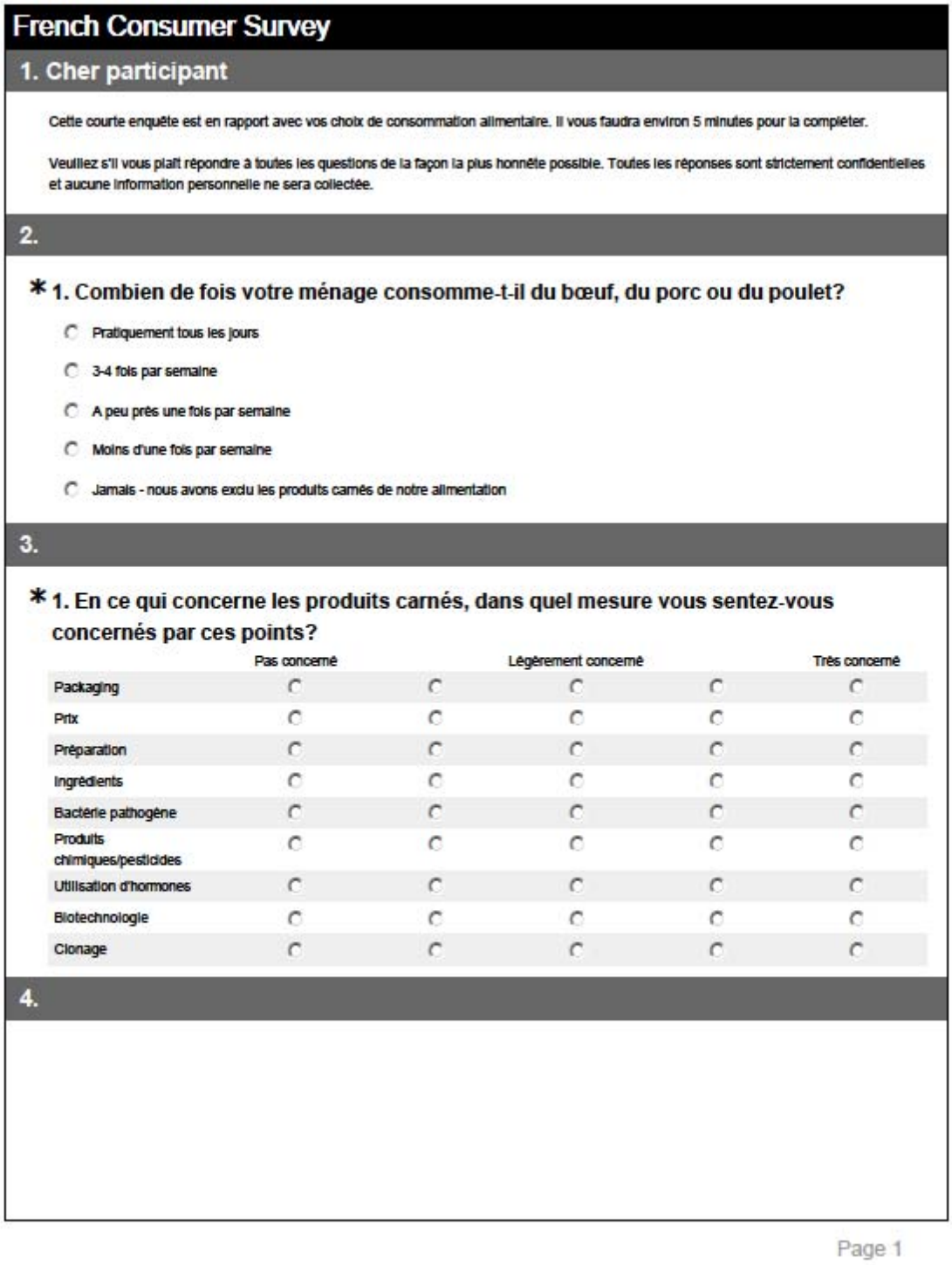
*** 9. Are there any children living in your household?**

	Yes	No
Under age 6?		
Between 6 and 18?		

11. Further Comments

1. Thank you for completing the survey. If you have any comments about it, please let us know here.

10.3.2 French Version Survey



French Consumer Survey

1. Cher participant

Cette courte enquête est en rapport avec vos choix de consommation alimentaire. Il vous faudra environ 5 minutes pour la compléter.

Veuillez s'il vous plaît répondre à toutes les questions de la façon la plus honnête possible. Toutes les réponses sont strictement confidentielles et aucune information personnelle ne sera collectée.

2.

*** 1. Combien de fois votre ménage consomme-t-il du bœuf, du porc ou du poulet?**

- Pratiquement tous les jours
- 3-4 fois par semaine
- A peu près une fois par semaine
- Moins d'une fois par semaine
- Jamais - nous avons exclu les produits carnés de notre alimentation

3.

*** 1. En ce qui concerne les produits carnés, dans quel mesure vous sentez-vous concernés par ces points?**

	Pas concerné		Légèrement concerné		Très concerné
Packaging					
Prix					
Préparation					
Ingrédients					
Bactérie pathogène					
Produits chimiques/pesticides					
Utilisation d'hormones					
Biotechnologie					
Clonage					

4.

Page 1

French Consumer Survey

*** 1. Mis à part le prix, regardez-vous avec attention les autres informations inscrites sur les emballages de produits carnés ?**

- Je ne sais pas
- Pas du tout
- Un peu
- Relativement
- Enormément

5.

*** 1. Dans quelle mesure êtes-vous informé sur les biotechnologies, le clonage, les manipulations et les modifications génétiques?**

- Pas du tout
- Peu
- De façon assez importante
- Beaucoup

6.

*** 1. Seriez-vous prêt à acheter et manger de la viande d'animaux clonés?**

	Pas probablement		Oui, probablement		Très probablement
S'il vous plaît évaluer	○	○	○	○	○

7.

*** 1. Parmi les propositions suivantes, choisissez la raison principale qui fait que vous n'êtes pas confiant pour acheter de la viande d'animaux clonés:**

- Le clonage animal est moralement contraire à mes opinions
- Doute à propos de la sécurité alimentaire des animaux clonés
- Le clonage animal pourrait conduire au clonage humain
- Doute que le bien-être animal soit garanti
- Ne sais pas
- Ne suis pas concerné
- Ne prête pas attention

French Consumer Survey

8.

*** 1. L'administration américaine pour la sécurité alimentaire (FDA) ainsi que l'autorité européenne pour la sécurité des aliments (EFSA) ont toutes deux déterminé que les produits carnés et laitiers obtenus à partir d'animaux clonés et de leurs descendants n'étaient pas différents des produits obtenus à partir d'animaux élevés de façon conventionnelle, et ainsi étaient sains pour la consommation humaine. Sachant ceci, si de la viande d'animaux clonés était en vente dans les magasins près de chez vous, seriez-vous prêt à en acheter et à en consommer?**

	Pas probablement		Oui, probablement		Très probablement
S'il vous plaît évaluer	○	○	○	○	○

9.

*** 1. Si le prix de la viande issue d'animaux clonés était de 10% inférieure à celle issue d'animaux conventionnels, seriez-vous prêt à manger de la viande d'animaux clonés?**

	Pas probablement		Oui, probablement		Très probablement
S'il vous plaît évaluer	○	○	○	○	○

10.

*** 1. Quel est votre sexe?**

- ○ Homme
- ○ Femme

*** 2. Avez-vous une affiliation religieuse?**

- ○ Oui
- ○ Non
- ○ Préfère ne pas répondre

*** 3. Avez-vous une formation ou un passé agricole?**

- ○ Oui
- ○ Non

French Consumer Survey

*** 4. Considérant les problèmes sociaux, vous considérez-vous plutôt:**

- Conservateur
- Modéré
- Liberal
- Pas d'affiliation
- Liberal sur certains sujets, conservateursur d'autres
- Autre
- Préfère ne pas répondre

*** 5. Sélectionnez votre tranche d'âge:**

- Moins de 20 ans
- 21 – 25
- 26 – 30
- 30 – 35
- 36 – 40
- 40 – 45
- 46 – 50
- 51 – 60
- 61 – 70
- Plus de 71 ans

*** 6. Quel est votre plus haut niveau de formation?**

- Lycée
- Baccalauréat
- Post-Bac
- Bac+3 (License)
- Plus haut que Bac+3
- Autre

*** 7. Pourriez-vous indiquer le revenue de votre ménage en 2008 avant impôts?**

- Moins de 15,000€
- 15,000 – 22,000€
- 22,000 – 30,000€
- 30,000 – 37,000€
- 37,000 – 52,000€
- 52,000 – 75,000€
- 75,000 – 110,000€
- Plus de 110,000€
- Préfère ne pas répondre

French Consumer Survey

*** 8. Vous compris, combien de personne(s) vive(nt) dans votre foyer?**

- 1 personne
- 2 personnes
- 3 personnes
- 4 personnes
- 5 personnes
- Plus de 5 personnes

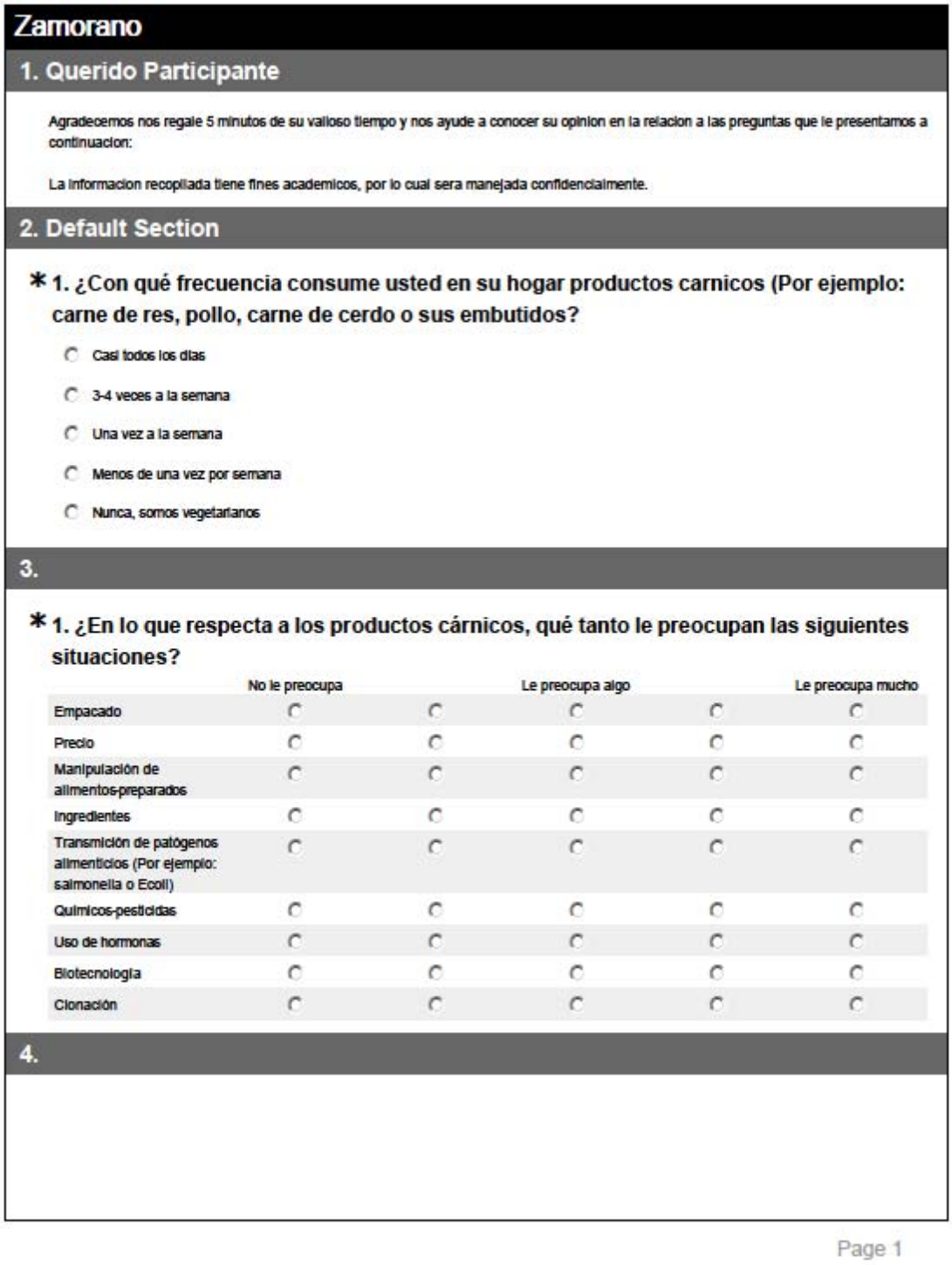
*** 9. Y-a-t'il des enfants qui vivent dans votre foyer?**

	Oui	Non
Moins de 6 ans?		
Entre 6 et 18 ans?		

11. Commentaires supplémentaires

1. Merci d'avoir complété cette enquête. Si vous-avez des commentaires à propos de cette enquête, merci de les inscrire ici.

10.3.3 Spanish Version Survey



Zamorano

1. Querido Participante

Agradecemos nos regale 5 minutos de su valioso tiempo y nos ayude a conocer su opinion en la relacion a las preguntas que le presentamos a continuacion:

La informacion recopilada tiene fines academicos, por lo cual sera manejada confidencialmente.

2. Default Section

*** 1. ¿Con qué frecuencia consume usted en su hogar productos carnicos (Por ejemplo: carne de res, pollo, carne de cerdo o sus embutidos?**

- Casi todos los dias
- 3-4 veces a la semana
- Una vez a la semana
- Menos de una vez por semana
- Nunca, somos vegetarianos

3.

*** 1. ¿En lo que respecta a los productos cárnicos, qué tanto le preocupan las siguientes situaciones?**

	No le preocupa		Le preocupa algo		Le preocupa mucho
Empacado					
Precio					
Manipulación de alimentos-preparados					
Ingredientes					
Transmición de patógenos alimenticios (Por ejemplo: salmonella o Ecoli)					
Quimicos-pesticidas					
Uso de hormonas					
Biotecnologia					
Clonación					

4.

Page 1

Zamorano

*** 1. Al momento de comprar productos cárnicos, ¿presta usted atención a la etiqueta que tienen los productos?**

- No sabe
- No presta atención
- Un poco
- Algo
- Mucho

5.

*** 1. ¿Cuánto sabe usted de la biotecnología, la clonación, la ingeniería genética, o modificación genética?**

- Nada
- Muy poco
- Algo
- Mucho

6.

*** 1. Si salieran al mercado productos carnicos producidos a partir de animales clonados ¿Qué posibilidades habria de que usted consumiera estos productos?**

	No muy probable		Algo probable		Muy probable
Indique					

7.

Zamorano

* **1. Por favor, indique ¿Cuál es la razón principal por la cual usted no consumiria productos carnicos elaborados a partir de animales clonados?**

- ○ La clonación de animales es moralmente incorrecta
- ○ No está seguro de la seguridad alimentaria de animales clonados
- ○ La clonación de animales podria llevar a la clonación humana
- ○ No está seguro de que la clonación es segura para los animales
- ○ No sabe
- ○ No se siente cómodo
- ○ No le importa

8.

* **1. Tanto la Administración de Alimentos y Medicamentos de los Estados Unidos (FDA) y la Autoridad Europea de Seguridad Alimentaria (EFSA) han determinado que los productos carnicos y lácteos elaborados a partir de animales clonados (y crias) NO SON DIFERENTES de los productos derivados de animales criados convencionalmente, y por lo tanto son seguros para el consumo humano. Sabiendo esto, ¿qué tan probable sería que usted comprara y consumiera productos carnicos de animales clonados?, si estos estuvieran en venta en su tienda de comestibles local.**

	Nada probable		Algo probable		Muy probable
Indique	○	○	○	○	○

9.

* **1. Si el precio de la carne de animales clonados fuera de 10 por ciento menos que la carne de animales convencionales, ¿compraria y consumiria usted productos carnicos de animales clonados?**

	Nada probable		Algo probable		Muy probable
Indique	○	○	○	○	○

10.

* **1. Genero**

- ○ Hombre
- ○ Mujer

Zamorano

*** 2. ¿Tiene una afiliación religiosa?**

- Sí
- No
- Prefiere no contestar

*** 3. ¿Tiene usted familiares campesinos?**

- Sí
- No

*** 4. Usted se considera una persona:**

- Conservador/a
- Moderado/a
- Liberal
- Ninguna, no tiene ninguna afiliación
- Ambos (liberal en algunas cosas, conservador en otras)
- Otro, indique
- Prefiere no contestar

*** 5. Seleccione su edad.**

- 20 o más jóven
- 21 – 25
- 26 – 30
- 30 – 35
- 35 – 40
- 40 – 45
- 46 – 50
- 51 – 60
- 61 – 70
- 71 – o más viejo

*** 6. 20. ¿Cuál es el nivel más alto de educación que ha completado?**

- Primaria
- Tercero basico
- Secundaria
- Universidad
- Posgraduado
- Otro, indique

Zamorano

*** 7. Por favor, seleccione la opcion que mas se acerque a sus ingresos anuales. (En dolares de Estados Unidos.)**

- ○ Menos de $20,000
- ○ $20,000 – 30,000
- ○ $30,000 – 40,000
- ○ $40,000 – 50,000
- ○ $50,000 – 70,000
- ○ $70,000 – 100,000
- ○ $100,000 – 150,000
- ○ Mas que $150,000
- ○ Prefiere no contestar

*** 8. ¿Incluyéndose usted, cuántas personas viven en su casa?**

- ○ 1 persona
- ○ 2 personas
- ○ 3 personas
- ○ 4 personas
- ○ 5 personas
- ○ Más de 5 personas

*** 9. ¿Hay niños viviendo en su casa?**

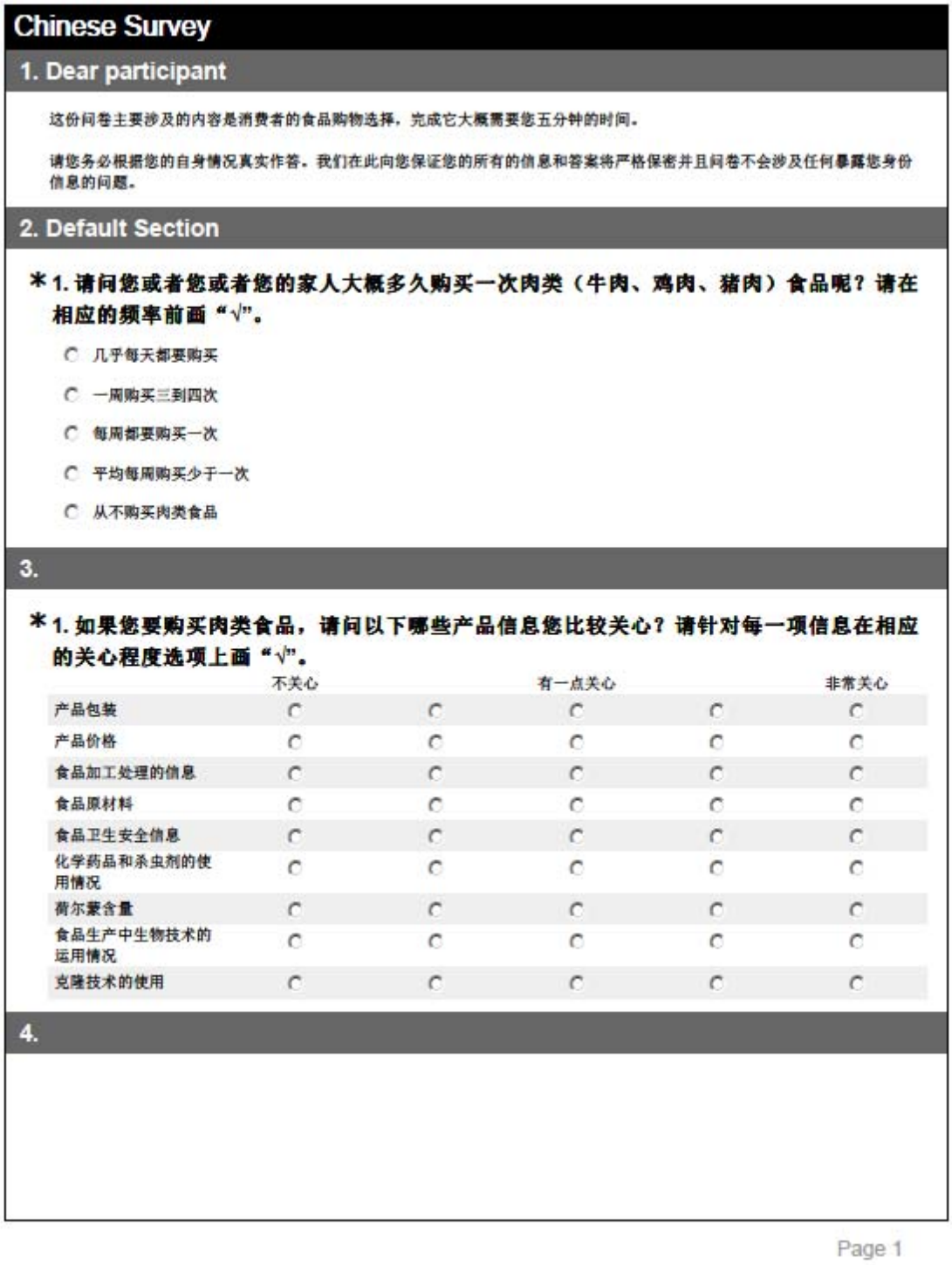
	Si	No
Menores de 6	○	○
Entre 6 y 18	○	○

11. Comentarios

1. Gracias por su amabilidad y disposicion al contestar esta encuesta. La misma ha sido traducida de ingles a espanol, por lo cual algunas preguntas pueden que no apliquen a su realidad.

Si tiene algún comentario u observacion en relacion al tema, apreciariamos nos lo haga saber por este medio.

10.3.4 Chinese Version Survey



Chinese Survey

1. Dear participant

这份问卷主要涉及的内容是消费者的食品购物选择，完成它大概需要您五分钟的时间。

请您务必根据您的自身情况真实作答。我们在此向您保证您的所有的信息和答案将严格保密并且问卷不会涉及任何暴露您身份信息的问题。

2. Default Section

＊1. 请问您或者您或者您的家人大概多久购买一次肉类（牛肉、鸡肉、猪肉）食品呢？请在相应的频率前画“√”。

- ○ 几乎每天都要购买
- ○ 一周购买三到四次
- ○ 每周都要购买一次
- ○ 平均每周购买少于一次
- ○ 从不购买肉类食品

3.

＊1. 如果您要购买肉类食品，请问以下哪些产品信息您比较关心？请针对每一项信息在相应的关心程度选项上画“√”。

	不关心		有一点关心		非常关心
产品包装	○	○	○	○	○
产品价格	○	○	○	○	○
食品加工处理的信息	○	○	○	○	○
食品原材料	○	○	○	○	○
食品卫生安全信息	○	○	○	○	○
化学药品和杀虫剂的使用情况	○	○	○	○	○
荷尔蒙含量	○	○	○	○	○
食品生产中生物技术的运用情况	○	○	○	○	○
克隆技术的使用	○	○	○	○	○

4.

Page 1

Chinese Survey

*1. 如果您要负责您本人及其家庭的食品购买，请问除了价格以外，您还注意肉类食品的标签上的其他信息么？请在相应的选项上画“√”。

- 不知道
- 一点也不注意
- 有一点注意
- 注意
- 非常注意

5.

*1. 请问您对生物技术，克隆，基因工程以及转基因技术了解多少呢？请在相应的选项上画“√”。

- 一点都不了解
- 了解一点
- 比较了解
- 非常了解

6.

*1. 如果您要负责您本人及其家人的食品购买，请问您有多大可能去购买并食用克隆生物的肉类食品呢？请在相应的选项上画“√”。

	非常不可能		有一定可能		非常有可能
请选择	○	○	○	○	○

7.

Chinese Survey

*** 1. 请问以下哪一条观点是致使您不太愿意食用克隆生物的肉类食品的主要原因呢？请在相应的选项前画“√”。**

- ○ 克隆生物从道德上讲就是错误的
- ○ 不太确定克隆生物的食品安全
- ○ 如果动物能克隆，那很有一天人也能克隆
- ○ 不确定克隆技术运用于动物身上是否安全
- ○ 我不知道
- ○ 我愿意食用克隆生物的肉类食品
- ○ 我不在乎（肉类食品是否来自于克隆生物）

8.

*** 1. 美国食品及药物管理局和欧洲食品安全协会发布消息说来源于克隆生物（以及他们的后代）的肉类以及乳制品与来自于普通生物的肉类制品和乳制品别无两样。当您知道这样的消息后，假如您要负责您本人及其家人的食品购买，当您在小区超市发现来源于克隆生物的肉制品，您有多大可能选择购买此类产品呢？请在相应的选项上画“√”。**

	非常不可能		有一定可能		非常有可能
请选择	○	○	○	○	○

9.

*** 1. 如果您发现克隆生物的肉类制品比一般肉类制品要便宜近百分之十，那您有多大可能去购买并食品克隆生物的肉类制品呢？请在相应的选项上画“√”。**

	非常不可能		有一定可能		非常有可能
请选择	○	○	○	○	○

10.

*** 1. 您问您的性别是？请在相应的选项前画“√”。**

- ○ 女
- ○ 男

*** 2. 您有信仰么？请在相应的选项前画“√”。**

- ○ 有
- ○ 没有
- ○ 不便作答

Chinese Survey

*** 3. 您有农业相关背景知识么？请在相应的选项前画“√”。**

- 有
- 没有

*** 4. 对于您对社会问题的看法，您觉得自己的态度偏向于？请在相应的选项前画“√”。**

- 保守
- 中庸
- 激进自由
- 觉得不相关
- 对于某些问题比较激进，有些问题比较保守
- 其他态度
- 不便作答

*** 5. 请选择您的年龄范围，在相应的选项前画“√”。**

- 20岁以及20岁以下
- 21 - 25
- 26 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 46 - 50
- 51 - 60
- 61 - 70
- 71岁以及71岁以上

*** 6. 您所完成的最高学历是？请在相应的选项前画“√”。**

- 高中但未毕业
- 高中毕业
- 大学但未毕业
- 大学毕业
- 研究生以上
- 其他

Chinese Survey

*** 7. 17. 为了避免我们重复选择样本，我们希望能知道您2008年大概的年收入（税前）是？请在相应的选项前画“√”。**

- ○ 少于¥ 136,254
- ○ ¥ 136,254 – 204,381
- ○ ¥ 204,381 – 272,508
- ○ ¥ 272,508 – 340,635
- ○ ¥ 340,635 – 476,889
- ○ ¥ 476,889 – 681,270
- ○ ¥ 681,270 – 1,021,905
- ○ 多于¥ 1,021,905
- ○ 不便作答

*** 8. 请问您家庭人员（包括您自己）人数是？请在相应的选项前画“√”。**

- ○ 一 个
- ○ 两个
- ○ 三个
- ○ 四个
- ○ 五个
- ○ 多余五个

*** 9. 请问您家庭中有小孩么？请在相应的选项前画“√”。**

	是	不是
小孩年龄小于六岁么？	○	○
小孩年龄介于六岁到十八岁之间？	○	○

11. Further Comments

1. 非常感谢您的支持与配合。如若您有什么意见与建议，请在此处告知我们，再次感谢！

Page 5

10.4 **Respondent Open Ended Comments**

Respondents were offered the opportunity to write any comments they had about the survey or subject matter. Below are all comments offered by respondents with no spelling or grammatical changes. The comments have been reviewed for correct spelling and where appropriate, have been translated into English.

10.4.1 Open Ended Responses: United States

- It is difficult for a college student to know how to answer on the last page. I answered them as if I was at home with my folks on the farm. Thanks.
- Meat grown in a lab seems artificial to me. However if they clone a whole living cow and have a whole living cow then that is real beef to be eaten.
- I liked this survey!
- The only reason I would not eat cloned animal meat is because I would think about the animal being cloned and it would make me feel sick. The other day I thought about my meatloaf being undercooked when it really wasn't but just the thought made me stop eating my meatloaf. It is all kind of a mind game with me.
- Interesting survey Sean! The information about cloning is especially interesting.
- I have worked in grocery stores for several years and have seen the behind the scenes reality of cutting and selling fresh meat products. People should be just as concerned about current meat contamination from improper cutting and handling as about cloning, etc.
- To be more specific, maybe ask if the person is a student and living in the dorms. Maybe ask them to base their answers off of their parent's household as they are included.
- The other people in my household eat meat. I do not.
- An Environmental Socio student - interesting on the cloning! Unbelievable how advanced things have become/are continuing to become.
- Since I am older I have found that the food and Drug admin has approved things in the past and then later had to issue warnings due to lack of information from companies that manufacture products being released in an attempt to rush getting approval.

- I would pay extra money for purchasing foods for my health. The FDA isn't always right and can't be trusted all of the time, especially if their pockets are being lined with money from special interest groups, though they claim to be impartial.

10.4.2 Open Ended Responses: Ireland

- I pay close attention to free range chicken products. I love chicken but am very reluctant to buy ready meals, pizzas or take away food with chicken as I prefer to eat free range chicken. I pay close attention to weather meat is Irish or not, regarding of the price I will pay for Irish products and also free range products. I would love to see labeling on pork products that shows what kind of farming practice has taken place, the swine industry makes me physically sick when I think of the lives the pigs have under a intensive system, I have cut back greatly on pig meat for this reason solely.

- I believe that meat from cloned animals would be perfectly safe. My objection to cloning would be on the basis of a reduction in the gene pool and locally adapted species in the long term. Science has a poor track record accommodating diversity. And who would have the intellectual property right on the clone - the farmer or the breeding company? This is a serious and maybe unnecessary implication of such interventions.

- We must take scientific measures in relation to food production or else the world will starve. GM is a must for survival. Organic is fine for a small few but it won't feed the world

- In regards to some of your questions the main thing i look for in the buying meat is it country of origin and fully traceability. These are in my opinion key to purchases. And i would only be in support of cloning if it didn't destroy the small family farm

- I understand that this survey is about the consumption of cloned animals but personally I would be far more concerned about the welfare of the animals as opposed to whether the specific animals I consume are cloned or not. Although I know mass producing animals is necessary in order to keep up with the demand for consumption, I would be happier to pay a higher price for animal products that come from well cared for, healthy animals that have a better quality of life rather than if they all have the exact same genetic make up or not. I do think cloning animals seems quite an expensive way of producing animals, but then I am no expert on the topic. And also I remember hearing that cloned animals have a shorter expected life span than their 'original' counter parts, so that may not be in keeping with how i feel about animals living a happy healthy life. Though I guess this wouldn't be a problem seeing with cloned animals as most animals are on our plates before long before we need to worry about them dying of 'natural causes'!!

- I work in the Food Science/Nutrition/Consumer food choice area and therefore I think I may have been biased towards some of the answers

- It is the DNA which shortens in cloning making the life span of the animal shorter which makes me uncomfortable about consuming cloned meat! I prefer to eat meat which is 'natural', organic and local by preference. There is something about cloning for consumption purposes that actually disturbs me

- Will need to do a lot of convincing to get people on board with cloned animal products. Cloning brings to mind GM, processing, hormones etc although some of these may not be closely related. People want natural, wholesome, organic, unprocessed foods and cloning just seems like a step backwards from nature.

- Good luck!

- The question regarding what was my objection to cloning is too narrow, society still needs boundaries. Although some people believe in God, some others think they are! I can think of many activities in the past which reek of ignorance and impatience, one being BSE/CJD. Maybe we should stop conc. on shortcuts to solve the world's problems and initiate the solutions with long term sustainable goals.

- I'm vegetarian that's why all the answers are negative

- I don't eat much meat, but when I do I prefer to buy free-range or organic, though I am tending to eat less. Also if cloned meat was introduced without proper labeling, I would definitely stop meat altogether. Same applies to GM produce

- I'm not sure about college graduate was the same as high school but you should change to post primary

- "Welcome to gattaca" (movie starring Jude Law) That's where we are going. Poor future generation...

- There should be a text box like this after some of the questions so comments can be left as some of the answers are a bit vague

- What's this about?

10.4.3 Open Ended Responses: France

These responses have been translated into English. For all intensive purposes, the intent of the comment has been kept over the literal translation as much as possible. For the sake of completeness, the original and English translated versions are included. The English translation is in italics.

- Ce qui me dérange dans le clonage est davantage le côté éthique j'ai peur qu'après nous arrivions à une seule et unique espèce, la plus productive, la race aux plus hauts rendements, et que nous perdions toutes les autres races rustiques qui font notre richesse...
  - *On my side, the problem with cloning is ethic. I'm afraid this will conduct to an only one species, the most productive, the highest yield race. And we'll lose all the other rustic races which make the diversity.*

- Sur la fin le questionnaire n'est pas très bien fait. En effet, l'enquêteur a oublié de mentionner une case "étudiante" qui par conséquent exclut les revenus pour la plupart d'entre eux. Mis à part ça j'ai trouvé ce questionnaire intéressant.
  - *At the end of the survey it is not very good. Indeed, you should have put a 'student' mention for the question about revenues. Otherwise the survey was very interesting.*

- oui j'ai un petit commentaire, aux questions sur l'identité, il n'y a pas le choix de ne pas avoir d'enfant, hors j'en ai pas encore! j'ai répondu par défaut <6 ans. bon courage pour la suite
  - *I have a comment for the question about identity; there is no choice to have no child, but I do not have any! Thus I answered <6. Good luck for next steps*

- Le clonage conduit à une uniformisation des races et à une homogénéisation du patrimoine génétique du cheptel considéré. Si un jour ceci sort en France?, je ne donne pas cher de l'entreprise qui aura le courage de s'être lancée dans cette entreprise. Je rajouterai même que c'est un scandale d'imaginer cela!
  - *Cloning conducts to a standardization of races and a homogenization of the considered livestock gene pool. What if this happens in France? I doubt the company which will have the courage to do that will succeed. In addition, I think it is a scandal to imagine that! (Wow, this is a good one!)*

- Vous êtes fou les américains!!!!!
  - *You american people are crazy!!!!!*

- Boncourage! God save America!
  - *Good luck! God save America!*

- il n'y a pas le prix qui est important dans l'achat de viande carné! il y a aussi et surtout la provenance! bonne continuation
  - *There is not only the price which is important when purchasing meat! There is also the origin, and it is the most important! All the best*

- Il m'apparait que le problème du clonage est un point sensible. Je ne me suis pas renseigné outre mesure avant votre questionnaire, mes réponses sont donc vraiment parfois dues uniquement à mon intuition. Par contre nous annoncer qu'il va encore falloir baisser les prix des éleveurs conventionnels locaux m'attriste profondément. Je ne

suis pas fils d'éleveur mais j'apprécierai que nous puissions manger la viande qui provient d'à côté de chez moi à un prix raisonnable plutôt qu'une viande ayant traversé l'Atlantique et élevée de manière intensive à des prix défiants toute concurrence. Ce n'est pas la France qui nécessite de telles innovations; d'autres continents en nécessité profonde de produits carnés tels que l'Afrique seraient peut être à cibler. Merci de prendre en considération ce commentaire, Respectueusement, un élève pur pannais.
    - *It appears to me that the cloning problem is a sensitive point. I did not enquire about this topic before the survey, so my answers are sometimes only due to my intuition. However, you tell us that we will again need to decrease conventional local farmer prices, and that makes me deeply sad. I do not come from a farm but I'd like to be able to eat meat which comes from the local area at a reasonable price instead of eating meat which crossed the Atlantic Ocean and was grown intensively at very competitive prices. France does not need such innovations; other continents, as Africa, might be targeted. Thanks for taking my comment into consideration. Sincerely, an ESA Purpan student.*

- il faudrait une caractéristique "étudiant" ==> pas de revenus du tout!!
    - *You must add a student characteristic => no revenue at all!!*

- Le problème lié à cette enquête est qu'en France on ne se sent pas beaucoup concerné par le clonage dut fait que l'on en parle pas du tout.
    - *The problem with this survey is that in France we do not feel really concerned about cloning because nobody talks about it.*

- la tradition du bien manger et de l'agriculture à la française !
    - *The good food tradition and the agriculture on the french way!*

- Je suis étudiante et n'ai donc pas de revenu. Il n'y a pas de réponse prévoyant ce cas. Pour ce qui est de ce que je pense du clonage, je ne suis pas vraiment moralement contre (c'est ma réponse dans le questionnaire). Les expériences scientifiques de clonage ne me choquent pas mais je trouve contre nature de cloner à grande échelle pour la consommation humaine. De plus je ne savais pas trop comment répondre à la question: vous sentez-vous concerné par le prix, le packaging... dans les produits carnés. En effet je peux dire que je me sens concerné par le prix par exemple. Je trouve bizard en revanche de dire qu'on se sent concerné (ou pas) par les bactéries pathogènes ou le clonage. J'aurais plutôt demandé: considérez-vous le clonage, les hormones... comme un danger?
    - *I am a student so I do not have any income. There is no answer for this case. About cloning, I'm not really against it morally (that's what I said in the survey). Scientific cloning experiments do not shock me, but I feel like it's not natural to clone at a large scale for human consumption. Moreover I did not really know how to answer the question: do you feel concerned about the price, packaging… for meat. Indeed, I can say I feel concerned about the price for example. But I think it is strange to say to feel (or not) concerned about pathogens or cloning. I would rather have asked: Do you consider cloning, hormones… as a danger?*

- Les questions sont étranges et il est difficile d'y répondre car on se sent peu concerné (surtout pour l'histoire de clonage qui me parait difficilement envisageable en France)
  - *Questions are sometimes strange and difficult to answer because we do not feel really concerned (mostly for the cloning history which seems difficult to have in France for me)*

- c'est bref, facile à répondre, c'est bien!
  - *It is short, easy to answer, it is good!*

- Les propositions pour les revenus sont bizarres. en effet, nous sommes étudiants, de ce fait, nous ne payons pas d'impot pour le moment...
  - *The propositions about revenues are strange. Indeed, we are students, thus we do not pay taxes for now…*

- La seule raison qui pourrait me pousser à être contre le clonage serait que la science prenne la place de l'éleveur.
  - *The only reason for me to be against cloning would be that the science takes the farmer place.*

- Je suis étudiant et n'ai donc pas de revenu. Et ce n'est pas parce que des autorités disent que la viande cloné est sans danger qu'il faut les prendre au sérieux, on sait trop bien comment les lobbyings jouent avec les études...
  - *I'm a student and do not have any income. And it is not because authorities say that cloning meat is not dangerous that we have to believe them, we know too much how lobbies play with studies…*

10.4.4 Open Ended Responses: Honduras

These responses have been translated into English. For all intensive purposes, the intent of the comment has been kept over the literal translation as much as possible. For the sake of completeness, the original and English translated versions are included. The English translation is in italics.

- Y ya estan en pruebas la carne de animales clonados??
  - *Do we already have meat from cloned animals?*

- El consumo de animales clonados no me preocupa por razones morales o religiosas. Como productor y consumidor me preocuparia más que sucediera lo mismo que en algunas plantaciones frutales, donde practicamente todos los frutales son clonados, que una plaga acaba con facilidad con grandes extensiones de terreno.
  - *Morality and religion are not the reasons why I am worried about consuming cloned animals meat. If a pest can easily affect a large plantation of fruits trees (GMO's) it*

could be the possibility something will affect cloned animals? If so, then I would worry.

- Espero haber contribuido positivamente a su estudio y ojalá otros colegas se sumen para que esta muestra sea válida
  - *I hope I have contributed positively to your research. Hopefully other colleagues will do help too and your sample will be representative.*

- Podria compartir los resultados de la encuesta, Gracias!
  - *Could you share the results of the survey? thanks!*

- Me gustaría que compartan los resultados de este estudio me parece interesante, saludos. josue069@hotmail.com, Nicaragua
  - *I would like you to share the results of this study. I think is interesting, Greetings. josue069@hotmail.com (Nicaragua)*

- Si la clonacion se usa para disminuir el hambre en el mundo, estoy de acuerdo. Caso contrario, si se usa para otros fines, es moralmente incorrecto.
  - *If cloning is used to reduce hunger in the world, I agree with it. Otherwise, is morally wrong.*

- excelente encuesta, saludos
  - *Excellent survey. Greetings*

- Yo considero que el consumo de carnicos es vital para la vida humana;por la riqueza de sus aminoacidos.
  - *I consider the meat consumption is very important for human being because is rich in its amino acids.*

- I think we need to develop another word instead of clonation to minimize people to think about eat "clonated meal"
  - *I think we should use another word instead of cloning, so we avoid the cloned meat thought.*

- La clonaciòn y ferilizaciòn In Vitro de animales, desde mi punto de vista con llevarìa a incrementar la producciòn de alimentos, asì como lo hizo la Revoluciòn Verde en su momento, el riego por goteo israelita y como lo està haciendo en la actualidad la producciòn bajo ambiente controlado (invernaderos o greenhouses). Lamento mucho que en paìses en desarrollo o subdesarrollados, estas tècnicas sean muy caras o poco asequibles como para popularizarlas. Regards Ivàn Alvarez Viñas
  - *From my point of view animals cloning and In Vitro fertilization would lead to increased food production. As in the past the Green Revolution and the Israeli drip irrigation did, and how is currently doing production by greenhouses. I regret that in developing or countries, these techniques are very expensive so aren't available as widely. Regards Ivan Alvarez Viñas.*

- Pienso que la clonación para obtener reproductores de alto potencial genetico, facilitaria llevar esta genetica para el mejoramiento del resto de la poblacion bovina, porcina, avicola, etc. No estoy de acuerdo con la clonacion masiva para fines de produccion porque reemplaza los procesos evolutivos de las especies en la naturaleza, aumenta el riesgo financiero y de salud animal al tener poblaciones con mayor homocigosis y vulnerables a pandemias que afectarian a toda la poblacion de animales.
  - *I think that cloning for breeding high genetic animals would help to improve the rest of the population of cattle, swine, poultry, etc. I do not agree with cloning if the purpose is to clone a lot of animals, because it replaces the evolutionary processes of species in nature, increases the financial risk and the health risk of having have more homozygous. Also increases the pandemics vulnerability.*

- Aparentemente, las dudas sobre los animales clonados y sus resultados como productos completamente seguros para la alimentación no han sido del todo aclaradas. Puede ser un proceso paso a paso, pero la gente espera mayor y mejor información, sin temores!
  - *There doubts about cloned animals and the effects of their products. It could be a step by step process but people need more information.*

- Creo que como consumidores tenemos derecho a saber que consumimos. Quiero saber si lo que consumo es clonado o no. Si decido consumirlo me hago responsable de lo que consumo. Por tanto es un asunto de preferencias de cada comprador.
  - *I think as consumers we are entitled to know what we consume. Let me know if what I consume is cloned or not and will be responsible for it. It depends on consumer preferences.*

- Muy interesante encuesta. Me gustaria saber acerca del motivo de su encuesta ademas que empresas estarian realizado este tipo de actiidades tan interesantes. Talves poder realizar ese tipo de praticas con fines didacticos en nuestra universidad. davids_c1@hotmail.com por si desean enviar información.
  - *It is a very interesting survey. I would like to know about the objective of it and also who is company is conducting this research. davids_c1@hotmail.com*

- EL punto moral es el que me preocupa, la razón del precio, me preocupa los pequenos productores que no puedan competir con las compañías que si lo hacen, estaríamos eliminando automaticamente al pequeño productos
  - *I am worried about the morality issue. I am worried about small producers because they cannot compete with Multinational companies that production cost are lower.*

- Deberían de colocar el objetivo de la encuesta. Éxitos en su trabajo!
  - *You should put the objective of the survey. Success in your work!*

- me parece una excelente idea consumir ese tipo de animales ya que asi se puede optimizar y mejorar la calidad de los productos al clonar animales ejemplares.
  - *I think this is a good idea because the quality can increase..*

- sugiero que en la pregunta 7 se reformule una de las opciones y ya uqe le termino seguridad alimentaria se refiere a si esa fuente de alimento siempre esta disponible para la población
  - *I propose to re-formulate Question 7 because the term food security sounds like if the meat is going to be available for ever.*

- Quiero aclarar algunas cosas, Soy estudiante Universitario. Con respecto a productos transgénicos, yo no considero malo ni mucho menos dañino hasta que me lo comprueben científicamente con pruebas científicas. Felicidades a la gente que trabaja con ingeniería genética, considero que tecnología transgénica es una herramienta para combatir el hambre y es un mecanismo muy útil para la seguridad alimentaria del mundo.
  - *I want to clarify some things, I am university student. I don't think GMO products are bad unless scientific prove it. Congratulate the people, who work with genetic engineering, I believe that GM technology is a tool to fight hunger and is a very useful mechanism for world food security.*

- Creo que la clonación es a la vez moralmente incorrecta por i afiliación religiosa, por lo cual es la razón primorial por la cual no consumiría prodctos cárnicos de animales clonados.
  - *I think that cloning is morally and religious incorrect, so that is the reason why I won't consume meat from cloned animals*

- no me parecen bien las oportunidades de que nos tomen en cuenta en su investigación
  - *I do not find a good opportunity that we are taken into account in your research*

- Me parece una excelente idea muy creativa e innovadora el vender carne de animales clonados! :)
  - *I think an excellent, creative and innovative idea to sell meat from cloned animals! :)*

- creo que los temas de OGM son muy interesantes e importantes en nuestros dias, sin embargo en lo particular moralmente creo que no estaría tan dispuesto a consumir productos de estos a menos que en realidad no se encuentre productos normales y tradicionales. Saludos,
  - *Nowadays, I think GMOs issues are very interesting and important, but I won't consume them because they are morally incorrect.*

- Exitos con el trabajo...
  - *Success in your research*

- Estoy en 4to año de Zamorano por lo cual indiqué que he completado la secundaria y no universidad, al igual que no tengo un salario para poder completar dicha pregunta. Me incomoda el hecho de consumir alimentos derivados de animales clonados, pero quisiera aprender un poco más sobre el tema para poder tomar una decisión acertada al momento de consumir.
  - *I'm in 4th year Zamorano so I indicated that I have completed high school but not college. Also, I don't have wages to complete the question. I am uncomfortable eating*

meat from cloned animal. However, I would like to learn more about the subject to take the right purchase decision.

10.4.5 Open Ended Answers: China

The original Chinese open ended answers will not be provided, only the translations. Because the answers were handwritten it is very difficult to transfer them to this document.

- Expecting the appearance of clone food and overspread of that kind of food, decreasing the negative effect on the natural environment
- No comments, but I care about the information of agricultural products
- Cloning is terrible
- There is too much saying about clone on a lot of products, I don't think that is safe.
- Too hasty.
- We are all kids, there is no sense for us to talk about that
- There is no sense to ask us this
- No Comment *(This was mentioned on numerous surveys.)*

10.5 **Animal Cloning Timeline**

1885 First Cloning Experiment Inspired by Embryos
August Weismann, A German zoologist, studied embryonic development where he believed embryonic development occurred through diminution, or loss of cells. Wilhelm Roux, Hans Dreisch, and Hans Spemann separately each studied Weismann's ideas and found the one nucleus was necessary for embryonic development. Spemann conducted the first ever cloning experiment by separating a fertilized cell in the very initial stages of development.

1950 Bull Semen successfully frozen
First successful freezing of bull semen at -79°C for later insemination of cows was accomplished.

1952 First Successfully Cloned Tadpole
Robert Briggs and Thomas King successfully cloned tadpoles by injecting the embryonic nucleus from one cell into another. John Gurdon builds on Briggs and Kings study to clone an adult frog by injecting adult epithelia cells into a clear nucleus.

1981 First Mice Cloned
Karl Illmensee and Peter Hoppe cloned adult mice using donor embryonic cells injected into oocytes and then developed in surrogate female mice.

1986 First Cloned Sheep from Embryonic Cells
Steen Willadsen cloned both sheep and dairy cows splitting frozen fertilized embryonic cells and developing them in surrogate mothers.

7/5/1996 Dolly the Sheep is born
Ian Wilmut and Keith Campbell were successful in producing the first ever organism to be cloned using Somatic Cell Nuclear Transfer (SCNT) by injecting donor adult cells into embryos. Dolly, a Poll Dorset ewe became an international sensation and lived to give birth to six healthy lambs before dying February 14, 2003. Belief that Dolly's arthritis was caused by the donor animal's age never was truly confirmed because there were too few clones to compare against at the time. Nonetheless, Dolly's success prompted international debate on the ethics and efficacy of cloning science in both animals and humans. Many felt there were substantial scientific and industry propositions to be made with the new technology.

1997 UNESCO signs Human Gene Declaration
186 member nations of the United Nations Educational, Scientific, and Cultural Organizations (UNESCO) sign the Declaration on the Human Genome and Human Right which calls the

human genome the “heritage of humanity” while avoiding the prescription of gene or cloning therapy (Bonnickson 2001).

Council of Europe bans Genetic Modification of Humans
The Council of Europe members open the Convention for the Protection of Human Rights and the Dignity of the Human Being with Regard to the Application of Biology and Medicine (Bioethics Convention) which essentially bans any type of human genetic modification (Bonnickson 2001).

3/4/1997 Human Cloning banned in the US
President Clinton proposed a five year moratorium on federal and privately funded human cloning research in the United States. The moratorium titled Prohibition on *Federal Funding for Cloning of Human Beings* led to both House and Senate hearings on the science over the coming months.

6/9/1997 Proposed voluntary moratorium on human cloning
President Clinton proposes legislation that would effectively ban the cloning or the study of cloning of humans for at least 5 years.

7/1/1997 Polly is born
Ian Wilmut and Keith Campbell, the scientists who created Dolly, also created Polly. Polly, a Polled Dorset lamb was cloned from sheep skin cells which were transgenically altered to contain human genes. While this was met with international debate, it is said to have been the final goal of the Wilmut team (Panno 2005). The argument followed that transgenic cloning had substantial opportunity to treat a variety of human diseases. This was confirmed in 2000 by the same research team with the successful cloning of sheep containing the human protein alpha 1-antitrypsin which is used to treat a variety of lung diseases (Wright 2004).

9/1/1997 Scientist sign voluntary moratorium on Human Cloning
Thousands of biologists and physicians sign a voluntary five-year moratorium on human cloning in the United States.

12/5/1997 Richard Seed announces intention to clone human
Richard Seed, a nuclear physicist, announces intentions to clone a human before federal laws could effectively prohibit the process. This statement went directly against the proposed ban by President Clinton and forced the United States in a national debate on human cloning which prompted legislative bans in numerous states as well as Congressional action.

1998 Several Advancements were made in animal cloning
Several advancements in animal cloning were published in scientific journals. The University of Hawaii cloned dozens of mice validating the science the birth of Dolly. The Raukura Research Center in New Zealand was able to clone the last cow from the rare breed of cattle. Japanese scientist published data showing the successful cloning of eight calves with remarkable success. (Wright 2004)

1/1/1998 Announcement made to map human genome
U.S. based Biotechnology firm Perkin-Elmer Corporation announced that, against international backlash, it would work with gene sequencing expert J. Craig Venture to privately map the human genome.

Nineteen European nations signed a ban on human cloning
19 out of the 40 European member nations of the Council of Europe signed an agreement which required that each nation introduce laws that would effectively prohibit any type of cloning. This effectively started strict regulations in Europe regarding human and animal cloning. The UK and Germany both refused on grounds of defending freedom of scientific research and stricter existing laws respectfully.

1/20/1998 FDA announces authority over human cloning
The United States Food and Drug Administration announced that it had sole authority over human cloning in the U.S. on grounds it was a form of cellular or genetic therapy. This forced any interest to conduce human cloning to be approved through the FDA first.

2001 13 Congressional Bills Introduced on Human Cloning
13 Bills were introduced to prohibit human cloning in the first session of the 107th Congress including H.Res. 214, H.R. 1260, H.R. 1372, H.R. 1608, H.R. 1644, H.R. 2172, H.R. 2608, H.R. 3495, S. 704, S. 790, S. 1758, and S. 1893. H.R. 2505 with H.Amdt. 284 passed in the House of Representatives (see July 16 and 31, 2001). No floor action was taken on the other measures. (Wright 2004)

FDA places Voluntary Moratorium on Consumer Ready Cloned Products
Once cloning became apparent in that it would enter the commercial livestock industry, FDA requested a voluntary moratorium that cloned livestock would be kept out of the food supply. Livestock producers and scientist agreed.

01/22/2001 UK passes first Legislation Regulating Human Cloning
The British Government enacted into law the 1990 Human Fertilization and Embryonic Regulations (HFER) which later adding to it the Human Reproductive Cloning Bill (1992). The legislation was internationally regarded because it gave flexibility to research while also banning the full gestation of cloned human embryos. There was extensive background work involved as well as advisement from 17 organizations which included research facilities, churches, pro-life groups, trade unions, and many women's institutes. (Panno 2005)

03/21/2001 Novel Foods Act (Directive 2001/18/EC
After years of debate and issuing moratoriums on human cloning, on March 12, 2001 the E.U. passed the obligatory Novel Foods Act (Directive 2001/18/EC) whereby all GMO's are governed for commercial release. Even with this act, cloning was not able to be explicitly included in the regulation. The Novel Foods Act defines GMO's as any "organism with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination" (E.U. 2001).

07/16/2001 H.R. 2505: Human Cloning Prohibition Act
Representative David Weldon (R-Florida) and Bark Stupak (D-Michigan) introduce House Resolution 2505, the Human Cloning Prohibition Act. The bill amended Title 18 of the Unites States Code in order to prohibit human cloning. It was passed by the House and sent to the Senate on August 1, 2001 were it received no further action to this day. (Wright 2004)

11/28/2001 President's Council on Bioethics
President Bush issues Executive Order 13237establishing the President's Council on Bioethics. The council was to advise the President on the bioethical issues concerning biomedical science and technology. (Wright 2004)

12/14/2001 United Nations General Assembly Takes Up Cloning
The UN began an international convention against the reproductive cloning of humans. While the debate ventured into all forms of reproductive and therapeutic cloning with the idea that it violates human dignity, only a non binding resolution was passed in 2005. The UN has also released a document which contains specific information for countries looking at ruling on Human Cloning.

2002 4 Congressional Bills Introduced on Human Cloning
4 bills were introduced in the second session of 107th congress to prohibit human cloning including S. 2893, S. 1899, S. 2076, and S. 2439. No floor action was taken on the measures and they died at the end of the 107th Congress. (Wright 2004)

Significant leaps were made in Cloning Science
Significant leaps were made in the science of animal cloning during 2002. Researchers at Advance Cell Technology in Worchester, MA cloned kidney-like organs that were not rejected when implanted into recipient cows. French researchers reported cloning rabbits that would aid in human cystic fibrosis studies. Stanford University announced a $120 million institute to study stem cell research which included cloning human embryos.

01/28/2002 S. 1899, Human Cloning Prohibition Act of 2001
Senator Sam Brownback (R-Kansas) introduced a Senate version of the Cloning Prohibition act. Even with 30 cosponsors, this bill never made it out of the Senate Judiciary Committee.

02/15/2002 Texas A&M Clones first house pet
Texas A&M College of Veterinary Medicine announces the cloning of the first cat. The cat was the first household pet to be cloned. Although the cat looked differently from the donor cat, it was in fact an exact genetic replica. The scientist warned that pet cloning is not reproduction, but rather resurrection and that cloned pets will resemble their donors, but will not exactly be owners' old pets.

10/1/2002 FDA sponsors report in preparation for ruling on safety of animal cloning
According to a National Academy of Science (NAS) panel issued report, there is no evidence that food from cloned livestock is unsafe for human consumption although it requires more research. The greatest concern is from transgenically cloned animals. The report issued by the

NAS was sponsored by the FDA in preparation to rule on the safety of cloned farm animals and other animal-biotechnology products.

12/27/2002 Director of Clonaid announces first human clone
Briigitte Boiselier, chemist and director of Clonaid a company founded by the religious sect Raelians announces a successful human clone was born; however no evidence of confirmation was made.

2003 10 Congressional Bills Introduced on Human Cloning
10 bills were introduced in Congress to prohibit human cloning including H.R. 234, H.R. 246, S. 246, H.R. 534, S. 303, H.R. 801, H.R. 916, H.R. 938, H.R. 534, and S. 1356. Each bill had varying determinates and each was met with varying success. Because cloning had become a part of the stem cell controversy, passing bills were very difficult.

02/23/2003 Funding for Cloning Research Prohibited
FY2003 Consolidated Appropriation Resolution P.L. 108-7 signed into law. The Appropriation Resolution signed into law included a provision originally apart of H.R. 246 which prohibited any private funding and only allowed for government funding regarding research that includes human cloning that uses human embryos.

02/27/2003 H.R. 534, Human Cloning Prohibition Act Passes House
Introduced by Representative David Weldon (R-Florida), H.R. 534 was to amend Title 18 of the United States Code to prohibit cloning. The bill was met with controversy, but passed the House by a 241-155 vote. The bill died in the Senate.

05/29/2003 First large Equid Cloned
University of Idaho and Utah State University announced the first birth a cloned mule. They used nuclei cells from a fetus related to a famous racing mule in order to avoid the aging issues found in Dolly the sheep.

08/6/2003 First Horse Cloned
Italian Scientist announced the birth of the first cloned horse. The donor mare was also the surrogate mother. The team had a .04% success rate of developed embryos to harvested eggs.

01/23/2004 Funding for Cloning Research Prohibited
The FY 2004 Consolidate Omnibus Appropriations Act P.L. 108-199 was signed into law. The appropriation act signed into law included a provision originally part of S.1356 which prohibited any private funding and only allowed for government funding regarding research that includes human cloning that uses human embryos. This bill has been repeated and signed into law 1998, 2001, 2004, 2007.

03/08/2005 United Nations General Assembly adopts Declaration on Human Cloning
After many years of deliberation, the UN adopts a nonbinding declaration on Human Cloning in which Member States "were called on to adopt all measures necessary to prohibit all forms of

human cloning inasmuch as they are incompatible with human dignity and the protection of human life" (United Nations 2005). This declaration did not answer the human cloning debate, but at the very least quelled the controversy.

9/26/2005 FDA head resigns, delaying cloning decision
FRA Head Lester Crawford abruptly resigns. His resignation, which did not relate to cloning, delayed a decision by the FDA on allowing the use of animal cloning in the human food industry. The FDA study had originally been commissioned to the National Academy of Sciences in 2002.

10/27/2005 Biotechnology shakes up the industry at the WWFE
The Worldwide Food Expo (WWFE) took on the controversial issue of animal biotechnology including transgenic and cloning. Martina Newell-McGloughlin, director of the University of California Systemwide Biotech Research and Education Program, states transgenics and cloning could develop high-merit farm animals, duplicate valuable animals used in pharmaceutical research, and create a homogeneous population of cells, tissues and even organs that can be transferred to organ-failure patients. She also stated that food-safety concerns held no merit because cloned animals are just copies of animals already in the environment.

11/2005 KRC Research Study on Animal Cloning
Even though Gallup Poll, Inc. had asked the question on moral acceptance of animal cloning, the KRC Research Study was the first to focus on what consumers will do once meat and milk from cloned animals reach supermarkets. The study found that opinions on animal cloning were still being formed and that there was a one third split on buying the product, buying but finding out more about the product, and never buying. The study was only lightly covered by the media but was followed by numerous other studies. (Sosin and Richards 2005)

11/17/2005 Pew Initiative Survey
One of the first studies to meet broader media attention, the Pew Initiative Study on Food and Biotechnology found that two out of three Americans felt "uncomfortable" with animal cloning and about 40% felt food from cloned animals is unsafe. (The Mellman Group, Inc. 2005)

1/4/2006 Six re-cloned calves born in China
China Agricultural University and Shandong Kelong Animal Husbandry Co confirm that 3 claves re-cloned from the cells of cloned cattle survived while three died after birth. These cattle were the first animals to be re-cloned from existing clones.

12/28/2006 FDA issues draft documents on the safety of animal clones
The draft risk assessment found that meat and milk from clones of adult cattle, pigs and goats, and their offspring, were as safe to eat as food from conventionally bred animals because they were genetic copies of the donor animals. They also stated special labeling was not necessary. The initial assessment was the first released from the FDA and was peer-reviewed by a group of independent scientific experts in cloning and animal health. The assessment did propose a risk management plan that mitigated animal welfare along with draft guidance to the industry because cloning had reached commercial proportions by this time. The release of this document

sparked dramatic controversy over use of cloning for human food. (Food and Drug Administration 2006)

2007 Animal Cloning is Met With Significant Controversy
With the release of FDA's draft documents stating cloned animals are safe to eat and that it does not require special labeling, consumer activist groups and food companies alike weighed in. Those who opposed boycotted the science saying consumers had the right to now the science used to producer their food and that cloning posed animal welfare issues. Those who approved felt the final study needed to be peer reviewed and extensive, but that cloning was only making exact copies of what already existed in nature.

1/12/2007 Major British grocers pledge boycott of meat from cloned animals
Due to unconfirmed reports that a cloned cow from the U.S. had birthed a calf on a British farm, virtually all major British grocery chains pledged a boycott of meat from cloned animals and their offspring. While British law prohibits the sale of meat or milk from cloned animals, it makes no mention of offspring of clones. Stores like Tesco, Wal-Marts Asada chain, and Morisons and Marks & Spencer were among the boycotts. (Hisey 2007)

2/7/2007 Activist Protest Animal Cloning in DC
Donning cow costumes, many consumer and animal rights activist groups marched in opposition to animal cloning in order to attract media attention and create greater congressional opposition to the FDA's draft documents released in December 2006. Besides consumers right-to-know food ingredients, the arguments cloning compromises the welfare of food animals, cloning hurts family farmers, and the moral, religious and ethical concerns about cloning were all brought up by Ben and Jerry's Ice Cream Inc. founder Jerry Greenfield.

2/15/2007 Whole Foods and Wild Oats boycott animal cloning
Whole Foods and Wild Oats are among the first U.S. based companies who released direct opposition to animal cloning. Each stated they would ban products from animal clones in their stores along with support for labeling which indicates cloning use.

5/3/2007 Scientists support FDA's Approval of food from clones
200 scientist pledged support of the FDA preliminary approval of animal cloning stating it was one of the most rigorous safety reviews ever conducted. In addition to the pledge, Federation of Animal Science Societies ran an ad in the Washington Post showing their support of the science and the FDA review process.

10/13/2007 Governor Schwarzenegger Veto's Food Labeling of Animal Clones
A bill passed in the California Senate which required all packages containing product from a cloned animal was vetoed by Schwarzenegger on grounds that it pre-empted federal law and labeling would costly to track. (Schwarzenegger 2007) California was the first state to address animal cloning for food use.

10/16/2007 AMI takes Pro Active stance in Consumer Education
American Meat Instituted (AMI) launches a website designed to reach out to consumers by creating an online directory concerning biotechnology and especially cloning. Amid the controversy, the AMI felt it was necessary to speak directly to consumers.

12/19/2007 Clone Companies Release Tracking System
Viagen Inc. and Trans Ova Genetics, the two main U.S. Cloning companies suggest a tracking system through an electronic ID tag to each animal cloned through the companies. Both companies are the only to hold patents on cloning in the U.S. (Viagen Inc, TransOva Inc 2007)

1/08/2008 FDA Approves Animal Cloning for Human Consumption
The much anticipated FDA approval for animal cloning was released. After years of detailed study and analysis, the 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" (Food and Drug Administration 2008). The release however emphasized that the FDA had no bearing on the ethical issues of animal cloning. The approval was met with consumer shock and international controversy from consumer and animal activist and trade organizations.

1/11/2008 EFSA Issues Draft Opinion Regarding Animal Cloning
As commissioned by the E.U. Commission, the European Food Safety Administration (EFSA) gave preliminary affirmation to animal cloning for human food. The EFSA declared that while there are still uncertainties about the science due to the "small amount of data and studies available", there is "no indication that differences exist in terms of food safety for meat and milk of clones and their progeny compared with those from conventionally bred animals." (European Food Safety Authority 2009)

1/15/2008 Numerous Companies announce their stance on Cloning
Smithfield Foods Inc,Tyson Foods Inc., Kraft Foods Inc, Wal-Mart Stores Inc., PCC Natural Markets each announced cloning would not be readily used within their companies. All companies announced they would follow the voluntary moratorium while many commented they would continue to monitor the scientific research. (Jargon and Jane 2008)

1/16/2008 EU EGE releases "Ethical aspects of animal cloning for food supply" report
As commissioned by the EU Commission, the European Group on Ethics in Science and New Technologies to the European Commission releases an opinion report on animal cloning. The report made reference to the draft scientific findings of the EFSA (2008) report, the group reported "doubts as to whether cloning for food is justified" (EGE 2008). The report recommended additional requirements be met including the safety of food products be guaranteed as a precondition for marketing; the "five animal freedoms" as recommended by the Organization for Animal Health (OIE) be met; EU legislation ensure traceability enforcement for all cloned animals and their products; and the import of cloned animals, their offspring, and materials derived be conditioned on paper (EGE 2008).

Asian Nations Promise to Study Cloning
Japan, South Korea, and Taiwan promise to study the issue of animal cloning for human food use. While their main concern was food-safety, neither country indicated urgency in the issue.

07/15/2008 EFSA Releases Official Report on Animal Cloning
The EFSA releases an official scientific opinion on the use of animal cloning and the progeny of cloned animals in the human food supply. The release mirrored their original statement in January 2008; however, they reiterate that the EFSA has no bearing on the ethical issue of animal cloning and instead refer to the European Commission asking the European Group on Ethics in Science and New Technologies to provide an opinion on the ethical aspects of cloning.

9/2/2008 WSJ report shows animal clone offspring has entered the U.S. Food Supply
An investigative report from the Wall Street Journal (WSJ) shows that the product from the offspring of cloned animals has entered the U.S. Food Supply, albeit at miniscule proportions. (Zhang and Jargon, Animal Clones' Offspring Are in Food Supply 2008)

04/1/2009 Japanese Commission Deems Cloned Livestock Safe to Eat
In a release by the Japanese Food Safety Commission, cloned cattle and pigs are deemed safe to eat. The release corresponded with the FDA 2008 and EFSA 2008 reports which helped to mitigate any potential trade issues. (Japan Food Safety Commission 2009)

05/2010 The EFSA Calls for Updated Assessments on Animal Cloning
In a request from the European Commission to update the current statement on animal cloning, the European Food Safety Administration sent a broad request for any scientific studies on animal cloning. This was the start of the 2010 animal cloning debate in Europe. The decision was released in October 2010.

07/07/2010 European Parliament Opens First Reading of Novel Foods Act (2010)
The Novel Foods Act, among addressing a multitude of safety and ethical issues of new food technologies, was introduced in an attempt to ban the sale of foods from cloned animals and their offspring. The legislation was sent to the EU legislators for finalization in September. (Novel Foods Act 2010)

07/29/2010 New York Times suggests cloned product already in Europe
New York Times reports a handful of breeders in Switzerland, Britain and possibly other countries have imported semen and embryos from cloned animals or their progeny from the United States. In addition they report that while no vendor has publicly acknowledged it, meat or dairy products originating from such techniques are believed to be already on supermarket shelves. (Kanter 2010)

08/4/10 Briton's FSA Confirms Cloned Product in Food Supply
Briton's Food Standards Agency (FSA) announced confirmation that it found meat from the offspring of a cloned cow in the UK food chain. Stirring extreme controversy in Europe, the FSA reiterated the EFSA's opinion on cloning but that cloned animals are considered Novel

Foods and are therefore required to be tracked per the Novel Foods Act 2010. The animals had derived from embryos harvested from a cloned cow in the United States (FSA 2007).

9/16/2010 EFSA Backs up its Previous Statement amid Controversy in Europe
Amid controversy based on the Novel Foods Act and confirmed reports of cloned meat in the food supply, the EFSA furthers their confirmation that product from cloned animals do not pose a health risk. The Scientific Committee concurred that no new scientific information had recently become available that would require EFSA to reconsider the conclusions and recommendations of its previous work in this area. (EFSA 2010)

9/29/2010 H.R. 6325 – Consumer Right to Know Food Labeling Act
Representative Rosa DeLauro (D-Connecticut) introduces a bill that would mandate that bioengineered meat products be labeled accordingly. It would require the USDA to label products of cloned animals if they are intended for consumption. The bill was referred to the Committee on Energy and Commerce and House Agriculture. While bills similar such as H.R. 5577 – Genetically Engineered Food Right to Know Act, this received media attention because it addressed cloning directly.

10/6/2010 Cloned steer wins Iowa State Fair Cattle Show
Doc, a cloned steer whose donor was the previous grand champion steer, won 4-H grand champion steer at the Iowa State Fair. The decision sparked controversy not only in the efficacy of animal cloning for progeny use, but also the ethics of spending vast sums of money for a youth competition. The owners of the steer admitted to entering Doc as means of marketing their business.

10/19/2010 European Commission Suspends Animal Cloning for Food Production
The European Commission proposes a temporary, five year ban on animal cloning for human food use. The release was in response to the calls from the European Parliament and Member States to launch a specific EU policy on the subject. However, the ban did not explicitly include products derived neither from the progeny of animal clones nor cloning for sport animals. This release was met by obvious backlash from many consumer and animal rights activist group in both Europe and the United States.

11/10/2010 Parliament Signals Cloning as Top Priorities for EU-US Summit
Ahead of the EU-US Transatlantic Economic Council summit on November 20th, the European Parliament signals differing rules on cloning as well as novel foods and genetically modified products will be addressed. (European Parliment 2010)

03/17/2011 EU Commission Rejects European Parliament ban on cloned offspring
The EU Commission rejects the European Parliaments attempt to ban products derived from animal clones. Citing potential trade retaliation, the EU Commission felt the ban on products derived from cloned animals was a 'de facto' ban on products from the progeny of cloned animals as well. Because no animal cloning labeling laws currently exist, banning products from the progeny of cloned animals would severely limit imports and create trade retaliation from trade partners.

03/28/2011 European Union and European Parliament Talks Break Down on Animal Cloning

Animal cloning talk between the European Union and the European Parliament break down because a compromise on how to treat the offspring of cloned animals could not be reached. Therefore the Directive 2001/18/EC - Novel Foods Act which attempted to ban animal clones, was actually revoked and now only regulates animal clones.